ENCYCLOPEDIA OF

# E-Business Development and Management in the Global Economy

IN LEE

# Encyclopedia of E-Business Development and Management in the Global Economy

In Lee
*Western Illinois University, USA*

Volume I

BUSINESS SCIENCE REFERENCE
Hershey · New York

| | |
|---|---|
| Director of Editorial Content: | Kristin Klinger |
| Director of Book Publications: | Julia Mosemann |
| Acquisitions Editor: | Lindsay Johnston |
| Development Editor: | Julia Mosemann |
| Publishing Assistant: | Sean Woznicki |
| Typesetter: | Deanna Zombro, Callie Klinger |
| Quality Control: | Jamie Snavely |
| Cover Design: | Lisa Tosheff |
| Printed at: | Yurchak Printing Inc. |

Published in the United States of America by
Business Science Reference (an imprint of IGI Global)
701 E. Chocolate Avenue
Hershey PA 17033
Tel: 717-533-8845
Fax: 717-533-8661
E-mail: cust@igi-global.com
Web site: http://www.igi-global.com/reference



Library of Congress Cataloging-in-Publication Data

Encyclopedia of e-business development and management in the global economy / In Lee, editor.
p. cm.

Includes bibliographical references and index.
Summary: "This research book is a repository for academicians, researchers, and industry practitioners to share and exchange their research ideas, theories, and practical experiences, discuss challenges and opportunities, and present tools and techniques in all aspects of e-business development and management in the digital economy"--Provided by publisher.

ISBN 978-1-61520-611-7 (hardcover) -- ISBN 978-1-61520-612-4 (ebook) 1. Electronic commerce. 2. Electronic commerce--Management. I. Lee, In, 1958-
HF5548.32.E518 2010
658.8'7203--dc22

2009036871

British Cataloguing in Publication Data
A Cataloguing in Publication record for this book is available from the British Library.

## Editorial Advisory Board



## List of Reviewers

Wei-Shuo Lo, *Meiho Institute of Technology, Taiwan*
Olivine Lo, *Hong Kong Shue Yan University, China*
Magnus Lofstrand, *Luleå University of Technology, Sweden*
Luis Miguel López-Bonilla, *Universidad de Sevilla, Spain*
Malamati Louta, *Harokopio University, Greece*
Stephan Lukosch, *Delft University of Technology, The Netherlands*
Amjad Mahmood, *University of Bahrain, Kingdom of Bahrain*
Maria Major, *ISCTE - Business School, UK*
Ross A. Malaga, *Montclair State University, USA*
Fabio M. Manenti, *University of Padua, Italy*
Penelope Markellou, *University of Patras, Greece*
Michael Martel, *Ohio University, USA*
Antonia Martínez-Carreras, *Universidad de Murcia, Spain*
María Pilar Martínez-Ruiz, *Universidad De Castilla-La Mancha, Spain*
Carol McDonough, *University of Massachusetts Lowell, USA*
Zack Mendenhall, *Concordia University, Canada*
Jan Mendling, *Humboldt-Universität zu Berlin, Germany*
Siddhartha Menon, *Michigan State University, USA*
Katina Michael, *University of Wollongong, Australia*
Kevin Mills, *NIST, USA*
Annette Mills, *University of Canterbury, New Zealand*
Patricia L Mokhtarian, *University of California – Davis, USA*
Mikolaj Morzy, *Poznan University of Technology, Poland*
Srikanth Mudigonda, *University of Missouri-St.Louis, USA*
Makoto Nakayama, *DePaul University, USA*
Marcelo Nepomuceno, *Concordia University, Canada*
Dave Novak, *University of Vermont, USA*
Markus Nüttgens, *Universität Hamburg, Germany*
Michael O'Grady, *University College Dublin, Ireland*
Ricky Ohl, *Qantm College Pty Ltd, Australia*
Kelley O'Reilly, *Utah State University, USA*
Felipe Ortega, *Rey Juan Carlos University, Spain*
Yasin Ozcelik, *Fairfield University, USA*
Roberto Paiano, *Universita' del Salento, Italy*
Nikolaos A. Panayiotou, *National Technical University of Athens, Greece*
Savvas Papagiannidis, *Newcastle University Business School, UK*
Narasimha Paravastu, *Metropolitan State University, USA*
Young Park, *Bradley University, USA*
Ada Pateli, *Ionian University, Greece*
Iryna Pentina, *The University of Toledo, USA*
Monica Perry, *University of Redlands, USA*
Georg Peters, *University of Applied Sciences - München, Germany*
Doncho Petkov, *Eastern Connecticut State University, USA*
Minna Pihlström, *Carezza Management Consulting, Finland*

# List of Contributors

# Contents
## by Volume

### Volume I

**Section 3: E-Marketplaces**

**Section 4: E-Business Strategies**



**Section 5: E-Business Models**

## Volume II

### Section 6: E-Business Management

**Section 7: Online Consumer Behavior**

**Section 8: Mobile Commerce**

**Volume III**

**Section 9: Web Services and E-Business Process Integration**



**Section 10: E-Business System Development**

**Section 11: E-Business: Issues, Challenges, and Opportunities**

**Section 12: Emerging Trends**

# Preface

In the early 1990s, e-business ushered in what is now called "the global economy." It revolutionized the process of buying, selling, and exchanging products and services, and spawned a host of business and technological innovations. As globalization and competition pose new opportunities and challenges, firms face increased pressures from stakeholders to create e-business values. They are attempting to find which e-business models and applications will contribute effectively to their sustainability, growth, and innovation. Innovations in technology in the e-business area have constantly encouraged firms to improve existing business processes and to come up with new business models and applications. Recently, advancements of wireless technologies have extended the reach of e-business to mobile business environments. As a growing number of customers utilize mobile devices to exchange information and to conduct business transactions, firms are competing to provide the most value-added, innovative, convenient mobile services for their customers. While large firms have been the early adopters and beneficiaries of most e-business innovations, an increasing number of small and medium-sized enterprises (SMEs) are also rapidly adopting e-business to better serve customers, improve productivity, extend a market base, and stay competitive.

E-business brought about a paradigm shift caused by "disruptive" technology that is radically changing the traditional way of doing business. The global economy emerging from the Internet revolution changed the rules and principles traditionally held by business firms. The paradigm shift was unprecedented in terms of the complexity and magnitude, and pressured firms to be more innovative and proactive to business problems than ever before. Anecdotal evidence of excellent companies such as e-Bay and Amazon.com shows that they understand the dynamics of the complex interrelated internal and external forces imposed on the company, develop comprehensive business plans from multi-layered stakeholders' perspectives, and implement the plans at the right time, magnitude, and place. However, in light of the current lack of comprehensive studies in e-business planning and management, an overarching framework is in urgent need to assist e-business managers in analyzing enabling technologies and the success factors when developing e-business plans.

Although a large volume of literature is already available on e-business, many new ideas and applications are constantly emerging and provide potential opportunities and challenges for further research. In light of this phenomenon, it is high time to take stock of the new knowledge in e-business development and management. **Encyclopedia of E-Business Development and Management in the Global Economy** provides a repository for academicians, researchers, and industry practitioners to share and exchange their research ideas, theories, and practical experiences, discuss challenges and opportunities, and present tools and techniques in all aspects of e-business development and management in the global economy.

This book is divided into twelve sections with a total of 129 articles: **Section 1, Theoretical Foundations of E-Business**, discusses various e-business theories and the impacts of e-business to the economy and society; **Section 2, E-Business Planning and Performance Evaluation**, addresses planning and performance evaluation methodologies for e-business; **Section 3, E-Marketplaces**, discusses various types of e-marketplaces and related technologies; **Section 4, E-Business Strategies**, addresses competition, dynamics, and trends in e-business; **Section 5, E-Business Models**, discusses various business models and their value creating opportunities; **Section 6, E-Business Management**, discusses organizational culture, leadership, management methods, customer management, and practices for e-business; **Section 7, Online Consumer Behavior**, presents e-commerce consumer acceptance models, trust, and psychological perspective on online consumer behavior; **Section 8, Mobile Commerce**, addresses mobile consumer behavior, mobile marketing, mobile virtual community, and mobile services; **Section 9, E-Business System Development**, presents service-oriented architecture, system design principles, quality of service, and e-business applications development; **Section 10, Web Services and E-Business Process Integration**, discusses various web service technologies and issues in business process integration; **Section 11, E-Business: Issues, Challenges, and Opportunities**, addresses digital divide, technological and regulatory challenges, emerging economies, and new e-business application opportunities; and **Section 12, Emerging Trends**, presents new web technologies, Web 2.0, and future trends. A brief introduction of each article follows:

**Section 1: Theoretical Foundations of E-Business** consists of nine articles. "The Macroeconomic Impacts of E-Business on the Economy" by Daniel Heil and James E. Prieger, Pepperdine University (USA), covers some of the impacts e-business has on the economy, emphasizing macroeconomic effects. It suggests directions for future research and discusses issues that e-business presents policymakers. "The Microeconomic Impacts of E-Business on the Economy" by James E. Prieger and Daniel Heil, Pepperdine University (USA), covers both the predicted impacts of e-business on the economy suggested by microeconomic theory, to understand why e-business has proliferated, and their empirical magnitude, to show the economic benefits. "The Power Laws of Enterprise 2.0" by Jacques Bughin, McKinsey & Company, Inc (Belgium), presents key stylized facts around the adoption, use and success of social software, a phenomenon dubbed "Enterprise 2.0." "Prices on the Internet" by Jihui Chen, Illinois State University (USA), reviews price dispersion and related literatures, and discuss future research directions. "Price Dispersion on the Internet: A Further Review and Discussion" by Fang-Fang Tang, Peking University (China); Xiaolin Xing, Fannie Mae (USA), reviews significant price differences and persistent price dispersions in the Internet markets. "The Electronic Law of One Price (eLOP)" by Camillo Lento, Alexander Serenko, and Nikola Gradojevic, Lakehead University (Canada); Lorne Booker, McMaster University (Canada); Sert Yol, Lakehead University (Canada), tests the eLOP by utilizing two datasets with online price data. Pairwise comparison tests reveals that the eLOP does not hold true for any of the product price categories tested. "Trust in Electronic Commerce: Definitions, Sources, and Effects" by Hongwei Du, California State University, East Bay (USA); Albert Lederer, University of Kentucky (USA); Jiming Wu, California State University, East Bay (USA), discusses the concept of trust, its definitions, and sources. "Avatar Theory" by Ching-I Teng, Chang Gung University (Taiwan); Shao-Kang Lo, Chinese Culture University (Taiwan), presents Avatar Theory to outline fundamental propositions related to avatars. Avatar Theory can provide a background theory for subsequent avatar studies related to online games. "Relationship between Second Life and the U.S. Economy" by Rosemarie Reynolds, Yusuke Ishikawa, and Amanda Macchiarella, Embry-Riddle Aeronautical University (USA), investigates the relationship between the economies of Second Life and the United States, using financial data collected from Linden Lab and the Federal Reserve.

**Section 2: E-Business Planning and Performance Evaluation** consists of nine articles. "E-Business Adoption and its Impact on Performance" by Sabah Abdullah Al-Somali, Ben Clegg, and Roya Gholami, Aston University (UK), discusses the process of e-business implementation, usage and diffusion (routinisation stage) on business performance. "B2B Website Benefits Realization in Australian SMEs" by Chad Lin, Curtin University of Technology (Australia); Yu-An Huang, National Chi Nan University (Taiwan); Rosemary Stockdale, Massey University (New Zealand), examines the relationships between B2B website adoption readiness, B2B website adoption constraints, IT investment evaluation, and B2B benefits in Australian SMEs. "Lifelong Learning in the Knowledge Economy: An Empirical Analysis of e-Learning Adoption at Firm-Level" by Maria Rosalia Vicente and Ana Jesus Lopez, University of Oviedo (Spain), examines e-learning adoption among a sample of European firms (an area for which empirical evidence is quite scarce), and investigates the factors driving its introduction. "Measuring the Quality of E-Business Services" by Mark Springer, Craig K. Tyran, and Steven Ross, Western Washington University (USA), develops a framework to compare and contrast different models of e-service quality. "Measuring B2C Quality of Electronic Service: Towards a Common Consensus" by Mahmoud Amer and Jorge Marx Gómez, Carl von Ossietzky University of Oldenburg (Germany), proposes a B2C electronic Service Quality "eSQ" model of consensus summarizing the past research efforts. The Business Value of E-Collaboration: A Conceptual Framework" by Lior Fink, Ben-Gurion University of the Negev (Israel), provides a conceptual framework for researchers and practitioners who are interested in investigating and understanding the organizational impacts of collaborative technologies. "A Model on Antecedents and Consequences of E-Procurement" by M. José Garrido, Ana Gutiérrez, and Rebeca San José, Universidad de Valladolid (Spain), analyzes whether different Internet tools are used throughout all purchasing phases and whether the characteristics of the buying situation determined the use of the Internet in that process. "Global Online Performance and Service Orientation" by Anna Morgan-Thomas, University of Glasgow, UK; Robert Paton, University of Glasgow (UK), examines the contribution of e-commerce to SME globalization. The focus here is explicitly on existing firms and their online activities. "Electronic Funds Transfer Systems and the Landscapes of Global Finance" by Barney Warf, University of Kansas (USA), summarizes some of the major public and private EFTS networks and the repercussions for capital markets, stock exchanges, and foreign exchange markets.

**Section 3: E-Marketplaces** consists of nine articles. "Intermediaries in E-Commerce: Value Creation Roles" by Nirvikar Singh, University of California, Santa Cruz, (USA), examines the evolution and robustness of intermediation in e-commerce, by examining the fundamental economics of intermediation in terms of economies of specialization, scale, and scope. "Identifying the Factors that Lead to a Successful Intermediary in Electronic Commerce" by Margaret Jackson and Marita Shelly, RMIT University (Australia), explores the factors that have led to the success of financial intermediaries and in particular, BPAY Ltd. in Australia. "A Framework for Identifying B2B E-Marketplace Strategies" by George Mangalaraj and Chandra S. Amaravadi, Western Illinois University (USA), reviews existing literature and provides a parsimonious framework for classifying electronic marketplaces. "Electronic Logistics Marketplaces" by Yingli Wang, Mohamed Naim, and Andrew Potter, Cardiff Business School, (UK), defines and describes Electronic Logistics Marketplaces (ELMs) in terms of their architectures, features and functionalities, impact on logistics practice and benefits to stakeholders, and future requirements. "An Agent-Based B2C Electronic Market in the Next-Generation Internet" by Vedran Podobnik, University of Zagreb (Croatia); Krunoslav Trzec, Ericsson Nikola Tesla (Croatia); Gordan Jezic, University of Zagreb (Croatia), presents an agent-based framework for the business-to-consumer (B2C) electronic market, comprising user agents, broker agents and provider agents, which enable Internet users to select an Internet Service Provider in an automated manner. “Concept of Agent-based Electronic Marketplace” by Norleyza Jailani, Ahmed Patel, Muriati Mukhtar, Salha Abdullah, and Yazrina Yahya, Universiti Kebangsaan Malaysia (Malaysia), explains the concepts of an electronic marketplace (e-marketplace) and the types of e-marketplaces in today’s computing environment that is facilitated and driven by the Internet. The concept of software agent and the different types of agents which may exist in an e-marketplace application in the current setting of the global economy is also discussed. “Concept of Mobile Agent-Based Electronic Marketplace Safety Measures” by Ahmed Patel, Universiti Kebangsaan Malaysia, (Malaysia), extends the basic concepts of Mobile Agent Systems (MAS) to elaborate on the principles and address the key issues of security, privacy, trust, and audit for normal e-business and digital forensics purposes. “Time Constraints for Sellers in Electronic Markets” by Kostas Kolomvatsos, and Stathes Hadjiefthymiades, University of Athens (Greece), describes a model for the seller behaviour and through this model quantifies the maximum time of seller participation. “Towards Efficient Trust Aware E-Marketplace Frameworks” by Malamati Louta, Harokopio University of Athens, Greece; Angelos Michalas, Technological Educational Institute of Western Macedonia, (Greece), proposes enhancements to the sophistication of the negotiation functionality that can be offered by e-commerce systems in open competitive communications environments.

**Section 4: E-Business Strategies** consists of five articles. “Assessing Relational E-Strategy Supporting Business Relationships” by Anne-Marie Croteau, Anne Beaudry, and Justin Holm, Concordia University (Canada), develops an integrative construct of e-strategy, mainly focusing on the relationships built between and within companies. “Leading the Organizational Dynamics of E-Business Firms” by Esin CAN MUTLU, Yasemin BAL, and Pınar BÜYÜKBALCI, Yıldız Technical University (Turkey), conceptually discusses the important organizational aspects in e-business firms and supports them with the needed leadership traits. “Adoption of e-Commerce by Canadian SMEs: Defining Organisational, Environmental and Innovation Characteristics” by Lynn L. Sparling, Okanagan College (Canada); Aileen Cater-Steel and Mark Toleman, University of Southern Queensland (Australia), focuses on the definitions of organisational, external, environmental and innovation variables in the organisational context. “E-Business Strategy in Franchising” by Ye-Sho Chen and Chuanlan Liu, Louisiana State University (USA); Qingfeng Zeng, Shanghai University of Finance and Economics (China), discusses how e-business can be “meaningfully” used in franchising. “Exploring the impact of Government Policies and Corporate Strategies on the Diffusion of Mobile Data Services: Case of Economies at Different Stages of Transition” by Tugrul U Daim, Portland State University (USA); Jing Zhang, Beijing University of Posts and Telecommunications (China); Byung-Chul Choi, Samsung Information Systems America (SISA) (USA), explores how governments and businesses impact the diffusion of mobile data services with their policies and strategies.

**Section 5: E-Business Models** consists of nine articles. “eBusiness and the Resource-based View: Towards a Research Agenda” by Pedro Soto-Acosta, University of Murcia (Spain), provides a review of the adoption of a resource-based view of the firm (RBV) in e-business literature and suggests directions for future research. “E-Commerce Business Models: Part 1” and “E-Commerce Business Models: Part 2” by Khaled Ahmed Nagaty, The British University in Egypt, (Egypt), presents various e-commerce business models and their advantages and disadvantages, and discusses the important issues and problems facing e-commerce web sites. “Creating Business Opportunities Based on Use of Electronic Knowledge Business Models” by Tsung-Yi Chen, Nanhua University (Taiwan); Yuh-Min Chen, National Cheng Kung University (Taiwan), explores the knowledge value chain in the collaborative innovation era, introduces the knowledge commerce model, and analyzes possible revenue streams and opportunities associated with knowledge commerce. "Online Private Sales Clubs: An Emerging Model Of Fashionable E-Commerce at Promotional Prices" by Ana Isabel Jiménez-Zarco, Open University of Catalonia (Spain); María Pilar Martínez-Ruiz, Castilla la Mancha University (Spain); Silvia Sivera-Bello and Sandra Vilajoana-Alejandre, Open University of Catalonia (Spain), identifies some of the keys to success, as well as the growth opportunities associated with the online private sales club. "Business Model Renewal: The TIA-MARIA Framework for Enterprise Realignment" by Rebecca De Coster, Brunel University, (UK), develops a framework for business model renewal based on case study research into firms entering the emerging sector of mobile networking. "Architecture Model for Supply Chain Orchestration and Management" by Marijn Janssen, Delft University of Technology (the Netherlands), discusses the role of Supply Chain Orchestrators, with the aim of deriving an architectural model for the integration of the activities of organizations in the supply chain. The architecture model is illustrated and evaluated using a case study. "Ambient e-Service: a bottom-up collaborative business model" by Yuan-Chu Hwang, National United University, (Taiwan), presents an ambient e-service framework that characterizes ambient e-services with three dimensions (value stack, environment stack and technology stack). Several ambient e-service applications are also exemplified. "Online Auctions: Pragmatic Survey and Market Analysis" by James K. Ho, University of Illinois at Chicago (USA), presents a survey and market analysis of various online auction business models.

**Section 6: E-Business Management** consists of twenty articles. "Configurators/Choiceboards: Uses, Benefits, and Analysis of Data" by Paul D. Berger, Bentley University (USA); Richard C. Hanna and Scott D. Swain, Northeastern University (USA); Bruce D. Weinberg, Bentley University (USA), discusses the uses and benefits of configurator/choiceboard systems, and how the analysis of its usage can be beneficial to the company. "E-CRM: A Key Issue in Today's Competitive Environment" by María Pilar Martínez-Ruiz, University of Castilla-La Mancha (Spain); María Rosa Llamas-Alonso, University of León (Spain); Ana Isabel Jiménez-Zarco, Open University of Catalonia (Spain), highlights the importance of e-CRM as a key business process for global companies, gaining a better understanding of its benefits from different managerial perspectives, emphasizing key factors for effective implementation, and pointing out challenges and future directions in the field. "Effective Virtual Project Management Using Multiple E-Leadership Styles" by Margaret Lee, Capella University (USA), reviews management concepts for virtual teams that include leadership styles such as control-related models, transformational and transactional leadership styles, leadership that empowers team members to self-manage, and situational and contingency leadership styles. "On-Line Credit Card Payment Processing and Fraud Prevention for e-Business" by James G. Williams, University of Pittsburgh (USA); Wichian Premchaiswadi, Siam University (Thailand), addresses the issue of credit card fraud in terms of how cyber-criminals function and the potential solutions used to deter credit card fraud attempts. "Virtual Stock Markets as a Research Tool in Marketing and Management" by Lorenz Zimmermann, Ludwig-Maximilians-University Munich (Germany), explains the basic concept of Virtual Stock Markets (VSM), describes the potential areas of application, and shows examples of successful implementations in business practice. "Potential Benefits of Analyzing Website Analytic Data" by Elizabeth Votta, Roosevelt University (USA), presents potential benefits of analyzing website analytic data, including: discovering traffic trends, targeting market segmentation, developing best practices, optimizing landing pages, and improving conversion rates. "Teams of Leaders Concept (Tol) and E-Business Operations" by Dag von Lubitz, MedSMART Inc. (USA), presents the concept of teams of leaders (ToL) and its implications to e-business operations. ToL centers on the active, platform independent fusion of advanced IM, KM and high performing leader teams. "Customer Relationship Management (CRM): A Dichotomy of Online and Offline Activities" by

Kelley O'Reilly and David Paper, Utah State University (USA), documents how companies can determine the best blended approach to CRM initiatives that balance both online and offline marketing initiatives. "Understanding E-Payment Services in Traditionally Cash-Based Economies: The Case of China" by Xiaolin Li and Dong-Qing Yao, Towson University (USA); Yanhua Liu, Wuhan College of Economics and Management (China), examines a series of issues pertaining to China's e-payment services, which include China's e-payment growth, mechanisms, characteristics, opportunities and challenges. "Scenario Driven Decision Support" by M. Daud Ahmed, Manukau Institute of Technology (New Zealand); David Sundaram, University of Auckland (New Zealand), introduces scenario as a DSS component and develops a domain independent, component-based, modular framework that supports scenario management process. "e-HRM in TURKEY: A CASE STUDY" by Yonca GÜROL, Yildiz Technical University, (Turkey); R. Ayşen WOLFF, Haliç University (Turkey); Esin ERTEMSİR BERKİN; Yildiz Technical University (Turkey), investigates several specific and critical points that will contribute to a better understanding of E-HRM by illustrating how it is used by a Turkish firm in the health sector. "ARIBA: A Successful Story in E-Commerce" by Zhongxian Wang, Montclair State University (USA); Ruiliang Yan, Indiana University Northwest (USA); James Yao, Montclair State University (USA), review major events and innovations that helped ARIBA to grow and succeed rather than fail. "Integrated Optimal Procedure of Internet Marketing" by Lan Zhao, Chongqing University (China) and SUNY/College at Old Westbury (USA), focuses on how to integrate all the phases of Internet marketing process into a seamless pipeline. "Managerial Succession and E-Business" by Anthonia Adenike Adeniji, Covenant University (Nigeria), focuses on why succession planning is crucial in e-business and in the global economy. "E-business and Web Accessibility" by Panayiotis Koutsabasis, University of the Aegean (Greece), proposes measures for reaching and maintaining a good level of Web accessibility in terms of the specifications, design and evaluation phases of a user-centered approach to systems development. "Understanding the Use of Business-to-Employee (B2E) Portals in an Australian University though the Management Lens: A Qualitative Approach" and "Understanding the Use of Business-to-Employee (B2E) Portals in an Australian University through the Employee Lens: A Quantitative Approach" by Md Mahbubur Rahim, Monash University (Australia); Mohammad Quaddus, Curtin University (Australia); Mohini Singh, RMIT University (Australia), analyse the views of the portal steering committee (who represent the interests of the university senior management) relating to the portal usage behaviour of university staff and identify the key factors which they believe to have contributed to employees' low usage practices of portals. "An Exploratory Study on the User Adoption of Central Cyber Government Office of the Hong Kong Government" by Kevin K.W. Ho, The University of Guam (Guam); Calvin Chun Yu, The Hong Kong University of Science and Technology (Hong Kong); Michael C.L. Lai, Hong Kong Police Force (Hong Kong), investigates those factors affecting the user adoption of the Intranet Portal of the Hong Kong Government, a.k.a., Central Cyber Government Office (CCGO). "An Exploratory Study on the Information Quality Satisfaction of Central Cyber Government Office of the Hong Kong Government" by Kevin K.W. Ho, The University of Guam (Guam), examines the information quality satisfaction of the Central Cyber Government Office (CCGO), which is a communication portal developed by the Hong Kong Government. "Visual Merchandising in Online Retailing based on Physical Retailing Design Principles" by Tony Pittarese, East Tennessee State University (USA), presents effective design guidelines for the creation of successful online stores which are based on the design principles and practices of physical retailers.

**Section 7: Online Consumer Behavior** consists of thirteen articles. "Internet Consumer Behavior: Flow and Emotions" by Marie-Odile Richard, University of Montreal (Canada); Michel Laroche, Concordia University (Canada), develops the flow construct of Internet consumer behavior, composed of skills, challenge and interactivity, and the emotions construct, composed of pleasure, arousal and dominance. "Internet Consumer Behavior: Web atmospherics" by Marie-Odile Richard, University of Montreal (Canada); Michel Laroche, Concordia University (Canada), presents six variables of web atmospherics: navigational characteristics, website structure, website organization, effectiveness of its content, website informativeness, and website entertainment. "Internet Consumer Behavior: Behavioral Variables" by Marie-Odile Richard, University of Montreal (Canada); Michel Laroche, Concordia University (Canada), examines the key behavioral variables identified by the literature: exploratory behavior, site attitude, product attitude, site involvement and product involvement. "Internet Consumer Behavior: Major Moderating Variables" by Marie-Odile Richard, University of Montreal (Canada); Michel Laroche, Concordia University (Canada), describes some of the key moderating variables such as gender, need for cognition (NFC) and optimum stimulation level (OSL). "Consumer Information Sharing" by Jonathan Foster and Angela Lin, University of Sheffield (UK), provides an up-to-date review of the practice of consumer information sharing. "B2C E-Commerce Acceptance Models Based On Consumers' Attitudes and Beliefs: Integrating Alternative Frameworks" by Ángel Herrero-Crespo and Ignacio Rodríguez-del-Bosque, Universidad de Cantabria (Spain), describes the main principles of Theory of Planned Behaviour, the Technology Acceptance Model and Decomposed Theory of Planned Behaviour and examines their weaknesses and strengths for the research of e-commerce acceptance. "Effect of Perceived Risk On E-Commerce Acceptance: State of the Art and Future Research Directions" by Ángel Herrero-Crespo and Ignacio Rodríguez-del-Bosque, Universidad de Cantabria (Spain), examines the influence that perceived risk in online shopping has on the process of e-commerce adoption by end consumers. "Third Party Internet seals: Reviewing the Effects On Online Consumer Trust" by Peter Kerkhof, VU University Amsterdam (the Netherlands); Guda van Noort, University of Amsterdam (the Netherlands), presents an overview of findings regarding the persuasiveness of Internet seals and reflects upon possible explanatory mechanisms for these effects. "The Importance of Gender, IT Experience, and Media-Rich Social Cues on Initial Trust in e-Commerce Websites" by Khalid AlDiri, Dave Hobbs, and Rami Qahwaji, University of Bradford (UK), investigates how to increase the perceived trustworthiness of vendor websites. "Using the Internet to Study Human Universals" by Gad Saad, Concordia University (Canada), provides a brief overview of how the Internet is a powerful tool for investigating many human preferences, choices, emotions, and actions which occur in universally similar manners. "The Neurocognitive and Evolutionary Bases of Sex Differences in Website Design Preferences: Recommendations for Marketing Managers" by Eric Stenstrom and Gad Saad, Concordia University (Canada), examines how sex differences in the processing of spatial and perceptual information lead to differential preferences in website design for men and women. "Exploring Video Games from an Evolutionary Psychological Perspective" by Zack Mendenhall, Marcelo Vinhal Nepomuceno, and Gad Saad, Concordia University (Canada), demonstrates how an evolutionary psychological (EP) approach could elucidate why video games have increased in popularity, and how it is related to our evolved human nature. "An Integrated Model for e-CRM in Internet Shopping: Evaluating the Relationship between Perceived Value, Satisfaction and Trust" by Changsu Kim, Yeongnam University (Korea); Weihong Zhao, Jiangxi Normal University (China); Kyung Hoon Yang, University of Wisconsin-La Crosse (USA), develops an integrated e-CRM model by investigating the psychological process that occurs when a customer maintains a long-term relationship with an Internet online retailer.

**Section 8: Mobile Commerce** consists of eleven articles. "Mobile Communications / Mobile Marketing" by Suzanne Altobello Nasco, Southern Illinois University Carbondale (USA), introduces mobile communication technologies, and discusses various mobile marketing and advertising strategies. “C2C Mobile Commerce: Acceptance Factors” by Lori N. K. Leonard, University of Tulsa (USA), presents a model of an individual’s intention to make use of mobile devices for C2C e-commerce which includes usefulness, ease of use, convenience, trust, and security. “Exploring the Mobile Consumer” by Kaan Varnali and Cengiz Yilmaz, Boğaziçi University (Turkey), provides insights into consumers’ experience with mobile marketing by presenting a review of the mobile consumer behavior literature in an organized framework. “The Personalization Privacy Paradox: Mobile Customers’ Perceptions of Push-Based vs. Pull-Based Location Commerce” by Heng Xu, John M. Carroll, and Mary Beth Rosson , Pennsylvania State University (USA), presents the personalization privacy paradox, and discusses the different impacts of pull and push mechanisms on the privacy personalization paradox. “Mobile Gaming: Perspectives and Issues” by Krassie Petrova, Auckland University of Technology (New Zealand), identifies the determinants of mGaming success and suggests recommendations for mobile game design and mGaming service provisioning. “Role of Personal Innovativeness in Intentions to Adopt Mobile Services – Cross-service approach” by Sanna Sintonen and Sanna Sundqvist, Lappeenranta University of Technology (Finland), contributes to the research on behavioral intentions to use mobile services. The key role is attributed to innovativeness in predicting mobile service adoption. “Service Discovery Techniques in Mobile E-commerce” by Nandini Sidnal, K.L.E.S. College of Engineering and Technology (India); Sunilkumar S. Manvi, Reva Institute of Technology and Management (India), discusses various mobile E-commerce issues with its main focus on the service discovery issue. It also elaborates on various syntax and semantic based service discovery mechanisms and concludes with future directions to service discovery mechanism. “Perspectives on the Viable Mobile Virtual Community for Telemedicine” by Jan-Willem van ’t Klooster, Pravin Pawar, Bert-Jan van Beijnum, Chariz Dulawan, Hermie Hermens; University of Twente, (the Netherlands), contributes to Mobile Virtual Community (MVC) in general and mobile patient monitoring and treatment in particular by 1) analyzing in detail the robustness and other requirements to be fulfilled by the technical platform for MVCs, 2) providing guidelines for MVC platform development based on service orientation, and 3) discussing the actors, front-end views and service components involved. “Socio-Economic Effects on Mobile Phone Adoption Behavior among Older Consumers” by Sanna Sintonen, Lappeenranta University of Technology (Finland), evaluates what influences the usage of mobile phones among the aging consumers. “Mobile Agents in E-Commerce” by Bo Chen, Michigan Technological University (USA), highlights good features of the mobile agent paradigm for the applications in e-commerce. A number of selected mobile agent-based e-commerce systems and the agent platforms are introduced. “Mobile Telephony as a Universal Service” by Ofir Turel, California State University Fullerton (USA); Alexander Serenko, Lakehead University (Canada), discusses the need for reasonably priced, high quality telecommunication services to everyone who wishes to employ them and suggests the inclusion of mobile telephony services in the “universal service” basket.

**Section 9: Web Services and E-Business Process Integration** consists of seven articles. “Web Service Discovery, Composition, and Interoperability” by Duy Ngan Le, Karel Mous, and Angela Goh, Nanyang Technological University (Singapore), presents a brief survey, problems and possible solutions to three Web service operations (Web Service Discovery, Composition, and interoperability). “Case based web services” by Zhaohao Sun, University of Ballarat (Australia); Gavin Finnie, Bond University (Australia); John Yearwood, University of Ballarat (Australia), proposes CWSR: a case-based web service reasoner. It examines the correspondence relationship between web services and CBR and provides a unified treatment for case-based web service discovery, composition and recommendation. “Web Services E-Contract and Reuse" by Marcelo Fantinato, University of São Paulo (Brazil); Maria Beatriz Felgar de Toledo, State University of Campinas (Brazil); Itana Maria de Souza Gimenes, State University of Maringá (Brazil), presents a two-level e-contract metamodel. This metamodel is designed to promote the reuse of e-contracts during e-contract negotiation and establishment, taking into account contract templates. "Situational Enterprise Services" by Paul de Vrieze and Lai Xu, SAP Research (Switzerland); Li Xie, GuangDong Polytechnic Normal University (China), investigates how to apply new Web technologies to develop, deploy and execute enterprise services. "Social Networks and Web Services-based Systems" Zakaria Maamar, Zayed University (U.A.E); Leandro Krug Wives, Federal University of Rio Grande do Sul – UFRGS (Brazil), defines a social network in the context of Web services and shows how this network is built and used to discover Web service. "Interoperability Issues of Business Processes-Key Issues and Technological Drivers" by Ejub Kajan, State University of Novi Pazar (Serbia), gives an overview of the main obstacles in system integration, a critical assessment of existing approaches and recent research efforts in order to overcome interoperability problems. "Integrated Business Process Designs and Current Applications of Workflow Systems in E-Business" by Mabel T. Kung and Jenny Yi Zhang, California State University at Fullerton (USA), shows a comprehensive list of the structural integration of workflow models and designs that are currently applied to e-business.

**Section 10: E-Business System Development** consists of thirteen articles. "Facilitating Interaction between Virtual Agents By Changing Ontological Representation" by Fiona McNeill and Alan Bundy, University of Edinburgh (UK), presents the Ontology Repair System, which is designed to be a tool for automated agents acting on behalf of people or systems. "Modeling Collaborative Design Competence with Ontologies" by Vladimir Tarasov, Kurt Sandkuhl, and Magnus Lundqvist, Jönköping University (Sweden), applies ontology engineering to modeling competences of individuals, including different competence areas like cultural competences, professional competences and occupational competences. "Event Driven Service-Oriented Architectures for E-Business" by Olga Levina and Vladimir Stantchev, Berlin Institute of Technology (Germany), provides an introduction on the event- and service-oriented technologies, their origins and application areas. "Speeding up the Internet: Exploiting Historical User Request Patterns for Web Caching" by Chetan Kumar, California State University San Marcos (USA), discusses proxy caching approaches that exploit historical user request patterns in order to reduce user request delays. "The Effect of User Location and Time of Access on Ecommerce: A Long Tail Study of Website Requests" by Chetan Kumar, California State University San Marcos (USA), discusses how user location and time of access affect website visitations, and the resulting implications for e-commerce. "Incorporating Knowledge Management into E-Commerce Applications" by Sandra Moffett, Martin Doherty, and Rodney McAdam, University of Ulster (UK), reviews how knowledge discovery, corporate collaboration and rapid decision making challenges can be incorporated into e-commerce applications, and presents tools and techniques which should be incorporated into a fully functioning web commerce application. "Application of Semantic Web Technology in E-Business: Case Studies in Public Domain Data Knowledge Representation" by Sotirios K. Goudos, Aristotle University of Thessaloniki (Greece); Vassilios Peristeras, National University of Ireland (Ireland); Konstantinos Tarabanis, University of Macedonia (Greece), presents a flexible and scalable framework of an information system for complex cases and shows the advantages of the semantic web technologies application to e-Business. "Design Elements and Principles for Maintaining Visual Identity on Websites" by Sunghyun R. Kang and Debra Satterfield, Iowa State University (USA), examines design factors and determines which of these factors affect people's ability to identify and perceive information on web sites. It will discuss how design elements can cross media boundaries and create a consistent and effective user experience between the physical business and its presence on the web. "Designing e-Business Applications with Patterns for Computer-Mediated Interaction" by Stephan Lukosch, Delft University of Technology (The Netherlands); Till Schümmer, FernUniversität in Hagen (Germany), discusses aspects common to e-business collaboration applications and presents an approach to capture the best practices within these applications by means of patterns.. "A SOA-Based Framework for Internet-Enabled CRM" by Wei-Lun Chang, Tamkang University (Taiwan), identifies the significant elements and value of Internet-Enabled CRM and provides a roadmap and practical and managerial implications for future CRM. "Building Context-Aware E-Commerce Systems: A Data Mining Approach" by Anahit Martirosyan, Thomas Tran, and Azzedine Boukerche, University of Ottawa (Canada), extends usage of context as compared to previously designed context-aware e-commerce systems. While in previous work, context was mainly considered for mobile e-commerce systems, it proposes to build and use context for e-commerce systems in general. "Efficient Service Task Assignment in Grid Computing Environments" by Angelos Michalas, Technological Educational Institute of Western Macedonia (Greece); Malamati Louta, Harokopio University of Athens (Greece), uses an Ant Colony Optimization algorithm (ACO) for service task allocation in Grid computing environments. "Policy Driven Negotiation to Improve the QoS in the Data Grid" by Ghalem Belalem, University of Oran (Es Senia) (Algeria), integrates into consistency management service, an approach based on an economic model for resolving conflicts detected in the data grid.

**Section 11: E-Business: Issues, Challenges, and Opportunities** consists of nine articles. "Understanding the dimensions of the broadband gap: more than a penetration divide" by Maria Rosalia Vicente and Ana Jesus Lopez, University of Oviedo (Spain), focuses on the analysis of the European broadband gap by means of multivariate statistical methods, and in particular, factor and cluster analyses. "E-inclusion: European Perspectives Beyond the Digital Divide" by Bridgette Wessels, University of Sheffield (UK), outlines the background to the emergence of the term 'e-inclusion' and its definition and provides the policy response by the European Union. "Importance of Electronic Record Preservation in E-Business" by Helena Halas, SETCCE, Slovenia; Tomaž Klobučar, SETCCE and Jožef Stefan Institute (Slovenia), analyzes electronic records preservation for business organizations from an organizational perspective. "Electronic Commerce Prospects in Emerging Economies Lessons from Egypt" by Sherif Kamel, The American University in Cairo, (Egypt), addresses the development of the digital economy in Egypt focusing on the challenges faced relating to a number of social, technological, financial and legal issues and the road map formulated in collaboration between the different stakeholders, including the government, the private sector and the civil society to diffuse e-commerce in Egypt. "Using Assistive Technology to Ensure Access to E-Learning for Individuals with Disabilities" by Hwa Lee, Bradley University (USA), provides an overview of technology access for E-Learning for individuals with disabilities including legislations relevant to technology access for individuals with disabilities. "A Holistic View of the Challenges and Social Implications of Online Distribution: The Case of Pensions" by Tina Harrison, The University of Edinburgh, U.K.; Kathryn Waite, Heriot Watt University (UK), critically evaluates the extent to which use of the Internet has facilitated and promoted pension distribution in the UK, as well as identifying the forces that are constraining or facilitating further change. "The Global Telecommunications Industry Facing the IP Revolution: Technological and Regulatory Challenges" by Harald Gruber, European Investment Bank (Luxembourg), unravels the interplay between the evolution of technology, market performance of the telecommunications sector and regulation in order to put the role of telecommunications for e-business into perspective. "Evolving e-Business Systems: Transgenic Forces in International Realpolitik Space in 2050" by Denis Caro, University of Ottawa (Canada), posits that transgenic governance forces are evolving and will engage future international e-business professionals in a multi-polar world of 2050. "E-recruiting: Sources, Opportunities, and Challenges" by In Lee, Western Illinois University (USA), classifies the various e-recruiting sources and discusses opportunities and challenges in developing and managing e-recruiting.

**Section 12: Emerging Trends** consists of fifteen articles. "Emerging Trends of E-Business" by Pengtao Li, California State University, Stanislaus (USA), presents the emerging trends of e-business in various areas, including Web services, Web 2.0, Mobile Commerce (M-Commerce), and corresponding ethical and social issues. "Virtual Commerce" by Suzanne Altobello Nasco, Robert E. Boostrom, Jr., and Kesha K. Coker, Southern Illinois University Carbondale (USA), presents virtual commerce in the context of virtual reality by illustrating how people buy and sell products and services in virtual worlds, and discusses how companies can incorporate virtual commerce into their existing marketing and overall business strategy. "The Web 2.0 Trend: Implications for the Modern Business" by Michael Dinger and Varun Grover, Clemson University (USA), introduces the use of Web 2.0 technologies in contemporary business environments, and presents a value oriented framework designed to guide firms in the development of Web 2.0 initiatives. "Web 2.0: The Era Of User Generated Content on Web Sites" by Jos van Iwaarden, Ton van der Wiele, and Roger Williams, Erasmus University (The Netherlands); Steve Eldridge, The University of Manchester (UK), looks into the role of user generated content (UGC) in purchasing decisions, and explains the strategic implications of UGC for online management of service quality. "Web 2.0 Concepts, Social Software and Business Models" by Matthes Fleck, Andrea von Kaenel, and Miriam Meckel, University of St. Gallen (Switzerland), provides an overview of the most prominent definitions, basic concepts and applications of the term Web 2.0, and investigates the Anderson's long tail concept, issues of transparency and the effects of an interconnected user base on e-business. "Grounding Principles For Governing Web 2.0 Investments" by Steven De Hertogh, Vlerick Leuven Gent Management School (Belgium) and Amsterdam Business School (The Netherlands); Stijn Viaene, Vlerick Leuven Gent Management School and K.U. Leuven (Belgium), proposes a set of grounding principles for governing web 2.0 investments. These grounding principles refer to attention areas and key choices that management ought to pay heed to if it wants to successfully invest in Web 2.0 for the enterprise. "Web 1.0, Web 2.0 and Web 3.0: The Development of E-Business" by Tobias Kollmann and Carina Lomberg, University of Duisburg-Essen (Germany), highlights the characteristics of Web 1.0, Web 2.0, and Web 3.0. "The New Generation of Knowledge Management for the Web 2.0 Age: KM 2.0" by Imed Boughzala, TELECOM Business School (France); Moez Limayem, University of Arkansas (USA), introduces, defines, and clarifies the concept of KM 2.0 compared to the traditional KM in terms of scope, nature of knowledge, place of the individual, process, and technology. "Recommender Systems: An Overview" by Young Park, Bradley University (USA), presents a brief overview of recommender systems as an effective and powerful personalization tool in the e-commerce environment. "A Linguistic Recommender System for Academic Orientation" by E. J. Castellano and L. Martínez, University of Jaén (Spain), develops OrieB, a Web-DSS for Academic Orientation based on a Collaborative RS (CRS) for supporting advisors in their student guidance task. "Wireless Technologies: Shifting Into the Next Gear?" by Simona Fabrizi, Massey University (New Zealand), provides a theoretical explanation for an apparent paradox of why some Mobile Operators (MOs) postpone upgrades while others do not. "Search Engines: Past, Present and Future" by Patrick Reid, AstraZeneca (UK); Des Laffey, University of Kent (UK), covers key issues in the area of search engines and looks at emerging issues in search, including rich media and mobile, and privacy issues. "E-Government – Status Quo and Future Trends" by Tobias Kollmann and Ina Kayser, University of Duisburg-Essen (Germany), provides an overview of current findings in the realm of e-government and presents future directions of research. "Blog Marketing: Potential and Limits" by Călin Gurău, GSCM – Montpellier Business School (France), investigates blog members' perceptions and level of acceptance of blog marketing, and discusses findings and implications for blog marketing communications. "RFID Enabled B2B E-Commerce Technologies and Applications" by Ygal Bendavid, Ecole Polytechnique de Montreal (Canada), focuses on the emerging phenomenon of Radio Frequency Identification (RFID) technologies and the EPC Network by examining how it enables innovative B2B E-Commerce applications.

The Encyclopedia of E-Business Development and Management in the Global Economy is an excellent collection of the latest research and practices associated with e-business theories, strategies, management, technologies, applications, and trends. This encyclopedia is the first comprehensive book that presents aspects from the research, industry, managerial, and technical sides of e-business. As leading experts in the e-business area, the contributors did an excellent job of providing our readers with extensive coverage of the most important research topics, concepts, business practices, technologies, and trends. The projected audience includes policy-makers, e-business application developers, market researchers, managers, researchers, professors, and undergraduate/graduate students in various academic disciplines. I expect this encyclopedia to shed new insights for researchers, educators, and practitioners to better understand the important issues and future trends of e-business research and technologies.

*In Lee, Ph.D.*
*Professor in Information Systems*
*Western Illinois University*
*Macomb, IL, USA*
*August 2009*

# Acknowledgment

I would like to acknowledge the help of the 225 expert reviewers involved in the double-blind review process for the 129 accepted article of the encyclopedia, without whose support it could not have been satisfactorily completed.

I sincerely thank Ms. Kristin M. Klinger, Julia Mosemann, Heather A. Probst, Jan Travers, Mehdi Khosrow-Pour, and other members of the IGI Global, whose contributions throughout the whole process from the inception of the initial idea to the final publication have been invaluable. I also thank my family for their understanding and support for this book project.

In closing, I would like to express my gratitude to the 234 authors for their invaluable contributions and collaboration.

*In Lee*
*Editor*

# About the Editor

**In Lee** is a professor in the Department of Information Systems and Decision Sciences in the College of Business and Technology at Western Illinois University. He received his MBA from the University of Texas at Austin and Ph.D. from University of Illinois at Urbana-Champaign. He is a founding editor-in-chief of the International Journal of E-Business Research. He has published his research in such journals as *Communications of the ACM, IEEE Transactions on Systems, Man, and Cybernetics, IEEE Transactions on Engineering Management, International Journal of Production Research, Computers and Education, Computers and Operations Research, Computers and Industrial Engineering, Business Process Management Journal, Journal of E-Commerce in Organizations, International Journal of Simulation and Process Modeling,* and others. His current research interests include e-commerce technology development and management, investment strategies for computing technologies, and intelligent simulation systems.

# Section 1
# Theoretical Foundations of E-Business

# Chapter 1
# The Macroeconomic Impacts of E-Business on the Economy

**Daniel Heil**
*Pepperdine University, USA*

**James E. Prieger***
*Pepperdine University, USA*

## INTRODUCTION

The growing use of information and communications technology (ICT) by business—e-business—has a profound impact on the economy. E-business lowers costs and increases the choices available to consumers and firms. These microeconomic changes work their way through the economy and ultimately influence macroeconomic conditions. Overall, e-business benefits the economy in many ways. Nevertheless, not all the effects of e-business on macroeconomic conditions are positive, and some aspects of e-commerce may limit the effectiveness of monetary policy.

E-business changes the macroeconomy in several beneficial ways. Some gains are static in nature, arising from the more efficient use of existing resources. For example, increases in productivity increase a nation's GDP. In addition, by lowering search and transaction costs, e-business unleashes deflationary pressures (Willis, 2004). Other gains are dynamic, altering the path national growth takes. By lowering the cost of transferring and employing knowledge, ICT enables greater R&D and innovation, which is crucial to long-run economic growth.

E-business exacerbates some macroeconomic policy challenges, and raises new ones. E-commerce crosses state borders seamlessly, resulting in lost sales tax revenue for state and local governments (Goolsbee, 2001). Consequently, e-business has potentially severe implications for fiscal policy and government financing, and policymakers continue to seek methods to tax e-business (Redpath, Redpath, & Ryan, 2007). The rise of electronic payments

DOI: 10.4018/978-1-61520-611-7.ch001

(e-payments) and the advent of e-money, an electronic medium of exchange separate from legal tender issued by a central bank, also complicate monetary policy and may alter its goals.

This article covers some of the impacts e-business has on the economy, emphasizing macroeconomic effects. Evidence from various empirical studies examining the impact greater use of ICT by business has on U.S. GDP is presented, followed by a review of the ways e-business affects monetary and fiscal policy. Suggested directions for future research and a discussion of issues that e-business presents policymakers close out the article.

## BACKGROUND

At the microeconomic level, e-business increases the productivity of firms and enhances the economic welfare of consumers.[1] Use of ICT by business increases productivity and profits by lowering search and transaction costs, enabling greater specialization, and broadening the market for trading goods (Wen, 2004). Through business-to-business (B2B) transactions, firms can connect their inventory systems with each other to order additional product quickly without using much labor in the process (Lucking-Reiley & Spulber, 2001). Business-to-consumer (B2C) e-business expands the marketplace, producing greater competition, lower prices, and broader consumer choice (Willis, 2004; Banham, 2005). Collectively, these reductions in cost and increases in productivity and consumer choice significantly benefit the economy.

The next section explains how e-business affects GDP, national growth, and monetary and fiscal policy. A country's GDP, which is a measure of total economic output, is a function of its physical and human capital, other resources, and the production processes used to turn inputs into output. The use of ICT by business increases GDP and economic growth by affecting all of these elements. To begin with, the information industry is itself a category in the GDP accounts, making up nearly four percent of US national income in 2008. More important is the way ICT makes other industries more productive. Investment in ICT increases the amount of physical capital, resulting in increased domestic output across the economy. E-business also makes labor and the production process itself more efficient, which will result in long run economic growth.

Monetary policy refers to how a central bank uses the money supply to influence interest rates, with the purpose of promoting sustainable economic growth. A key goal of monetary policy in most nations is price stability. E-business can produce significant cost reductions that lead to deflationary pressures. E-payments and e-money also affect monetary policy by creating "inside money", which is money produced by the private sector instead of by the central bank. While mainstream monetary economics takes the passive view of inside money (i.e., that it has no role in the transmission of monetary policy; Stracca, 2007), some commentators argue that inside money should change the *goal* of policy.[2]

Fiscal policy refers to actions of the government involving spending or taxation undertaken with the goal of economic growth or stability. E-commerce creates new avenues for avoidance of states sales taxes, and thus may limit a state government's power to raise revenue and fund its spending.

## THE MACROECONOMIC IMPACTS OF E-BUSINESS

### Impact on National Growth

The theoretical implications of e-business on the macroeconomy are far reaching, because ICT increases productivity, enhances competition, and broadens consumer choice. However, quantifying how e-business affects the economy is difficult, because the impacts are largely intangible (Lee, Gholami, & Tong, 2005). For example, ICT does not merely add to the physical capital stock of a firm, but can transform the nature of the entire production, sales, and distribution process. Early attempts at measurement led to a paradox: ICT could be found everywhere but in the productivity statistics.[3] Many recent empirical efforts, however, overcome the problem of intangibility and find that ICT adoption has a sizeable affect on national wealth and productivity.

In the short term, investment in ICT increases economic growth by adding to the capital stock of a nation, which makes labor more productive. Jorgenson and Vu (2005) find that investment in ICT capital accounted for 0.7 percentage points of growth in G7 countries during 1995-2003, which was about half of the contribution of capital to growth and about one quarter of total growth.[4]

In the longer term, use of ICT by business also spurs growth in total factor productivity (TFP) (Brynjolfsson & Hitt, 2002). TFP refers to the part of output not directly explained by measurable input usage. ICT enhances productivity by improving the efficiency of capital and labor and enabling greater technological innovation in the production process (UNCTAD, 2008).[5] Furthermore, e-business promotes greater economies of specialization within firms (or nations, in the case of international trade) by lowering transactions costs with other firms or nations (Wen, 2004). Inputs and services formerly produced within the firm or nation can be more easily provided from without via e-business. Economies of specialization in production can then lead to higher productivity.

Lee, Gholami, and Tong (2005) measure the effect of ICT investments on TFP. They find that investments in ICT contribute to the productivity of developed and newly industrialized nations, but not to that of developing nations. Oliner and Sichel (2002) find that 80 percent of TFP growth in the US during the productivity acceleration of 1996-2001 was due to the IT-producing sector. Belorgey, Lecat, and Maury (2006) find that ICT adoption improves the growth rates of labor productivity and partially explains the higher productivity growth in the US in the 1990s, compared to Europe. Similarly, the OECD (2004) found that ICT was responsible for all of the growth in labor productivity over 1996-2002 in OECD countries. Oliner and Sichel (2000) find the increased use of ICT accounts for two-thirds of the one percentage point increase in productivity growth in the latter half of the 1990s in the United States.

Empirical efforts to measure changes in GDP caused directly by specific forms of e-business are scarce. Brookes and Wahhaj (2001) estimate that B2B e-commerce increases economic growth by 0.25 percentage points per year in industrialized countries. Greenstein and McDevitt (2008), following careful national income accounting methodology, find that broadband diffusion generally (not just as part of e-business) has added a relatively modest $8-11 billion to GDP. Their finding contrasts with other estimates that are an order of magnitude higher (Crandall & Jackson, 2003).

## IMPACT ON MONETARY POLICY

### Inflation

Monetary policy in many countries aims to control inflation. E-business' potential for dramatic cost savings and greater competition can have considerable influence on the aggregate price level. The lower costs and prices associated with the growth of e-business have lowered inflation, at least in the short-term. In addition, e-business allows firms to adjust prices more quickly to respond to economic shocks. Reductions in such "menu costs" can produce ongoing reductions in the welfare harms from inflation. E-payments may also have disciplined central banks in recent years, keeping inflation low.

ICT lowers the cost of transferring, storing, and processing information. Accordingly, firms have embraced B2B e-commerce to lower procurement costs (Lucking-Reiley & Spulber, 2001). Cost reductions can be significant. Varian, *et al.* (2002) report cost savings over 1998-2001 of $164 billion to US firms from adoption of e-business, and Brookes and Wahhaj (2001) estimate that B2B e-commerce reduces input costs by 4–5 percent across all industry categories. Lower costs for firms result in lower prices for final goods and services. E-commerce also widens markets by removing geographical boundaries, bringing greater numbers of firms into competition with each other and lowering prices. The broadening of markets and the lowering of search costs for consumers forces both online and "brick and mortar" stores to lower prices (Willis, 2004; Banham, 2005).[6]

There is consensus among empirical studies that the growth in e-business lowers price levels. Brookes and Wahhaj (2000) find that B2B transactions reduce the overall price level by 3.4 percent, although they revise the estimated long-term impact to 0.5 percent in a later study (Brookes & Wahhaj, 2001).[7] Similarly, Basu and Siems (2004) attribute a portion of the decline in the price of core commodities and services in last twenty years to the adoption of e-business technologies.[8] Even if the effects of e-business on the overall price level are permanent, the main impact on the rate of inflation may last only while the cost reductions work their way through the economy. In the long term, however, e-business may not affect inflation much unless costs continue to fall at similar rates. Also, firms and consumers will adjust their behavior to account for the presence of e-business (when it becomes just "business"), at which point one would not expect further cost-savings from competition (Willis, 2004).

Lower costs are only one way e-business may lower the aggregate price level. Since e-firms have lower menu costs (the costs of changing prices) than offline stores, their prices should be less rigid and they should adjust prices more often. Thus, B2C and B2B e-commerce lessens price rigidity, causing unexpected, temporary cost shocks to have a lesser or shorter lasting effect on price levels (Willis 2004). Brynjolfsson and Smith (2000) confirm that online bookstores have more flexible pricing than offline establishments. Other, more recent economic studies find that considerable price rigidity still exists among e-firms, however (Kaufmann & Lee, 2004; Chakrabarti & Scholnick, 2007). Unlike one-time cost savings from adopting e-business, decreased menu costs can continue to alter the way adverse cost shocks are promulgated to prices on an ongoing basis, setting up persistent deflationary pressures.

The final way e-business affects inflation is by providing cash substitutes such as e-payments. Marimon, Nicolini, and Teles (2003) suggest that one reason worldwide inflation was low in the 1990s was that the widespread use of interest-bearing cash substitutes required central banks to exercise more monetary discipline. In their theoretical model, competition between the central bank and the suppliers of inside money reduces the temptation to depreciate the currency. When consumers can switch to inside money (e-payments, e-money, etc.), the government knows it will lose future seigniorage revenue and the incentive to inflate is lessened.

## E-Payments and E-Money

In the US, about two-thirds of non-cash settlements make use of e-payment instruments such as credit and debit cards (CPSS, 2008). One estimate holds that moving from paper checks to e-payments for non-cash transactions can save an economy 0.6 percent of GDP (Humphrey, Kim, & Vale, 2001). E-money products, which store value purchased by a consumer on an electronic device and reduce the funds when purchases are made, are also intended to serve as a general means of payment. However, e-money has not yet diffused widely in the US (perhaps because of issues of security and trust), and still constitutes a negligible fraction of the settlement media market (CPSS, 2008).

Despite slow adoption in the US of e-money specifically, e-payments in general raise issues for monetary policy. Two key questions prompted by the rise of e-payments are whether traditional policy instruments will continue to work as in the past and whether the growing prevalence of inside money should change the goals of monetary policy. Central banks undertake open market operations and set banks' reserve requirements and the discount rate to accomplish their objectives. The effectiveness of these instruments depends on the public's demand for bank reserves and on the central bank's capacity to supply these reserves. If e-payments and e-money alter the demand for reservable deposits (perhaps because e-money offers greater liquidity or convenience), then a central bank would need to adjust its operating techniques (BIS, 1996). On the supply side, if enough demand for cash leaks toward e-payments instead, then central bank balance sheets (on which cash is a major component) may be too small to undertake desired daily open market operations. While some commentators argue that e-money is liable to weaken or destroy the leverage central banks have over the money supply (Solomon, 1997; Quaden, 2001), the consensus among central banks is that inside money—at least at its scale seen to date—does not fundamentally change the implementation of monetary policy (BIS, 1996; Green, 2001; Stracca, 2007).[9]

On the other hand, inside money can prompt monetary authorities to re-evaluate their priorities. As buyers use less and less cash to transact, the smaller is the harm done by increases in inflation, because inside money typically bears interest and is relatively immune to the "inflation tax" (Aiyagari, Braun, & Eckstein, 1998). If so, then as e-payments become ubiquitous, perhaps central banks should shift their attention away from price stability toward other objectives, such as managing unemployment or attenuating business cycles.[10]

## Impact on Fiscal Policy

E-business as currently practiced reduces sales tax revenue for state and local governments. E-commerce in the US often crosses state borders, and states cannot force an out-of-state merchant to collect sales taxes if the merchant has no physical presence in the state.[11] Instead, in most states the consumer is required to pay a "use tax" on goods that would have been taxed if purchased within the state (Redpath, Redpath, & Ryan, 2007). Use taxes are self-reported and thus, with exception of large purchases like automobiles, go largely unreported (Varian, 2000). The loss of sales tax revenue from B2C transactions receives the most attention from policymakers because these transactions are the most likely to be taxable. However, attempts to tax B2B transactions have occurred as well, despite the economic inefficiency of taxing intermediate goods (Diamond & Mirrlees, 1971).

Policymakers have expressed concern over the potential loss in sales tax revenue due to e-commerce. However, for various reasons, the actual amount of lost revenue is likely not substantial. Many e-firms are in industries that do not sell taxable products, such as the travel industry and event ticket industry. Further, e-commerce often replaces similarly tax-exempt mail order purchases. Also, for many online purchases, the merchant has a nexus in the consumer's state, and accordingly pays sales tax (Goolsbee, 2001). Nevertheless, since sales taxing states receive about one-third of total tax revenue from their sales and use taxes, policymakers there are keenly interested in reducing leakage.

How much tax revenue is lost to e-commerce? Goolsbee (2001) finds that online sales evaporate $612 million dollars of sales tax revenue—only 0.3 percent of total sales tax—for all state and local governments in 1999. Other estimates find the loss of sales tax revenue at the turn of the millennium to be closer to one billion dollars per year (Jossi, 2003). The estimate of Bruce and Fox (2004), however, is $15.5 billion lost to e-commerce in 2003 and a projected $21.5 billion lost in 2008. Jossi (2003) argues that such large projections overestimate growth in the future Internet economy and neglect voluntary payments of use taxes by businesses. In addition, the larger projections neglect the dynamic impacts of taxing online purchases as consumers adapt their purchasing behavior to the new taxes (Goolsbee, 2001).

State and local policymakers, noting the potential to add to state revenue in difficult economic times, are exploring methods to increase sales tax revenue from online sales. Nevertheless, the burden on e-firms would likely be substantial, as there are thousands of taxing jurisdictions in the US with divergent rates (Redpath, Redpath, & Ryan, 2001).

## FUTURE RESEARCH DIRECTIONS

In the current context of the global economic crisis that began in 2008, it is natural to investigate the role e-business may have played and how e-business may help recovery. While rigorous analysis has yet to be done, some avenues appear promising to explore. For example, the lean inventories that businesses hold up and down the manufacturing supply chain, a product of the "just-in-time" inventory practices enabled by ICT, may have contributed to both the initial downturn and its length. Seeking to minimize inventory cost, firms responded to uncertainty in future demand by severely restricting production. Preliminary data indicate that almost half of the 6.1% (annualized) decline in US GDP came from reductions in inventory (Dvorak, 2009). As retailers begin to expand sales again, some have found that lack of inventory held by wholesalers is delaying the restocking of the shelves. Of course, e-business can also help the global recovery in many ways. To mention just one, the reduced capital required to start an online business, for example, helps spur business formation at a time when credit to startups remains tight.

More empirical research is needed in general to quantify the effects of e-business on the macroeconomy. While productivity enhancements from the use of ICT by business are now widely documented, isolating the effect on productivity of specific forms of e-business such as B2B e-commerce remains a difficult feat. This reality partially follows from the relatively nascent nature of e-commerce. As online markets continue to grow, and statistics on e-business activity improve, one should expect more detailed analyses of the impact e-business has on aggregate productivity levels to be possible.

In the future, monetary policy will need to adapt to the continued evolution of the payment and banking systems. As e-banking becomes more prevalent and as inside money hits the road with mobile commerce and banking (m-commerce and m-banking), it remains to be seen whether the traditional control authorities exercise over the money supply will remain intact. Future research should explore the theoretical and actual impacts of e-banking (national and cross-border), increased competition among forms of money, and other innovations spawned by e-business on the effectiveness of traditional instruments of monetary policy. Research must also suggest new instruments.

Finally, sales tax leakage also merits future research. Most of the e-commerce studies on the subject were completed before the dot-com bubble burst. Consequently, the trends and projections in these articles rely on overly optimistic estimates regarding the growth of e-commerce. In addition, these studies should more carefully distinguish the effects of B2B from B2C transactions. Sales taxes on B2B transactions as inefficient, since a firm's final output is likely already taxed (Goolsbee, 2001). Accordingly, future research may want to compare the lost economic surplus from taxing B2B e-commerce with the benefits of meeting the revenue needs of the state and local governments.

## CONCLUSION

E-business will have a growing impact on the macroeconomy. B2B and B2C transactions will continue to expand into existing and future industries. The growth in e-business will further increase productivity, reduce cost, and enhance competition. Consequently, e-business will continue to stimulate aggregate economic activity across the world. Similarly, cost reductions and the disciplining of monetary authorities will continue to exert deflationary pressures in the near future. While the economic gains from e-business are certainly welcome, policymakers will face challenges in managing the monetary and fiscal impacts of e-business. Meeting these challenges as they evolve will require deepening our understanding of the theoretical and empirical effects e-business has on the overall economy.

## REFERENCES


Aiyagari, S. R., Braun, R. A., & Eckstein, Z. (1998). Transaction services, inflation, and welfare. *The Journal of Political Economy*, *106*(6), 1274–1301. doi:10.1086/250047

Bakos, Y. (2001). The emerging landscape for retail e-commerce. *The Journal of Economic Perspectives*, *15*(1), 69–80.

Banham, R. (2005). Power to the little people. *CFO*, *21*(17), 62–68.

Bank for International Settlements (BIS). (1996). *Implications for central banks of the development of electronic money*. Basel, Switzerland: Bank for International Settlements.

Basu, M., & Siems, T. F. (2004). *The impact of e-business technologies on supply chain operations: A macroeconomic perspective* (Research Department Working Paper 0404). Dallas, TX: Federal Reserve Bank of Dallas.

Belorgey, N., Lecat, R., & Maury, T.-P. (2006). Determinants of productivity per employee: An empirical estimation using panel data. *Economics Letters*, *91*(2), 153–157. doi:10.1016/j.econlet.2005.09.003

Brookes, M., & Wahhaj, Z. (2000, February). The 'new' global economy – Part II: B2B and the Internet. *Global Economic Commentary*, Goldman Sachs, 3-13.

Brookes, M., & Wahhaj, Z. (2001). The economic effects of business to business Internet activity. *National Institute Economic Review*, *175*, 95–108. doi:10.1177/002795010117500109

Bruce, D., & Fox, W. F. (2004). *State and local sales tax revenue losses from e-commerce: Estimates as of July 2004*. Unpublished manuscript, University of Tennessee, Center for Business and Economic Research. Retrieved February 3, 2009, from http://cber.bus.utk.edu/ecomm/Ecom0704.pdf

Brynjolfsson, E., & Hitt, L. M. (2002). Computing productivity: Firm-level evidence. *The Review of Economics and Statistics*, *85*(4), 793–808. doi:10.1162/003465303772815736

Brynjolfsson, E., & Smith, M. (2000). Frictionless commerce? A comparison of Internet and conventional retailers. *Management Science*, *46*(4), 563–585. doi:10.1287/mnsc.46.4.563.12061

Chakrabarti, R., & Scholnick, B. (2007). The mechanics of price adjustment: New evidence on the (un)importance of menu costs. *Managerial and Decision Economics*, *28*(7), 657–668. doi:10.1002/mde.1374

Committee on Payment and Settlement Systems (CPSS). (2008). *Statistics on payment and settlement systems in selected countries: Figures for 2007*. Basel, Switzerland: Bank for International Settlements.

Crandall, R. W., & Jackson, C. L. (2003). The $500 billion opportunity: The potential economic benefit of widespread diffusion of broadband internet access. In A. L. Shampine (Ed.), *Down to the wire: studies in the diffusion and regulation of telecommunications technologies*. Hauppauge, NY: Nova Science Press.

Diamond, P. A., & Mirrlees, J. A. (1971). Optimal taxation and public production I: Production efficiency. *The American Economic Review*, *61*(1), 8–27.

Dvorak, P. (2009, May 18). Clarity is missing link in supply chain. *The Wall Street Journal*, A1.

Goolsbee, A. (2001). The implications of electronic commerce for fiscal policy (and vice versa). *The Journal of Economic Perspectives*, *15*(1), 13–23.

Green, E. (2001). Central banking and the economics of information. In A. M. Santomero et al. (Ed.), *Challenges for Central Banking*. Norwell, MA: Kluwer Academic Publishers.

Greenstein, S., & McDevitt, R. (2009). *The broadband bonus: Accounting for broadband internet's impact on U.S. GDP.* Paper presented at ASSA Annual Convention, San Francisco.

Humphrey, D. B., Kim, M., & Vale, B. (2001). Realizing the gains from electronic payments: Costs, pricing, and payment choice. *Journal of Money, Credit, and Banking*, *33*(2), 216–234. doi:10.2307/2673882

Jorgenson, D. W., & Vu, K. (2005). Information technology and the world economy. *The Scandinavian Journal of Economics*, *107*(4), 631–650. doi:10.1111/j.1467-9442.2005.00430.x

Jossi, F. (2003). The taxing issue of e-commerce. *Fedgazette*, *15*(6), 9–10.

Kauffman, R. J., & Lee, D. (2004). Should we expect less price rigidity in the digital economy? In R. Sprague (Ed.), *Proceedings of the 37th Hawaii International Conference on Systems Science,* Kona, HI. Los Alamitos, CA: IEEE Computer Society Press.

Lee, S.-Y. T., Gholami, R., & Tong, T. Y. (2005). Time series analysis in the assessment of ICT impact at the aggregate level – lessons and implications for the new economy. *Information & Management*, *42*(7), 1009–1022. doi:10.1016/j.im.2004.11.005

Lucking-Reiley, D., & Spulber, D. F. (2001). Business-to-business electronic commerce. *The Journal of Economic Perspectives*, *15*(1), 55–68.

Marimon, R., Nicolini, J. P., & Teles, P. (2003). Inside–outside money competition. *Journal of Monetary Economics*, *50*(8), 1701–1718. doi:10.1016/j.jmoneco.2003.08.009

Oliner, S., & Sichel, D. E. (2000). The resurgence of growth in the late 1990s: Is information technology the story? *The Journal of Economic Perspectives*, *14*(4), 3–22.

Oliner, S. D., & Sichel, D. E. (2002). *Information technology and productivity: Where are we now and where are we going?* (Finance and Economics Discussion Series no. 2002-29). New York: Board of Governors of the Federal Reserve System (US).

Organization for Economic Co-operation and Development (OECD). (2004). *The economic impact of ICT: Measurement, evidence, and implications.* Paris: OECD Publishing.

Quaden, G. (2001, October). *Central banking in an evolving environment*. Speech presented at the 23rd SUERF Colloquium, Brussels.

Redpath, I. J., Redpath, E. M., & Ryan, K. (2007). Sales and use taxation in e-commerce: Where we are and what needs to be done. *Information Systems Management*, *24*(3), 239–245. doi:10.1080/10580530701404611

Solomon, E. H. (1997). *Virtual money: Understanding the power and risks of money's high-speed journey into electronic space*. Cambridge, UK: Oxford University Press.

Stracca, L. (2007). *Should we take inside money seriously?* Working Paper Series no. 841. Frankfurt, Germany: European Central Bank.

United Nations Conference on Trade and Development (UNCTAD). (2007). *Information economy report 2007-2008: Science and technology for development: the new paradigm of ICT*. New York and Geneva: United Nations.

Varian, H., Litan, R. E., Elder, A., & Shutter, J. (2002). *The net impact study: The projected economic benefits of the internet in the United States, United Kingdom, France and Germany*, v2.0. Retrieved March 5, 2009 from http://www.netimpactstudy.com/NetImpact_Study_Report.pdf

Varian, H. R. (2000). Taxation of electronic commerce. *Harvard Journal of Law & Technology*, *13*(3), 639–651.

Wen, M. (2004). E-commerce, productivity, and fluctuation. *Journal of Economic Behavior & Organization*, *55*(2), 187–206. doi:10.1016/j.jebo.2003.10.002

Willis, J. L. (2004). What impact will e-commerce have on the U.S. economy? *Federal Reserve Bank of Kansas City Economic Review*, *89*(2), 53–71.

## ADDITIONAL READING

Board of Governors of the Federal Reserve System (US). (2005). *The Federal Reserve System: Its Purposes and Functions*. Washington, D.C.

Ferguson, R. W. (1998, June). *Implications of developments in electronic commerce*. Testimony before the Subcommittee on Finance and Hazardous Materials of the Committee on Commerce, US House of Representatives.

Fraumeni, B. M. (2001). E-commerce: Measurement and measurement issues. *The American Economic Review*, *91*(2), 318–322.

Galimov, A., & Dorofeeva, J. (2009). Global economic crisis fuels online business. *EzineArticle.com*. Retrieved May 19, 2009 from http://ezinearticles.com/?Global-Economic-Crisis-Fuels-Online-Business&id=1887677

Goolsbee, A. (2000). In a world without borders: The impact of taxes on Internet Commerce. *The Quarterly Journal of Economics*, *115*(2), 561–576. doi:10.1162/003355300554854

Goolsbee, A., & Zittrain, J. (1999). Evaluating the Costs and Benefits of Taxing Internet Commerce. *National Tax Journal*, *52*(3), 413–428.

Kauffman, R. J., & Walden, E. A. (2001). Economics and electronic commerce: Survey and directions for research. *International Journal of Electronic Commerce*, *5*(4), 5–116.

Prinz, A. (1999). Money in the real and the virtual world: E-money, c-money and the demand for cb-money. *NETNOMICS: Economic Research and Electronic Networking*, *1*(1), 11–35. doi:10.1023/A:1011441519577

See also the additional reading section for the companion article on the microeconomic impacts of e-business.

Seims, T. F. (2007). The macroeconomic benefits of intelligent business enterprise. In Y. Kurihara et al. (Eds.), *Information Technology and Economic Development* (pp. 71-86). Hershey, PA: IGI Global.

Victor, C., & Jih, W. J. (2006). Fair or not? The taxation of e-commerce. *Information Systems Management*, *23*(1), 68–72. doi:10.1201/1078.10580530/45769.23.1.20061201/91774.8

## KEY TERMS AND DEFINITIONS

**E-Money:** Electronic money. A class of prepaid, stored value retail payment mechanisms in which an electronic device in a consumer's possession stores a record of the funds available to the consumer. Purchases the consumer makes with the device reduce the funds available. In some new forms of e-money, funds are stored centrally in a server, apart from any physical device in the consumer's possession.

**E-Payment:** Electronic payment. Often the term is used narrowly for online payments, but is used here to refer to any payment made using a system involving electronic networks, such as credit and debit cards, and e-money.

**Fiscal Policy:** The policy involving government spending and taxation, designed to influence the level of aggregate economic activity.

**GDP:** Gross domestic product. A commonly used measure of the value of a nation's production, GDP is the market value of all the goods and services produced in the country.

**Monetary Policy:** The policy involving a nation's monetary authority influencing the money supply and the rate of interest. The goals of monetary policy typically include stable prices, moderate interest rates, and full employment.

**Seigniorage:** The revenue to the issuer of outside currency (the central bank or the government) from expanding the money supply. Seigniorage results directly from the cost of printing currency being less that its face value. The US Federal Reserve also earn seigniorage indirectly through the interest it earns on the securities it holds to cover its liability for issued reserve notes (cash).

**Total Factor Productivity:** Productivity growth not explained by increases in inputs such as capital and labor. TFP, as a residual, captures all other factors influencing growth, such as improved uses of the measurable inputs, general technological progress, and changes in policy and institutions.

## ENDNOTES

[*] This chapter was written while the second author was visiting the Federal Communications Commission. The views expressed in this chapter are those of the authors and do not necessarily reflect the views of the FCC or any of its Commissioners or other staff.

[1] We discuss the microeconomic aspects extensively in the companion article on the microeconomic impacts of e-business in this volume.

[2] Green (2001) describes but does not espouse the latter view.

[3] From an oft-quoted *bon mot* of Robert Solow ("We'd better watch out," *New York Times Book Review*, July 12, 1987, 36).

[4] For the 15 non-G7 industrialized economies Jorgenson and Vu (2005) also studied, investment in ICT also played a significant (but lesser) role.

[5] E-business and ICT use also greatly improves the process of R&D, innovation, and diffusion (see ch. 4 of UNCTAD (2007)).

[6] However, there is potential for online firms to limit competition, exercise market power, and price discriminate by raising switching costs for consumers (Bakos, 2001). See our companion article in this volume on the microeconomic impacts of e-business.

7 Interestingly, Brookes and Wahhaj (2001) find that B2B e-commerce is mildly inflationary over the first two years after adoption, because the expectation of greater future productivity gains inflates asset values in the present. The holders of the affected equities experience wealth effects boost their demand for goods, which creates inflationary pressure.

8 See our companion article for evidence that e-commerce lowers prices in specific industries.

9 Since e-payments reduce the time payees must wait to receive payment, businesses need less working capital. Thus another way e-business affects monetary calculus is that a given monetary aggregate can sustain greater activity in the economy (Humphrey, Kim, & Vale, 2001).

10 Green (2001) holds a contrary view.

11 Quill Corp. v. North Dakota (91-0194), 504 U.S. 298 (1992). New York State recently legislated that if an e-tailer advertises on web sites run by New York residents, it must collect sales taxes for the state. The state Supreme Court has ruled the law to be constitutional, but the ruling will likely be appealed.

# Chapter 2
# The Microeconomic Impacts of E-Business on the Economy

**James E. Prieger**
*Pepperdine University, USA*

**Daniel Heil**
*Pepperdine University, USA*

## INTRODUCTION

The use of information and communications technology (ICT) in business—the most expansive definition of e-business—is transforming the world economy. E-business at the microeconomic level of retail, wholesale, and labor market transactions has an enormous impact on the performance of companies and the economic welfare of consumers and workers. The gains in efficiency and economic benefits at the microeconomic level exert influence all the way up to the macroeconomic level of GDP and fiscal and monetary phenomena. However, new policy challenges accompany the rewards from e-business in the economy.

The economics of e-business are shaped by the way that ICT lowers the cost of transferring, storing, and processing information (Borenstein & Saloner, 2001). When the cost of information falls, there are profound consequences for how firms conduct business with each other, with consumers, and with workers. This article covers both the economic theory that suggests how e-business changes the economy (to understand why e-business has proliferated) and the empirical magnitude of the impacts (to show the economic benefits).

The impacts of e-business on the economy play out in several principal arenas that are defined by the type of interaction between economic primitives. The interactions are transactions in the case of economic actors or transformations in the case of economic goods. First is the business-to-consumer (B2C) channel, with focus on retail transactions. Next is the arena for interactions among firms, both business-to-business (B2B) e-commerce and competition in the output market. A closer look at the market for one key input firms use, labor, provides a look at how e-business changes transacting between business and its workers. The last arena is for the effect of e-business on firms' productivity—how efficiently the firm transforms its inputs into outputs. The close of the article discusses directions for future research, covering some of the new policy questions that e-business raises for the economy. Throughout, the emphasis remains on the microeconomic effects of e-business.

DOI: 10.4018/978-1-61520-611-7.ch002

## BACKGROUND

Information is the key component of the modern economy. While pure knowledge is disembodied, transferring, storing, and processing information is costly for firms and consumers. E-business has such a great impact on today's economy because ICT lowers the costs associated with information. Viewed through the lens of cost reduction, transformations of the production process enabled by e-business such as outsourcing, electronic procurement, and online trading not only make sense but also become predictable. Similarly, given the importance of information in search and matching markets such as consumer purchasing and the labor market, the advent of electronic intermediaries such as auction sites and online resume exchanges makes sense. Wherever the costs involved with transacting information are high, the gains from adopting e-business practices are highest and the market will naturally implement ICT there first.

Reduced informational costs cannot only facilitate given transactions, but can expand the set of transactions included within a specific market. By lowering the costs of bringing together geographically distant buyers and sellers, e-business increases the size of any given market. Larger markets make the trade of goods and services more reliable and efficient, in part because bigger markets often have lower average costs associated with them. However, the aggregation of information in larger markets is beneficial in its own right, especially compared to the bilateral negotiation between economic agents that e-business may replace. The inefficiency of bilateral negotiation—that some mutually beneficial trades may not occur—is due to the asymmetric information (e.g., on the reservation prices) held by the parties. Thicker markets mitigate such inefficiencies (Vulkan, 2003).

## THE MICROECONOMIC IMPACTS OF E-BUSINESS

### Interactions between Consumers And Firms

B2C e-commerce over the Internet has grown steadily since its inception in the 1990's. Official estimates in the US peg e-commerce at $135 billion in 2008, which is 3.4 percent of total retail sales (US Dept. of Commerce, 2009).[1] B2C interactions allow better matching of consumers to products and services (Santarelli & D'Altri, 2003). Search tools for buyers, retail auction sites such as eBay, and on-line brand communities (Jang, *et al.*, 2008) all lower the consumer's cost of searching for goods and prices. With a lower search cost, consumers search more (Su, 2008) and obtain a better match. On the seller's side, e-commerce allows the collection of more information about customers than is provided by "old economy" retail channels. Such information is valuable for firms, allowing them to push tailored marketing messages to consumers based on past behavior and offer mass customization of their product lines (e.g., Dell's system of allowing buyers to choose features of their computers) (Vulkan, 2003).

Improved matching of customers to products has two impacts on market outcomes. In some markets, e-commerce primarily lowers prices, while in others it spurs product differentiation and price discrimination (Bakos, 2001). Prices fall in some markets, particularly those for homogeneous goods, for two reasons. When it becomes cheaper for consumers to search among the prices of competing retailers, demand for any one seller's product becomes more elastic, retailers must compete more directly with each other on price, and prices fall. Prices also drop due to disintermediation. When e-commerce cuts middlemen out of the sales channel, such as when a customer directly buys books from Amazon or computers from Dell without visiting a physical store, then costs arising from wholesaling are avoided. While

B2C e-commerce trades lower wholesaling costs for increased shipping costs (since firms must individually transport products to the consumers' sites), often the savings are large. B2C practices also reduce labor costs through elimination of retail floor sales help, reduce the need to carry inventory at multiple retail sites (which also reduces theft from inventory), and reduce real-estate rental costs (Brynjolfsson & Smith, 2000).

Prices for some goods have fallen greatly due to e-commerce. Prices for books and CDs purchased on-line (inclusive of delivery charges and taxes) average 9-16 percent lower than prices at traditional stores (Brynjolfsson & Smith, 2000).

Some of the economic gains from e-business stem from the creation of new products, such as those for downloaded mp3 music, electronic book sales, and software applications for smart phones. New goods potentially cause large economic benefits for consumers, although empirical measurement is scarce.

## Interactions among Firms

E-business has greatly changed how firms transact with each other as they purchase intermediate goods. Business-to-business e-commerce—interaction between firms that takes place electronically, including electronic data interchange (EDI) and Internet based auctions and exchanges—dwarfs the B2C sector. More than 80 percent of e-commerce worldwide and about 93 percent of e-commerce in the US is B2B.[2] Firms have enthusiastically adopted B2B e-commerce because of its great potential to lower the costs of procurement (Lucking-Reiley & Spulber, 2001). Cost savings come directly from freeing labor from the time-consuming process of non-electronic procurement methods, from the greater ease of finding suitable vendors and prices, and from the greater control that e-commerce lends to a firm's spending strategy (Vulkan, 2003). Phillips and Meeker (2000) estimate that processing a purchase order manually costs 8-18 times what online procurement costs. By lowering search costs, B2B e-commerce strengthens a business' control over its spending by reducing the cost of going "off contract" to procure inputs not available from its approved suppliers. Vulkan (2003) claims that such maverick buying makes up 40 percent of procurement spending in the US, and that Internet-based automation of procurement should greatly reduce that amount.

Cost savings from B2B also come from a transformation of intermediation, as in B2C e-commerce. Brokers, content aggregators, auctioneers, dealers, and exchanges[3] are able to link larger markets via e-commerce—and to do it more efficiently—than can catalog-based or other non-electronic systems. Thus, in markets in which information plays a key role intermediation becomes more important (Lucking-Reiley & Spulber, 2001; Vulkan, 2003). In a study of a large sample of German firms, Bertschek, Fryges, and Kaiser (2006) find that firms using a knowledge-intensive production process and engaged in international business are more likely to adopt B2B. The lower cost of effective intermediation can also change the structure of the firm through vertical disintegration, as it becomes more feasible to outsource some tasks of the firm that formerly were provided in-house (Lucking-Reiley & Spulber, 2001; Nakamura *et al.*, 2009).

However, intermediation dealing with managing physical inventory becomes less important, as adoption of ICT improves inventory management (Bakos, 2001). Indeed, the manufacturing sector, where inventory costs can be large, is the largest adopter of B2B in the US, with e-commerce composing about one-third of the value of total shipments (US Dept. of Commerce, 2008).

In summary, B2B e-commerce can improve a firm's productivity in many ways, and empirical studies bear this out (although one must always be wary of publication bias).[4]Bertschek, Fryges, and Kaiser (2006) find that investment in ICT improves labor productivity, but only for firms engaged in B2B e-commerce.[5] We return to the impact of e-business more generally on productivity in a later section. The economic benefits of B2B adoption can be significant for firms. In terms of the bottom line, Efendi, Kinney, and Smith (2007) find that firms adopting buy-side B2B systems increased average return on assets by nearly three percentage points and the average profit margin by 2.7 percentage points, relative to a matched sample of non-adopting businesses.

## Interactions between Firms and the Labor Market

Since information is of preeminent importance in labor markets, it is no surprise that e-business is profoundly transforming the labor market. The primacy of information stems from the matching aspects of the labor market: firms try to find capable employees without being able to observe their productivity before hiring, and workers search for jobs without knowing all possible openings and all job characteristics. Given that e-business fundamentally lowers the cost of information, it has dramatically changed the process of matching workers to firms (Autor, 2001).[6] Information is also important in the labor market once a match is made. Reduced costs of transmitting information allows many labor services to be delivered to the firm over the Internet that were formerly required to be produced in house.

First generation e-business phenomena such as passive online resume exchanges, job postings, and applications for positions, as well as later generation services such as front-end e-recruiting websites married to back-end automated information processing, improve the efficiency of matching in the labor market (Autor, 2001; Nakumura *et al.*, 2009). More than two-thirds of workers look for jobs online now (Stevenson, 2009), and the relatively low cost of finding and screening applicants means that higher quality matches are possible (which raises labor productivity as well).[7] While direct evidence on how e-business improves matching quality is scarce, one study looking at an electronic labor intermediation program in Italy found that it increases the chance that an individual finds a job and improves matching quality, as evidenced by higher wages and worker satisfaction (Bagues & Sylos Labini, 2009).[8]

Whether Internet searching directly reduces the length of unemployment spells is currently an open question. Kuhn and Skuterud (2004) conclude that workers using the Internet to look for jobs are unemployed for just as long (and maybe even longer) as others are. The authors suggest that searching on the Internet for jobs may send a negative signal about the worker, although such an effect is likely to lessen as Internet searching becomes ubiquitous. Stevenson (2006) notes that the analysis of Kuhn and Skuterud (2004) does not include workers who switch directly from one job to another (i.e., those with unemployment durations of zero). Truncating the zero-length unemployment spells in the data artificially skews their sample, since Stevenson (2009) finds that Internet users are more likely to change jobs directly. Stevenson (2009) provides a final bit of evidence that online searching leads to better matching: even after controlling for sample selection bias, workers who use the Internet to search are 15 percent more likely than non-users to have moved to a new job within a month.

Cheaper and more efficient communications between workers and their employers creates expanded opportunity to outsource labor tasks. ICT makes it possible to move call centers off site (and perhaps offshore), to monitor equipment remotely, and to telecommute (Autor, 2001; Nakumura *et al.*, 2009). Görg, Hanley, and Strobl (2008) find from plant-level data for Irish firms that international outsourcing increased the firms' productivity, even after controlling for factors causing firms to choose outsourcing. Kaiser (2004) finds that telecommuting in the manufacturing and trade sectors leads to large increases in labor productivity (measured by firms' profits, value added, and revenue per worker).

## Productivity at the Firm Level

How efficiently a firm produces a good or service depends on interactions among the firm's inputs and outputs. E-business can increase productivity by changing how the firm transforms inputs into outputs, as the previous section on labor shows. For example, the use of ICT reduces the cost of coordinating workers assigned to different tasks, enabling firms to intensify the specialization of labor celebrated by Adam Smith in the pin factory.[9] Use of ICT and adoption of e-business has measurably increased labor productivity, and we turn to some of the available evidence now. The estimates here are from firm-level studies, and are necessarily specific to the industry and technology examined.[10] The companion article on the macroeconomic impacts of e-business in this volume covers the general macroeconomic impacts of e-business on productivity.

The use of computers increases productivity in the short run by deepening the capital available to workers, and in the longer run by increasing total factor productivity (Brynjolfsson & Hitt, 2002).[11]Maliranta and Rouvinen (2003), looking at Finnish firms, find that equipping all employees with computers increases labor productivity by 18 percent in manufacturing and 28 percent in services. Adopting computers also spurs firms to invest in complementary intangibles (Brynjolfsson & Yang, 1999), such as software, new incentive systems, training, patterns of interaction within the firm, and other new business practices. Increasing the stock of such "organizational capital" related to ICT adoption is one reason that total factor productivity increases in the long run from e-business. Matteucci *et al*. (2005) investigate the dynamic payoffs from investing in any form of ICT, finding that it increased the average productivity of German manufacturing firms over the next three years by 36 percent (but had no effect on service industry productivity).

A business typically uses computers to communicate within and without the firm via networks. Evidence from a US manufacturing sample shows that the use of computer networks such as LANs, EDI, and the Internet in a firm increase labor productivity by almost four percent (Atrostic & Nguyen, 2005). The Finnish study mentioned above finds that granting an employee Internet access at work increases his productivity by three percent in the service sector, but has no significant effect in manufacturing (Maliranta & Rouvinen, 2003). Perhaps the dominance of EDI over Internet-based e-procurement in the manufacturing sector accounts for this result. Other studies that examine Swedish firms find that access to broadband is associated with increases in productivity of 3.6 percent for manufacturing and services firms (Hagén & Zeed, 2005) and 62 percent for ICT firms (Hagén, *et al.*, 2007).

A final, smaller collection of studies looks specifically at the impact of e-commerce on the productivity of workers. Several studies find that when firms buy inputs online they have higher productivity and that when they sell output they have lower productivity (Criscuolo & Waldron, 2003; Farooqui, 2005). Criscuolo and Waldron (2003) measured the size of the productivity change at an increase of seven to nine percent for buying online and a decrease of five percent for selling online. However, the negative results for selling online may merely reflect a price effect, since these studies measure output in monetary value, online sellers have lower prices, and the impact is identified by comparing adopters and non-adopters of e-commerce.

## FUTURE RESEARCH DIRECTIONS

Much of the available research regarding e-business and the economy dates from the expansionary years of the dot-com bubble. Consequently, some of the early rosy expectations and prognostications for e-business in general (and B2C e-commerce in particular) have not been borne out. For example, new intermediaries in the online air travel booking industry have not been as successful as the earliest research foretold (Klein & Loebbecke, 2003). Furthermore, despite the potential for—and demonstration of—e-business to lower the costs of information in ways that greatly enhance economic welfare, the benefits come mixed with issues that future research must address to inform public policy.

## Price Discrimination

E-business allows firms to price discriminate as never before. Price discrimination can run counter to the impetus for prices to fall created by increased consumer price searching and cost reductions from disintermediation. With no physical price tags or postings available for all customers to see, it is inexpensive for a firm to offer different prices to different consumers. In a notorious episode from the dot-com boom years, Amazon offered differing prices to consumers for identical products, claiming after discovery and negative publicity that it was randomly adjusting prices in order to estimate the elasticity of demand (Streitfeld, 2000). By collecting information on past customer behavior, or through creating switching costs for consumers through lock-in to a particular e-tailer, targeted differential pricing also becomes an option. While evidence on online price discrimination is rare, research is available on the closely related phenomena of price dispersion among firms. Brynjolfsson and Smith (2000), Clemons, Hann, and Hitt (2002), and Walter, Gupta, and Su (2006) show that price dispersion is present across a broad range of e-commerce goods, although it may decline as online markets mature (Bock, Lee, & Li, 2007).

While charging customers different prices is not illegal, the antitrust laws in the US limit companies from using price discrimination as an anticompetitive device. Research on whether any given discriminatory practice enabled by e-business is anticompetitive will be active, evolving as business employ ever newer methods to eke out more profits from consumers.

## E-Commerce, Competition, and the Structure of Industry

E-commerce affects how businesses compete against each other (Lucking-Reiley & Spulber, 2001). E-commerce can increase the economies of scale in intermediary markets, because many online markets such as auction sites require large fixed costs to set up but nearly no marginal transaction costs since the product (information) is intangible. Economies of scale can lead to domination of a market segment by a few large actors. Internet-based markets such as platforms for content aggregation and exchanges also exhibit network effects: having many traders on a platform increases market liquidity, which attracts even more traders to the platform. The positive feedback in market share due to network effects often leads to "winner take all" outcomes in platform markets. Indeed, DIW Berlin (2008) finds that ICT use is associated with higher market shares in the chemical, retailing, and transport services sectors. Lucking-Reiley and Spulber (2001) point to the commodities futures market in early 20th century as an example of how economies of scale and liquidity concerns led to market dominance.

E-business adoption may have anticompetitive effects apart from facilitating economies of scale and network effects (OFT, 2000). ICT lessens the cost of sharing information among competitors, which can facilitate (tacit or explicit) collusion. For example, competitors can use online price comparison services to check each other's prices to ensure no firm deviates from a tacit agreement to maintain high prices. Vulkan (2003) points out that since e-tailers often must explicitly allow price comparison web crawlers to search their sites, or directly provide a data feed to price comparison web sites, opting in can constitute a commitment not to cut prices for competitors to observe. There is little solid empirical research yet that ascertains the importance of the competitive implications of e-business.

## CONCLUSION

Information is the linchpin holding together today's worldwide economy. Anything facilitating the processing and flow of information is therefore supremely important. E-business, by lowering costs of transferring and storing information, now affects nearly every aspect of commerce. This article has reviewed the main type of interactions that e-business affects: those between firms and consumers, those among firms, those between firms and labor, and the transformation of inputs into output (productivity). Available empirical evidence shows that the microeconomic impacts of e-business and ICT have often been large. The transformations of economic interactions wrought by e-business at the microeconomic level, in aggregate, have important implications for macroeconomic phenomena such as taxation and other fiscal policy, monetary policy, international trade, and national economic growth. Evidence regarding macroeconomic effects of e-business is reviewed in the companion article in this volume.

## REFERENCES

Atrostic, B. K., & Nguyen, S. (2005). IT and Productivity in US Manufacturing: Do Computer Networks Matter? *Economic Inquiry*, *43*(3), 493–506. doi:10.1093/ei/cbi033

Autor, D. (2001). Wiring the labor market. *The Journal of Economic Perspectives*, *15*(1), 25–40.

Bagues, M. F., & Sylos Labini, M. (2009). Do on-line labor market intermediaries matter? The impact of AlmaLaurea on the university-to-work transition. In D. H. Autor (Ed.), *Studies of labor market intermediation*. Chicago: University of Chicago Press.

Bakos, Y. (2001). The emerging landscape for retail e-commerce. *The Journal of Economic Perspectives*, *15*(1), 69–80.

Berlin, D. I. W. (2008). *An economic assessment of ICT adoption and its impact on inno-vation and performance*. European Commission, DG Enterprise & Industry, Sectoral E-Business Watch study report No. 10/2008. Berlin and Brussels: European Commission.

Bertschek, I., Fryges, H., & Kaiser, U. (2006). B2B or not to be: Does B2B e-commerce increase labour productivity? *International Journal of the Economics of Business*, *13*(3), 387–405. doi:10.1080/13571510600961395

Bock, G.-W., Lee, S.-Y. T., & Li, H. Y. (2007). Price comparison and price dispersion: products and retailers at different internet maturity stages. *International Journal of Electronic Commerce*, *11*(4), 101–124. doi:10.2753/JEC1086-4415110404

Borenstein, S., & Saloner, G. (2001). Economics and electronic commerce. *The Journal of Economic Perspectives*, *15*(1), 3–12.

Brynjolfsson, E., & Hitt, L. M. (2002). Computing productivity: firm-level evidence. *The Review of Economics and Statistics*, *85*(4), 793–808. doi:10.1162/003465303772815736

Brynjolfsson, E., & Smith, M. (2000). Frictionless commerce? A comparison of Internet and conventional retailers. *Management Science*, *46*(4), 563–585. doi:10.1287/mnsc.46.4.563.12061

Brynjolfsson, E., & Yang, S. (1999). *The intangible costs and benefits of computer investments: Evidence from the financial markets.* Unpublished manuscript, MIT. Retrieved February 20, 2009, from http://ebusiness.mit.edu/erik/ITQ00-11-25.pdf

Clemons, E., Hann, I., & Hitt, L. (2002). Price dispersion and differentiation in online travel: An empirical investigation . *Management Science*, *48*(4), 534–550. doi:10.1287/mnsc.48.4.534

Criscuolo, C., & Waldron, K. (2003). E-commerce and productivity. [UK Office for National Statistics]. *Economic Trends*, *600*, 52–57.

Efendi, J., Kinney, M. R., & Smith, L. M. (2007). *Technology and profitability: Did B2B buy-side e-commerce systems improve financial performance?* Unpublished manuscript, Texas A&M University.

Farooqui, S. (2005). Information and communication technology use and productivity. [UK Office for National Statistics]. *Economic Trends*, *625*, 65–74.

Görg, H., Hanley, A., & Strobl, E. (2008). Productivity effects of international outsourcing: Evidence from plant-level data. *The Canadian Journal of Economics. Revue Canadienne d'Economique*, *41*(2), 670–688.

Hagén, H.-O., Ahlstrand, C., Daniels, M., Nilsson, E., & Adermon, A. (2007). Innovation matters: An empirical analysis of innovation 2002–2004 and its impact on productivity. *Yearbook on Productivity 2007, Statistics Sweden*, 33-62.

Hagén, H.-O., & Zeed, J. (2005). Does ICT use matter for firm productivity? *Yearbook on Productivity 2005, Statistics Sweden.*

Harrington, J. W., & Velluzzi, N. (2008). Labour market intermediation. In C. Tamásy, M. Taylor, & M. Taylor (Eds.), *Globalising worlds and new economic configurations*. Aldershot, UK: Ashgate Publishing, Ltd.

Jang, H., Olfman, L., Ko, I., Koh, J., & Kim, K. (2008). The influence of on-line brand community characteristics on community commitment and brand loyalty. *International Journal of Electronic Commerce*, *12*(3), 57–80. doi:10.2753/JEC1086-4415120304

Kaiser, U. (2004). *Is there really no place like home for productivity?* (Discussion Paper 2004-06). Copenhagen: Centre for Economic and Business Research.

Klein, S., & Loebbecke, C. (2003). Emerging pricing strategies on the web: Lessons from the airline industry. *Electronic Markets*, *13*(1), 46–58. doi:10.1080/1019678032000052943

Koellinger, P. (2005). *Why IT matters – An empirical study of e-business usage, innovation, and firm performance* (Discussion Paper 495). Berlin: DIW Berlin, German Institute for Economic Research.

Kuhn, P., & Skuterud, M. (2004). Internet job search and unemployment duration. *The American Economic Review*, *94*(1), 218–232. doi:10.1257/000282804322970779

Lucking-Reiley, D., & Spulber, D. F. (2001). Business-to-business electronic commerce. *The Journal of Economic Perspectives*, *15*(1), 55–68.

Maliranta, M., & Rouvinen, P. (2003) *Productivity effects of ICT in Finnish business* (Discussion paper no. 852). Helsinki, Finland: Research Institute of the Finnish Economy.

Matteucci, N., O'Mahony, M., Robinson, C., & Zwick, T. (2005). Productivity, work-place performance and ICT: Industry and firm-level evidence for Europe and the US. *Scottish Journal of Political Economy*, *52*(3), 359–386. doi:10.1111/j.0036-9292.2005.00349.x

Nakamura, A. O., Shaw, K. L., Freeman, R. B., Nakamura, E., & Pyman, A. (2009). Jobs online. In D. H. Autor (Ed.), *Studies of labor market intermediation*. Chicago: University of Chicago Press.

Office of Fair Trading (OFT). (2000). *E-commerce and its implications for competition policy* (Discussion Paper 1, OFT308). London: UK Office of Fair Trading.

Phillips, C., & Meeker, M. (2000). The B2B Internet report: Collaborative commerce. New York: Morgan Stanley Dean Witter Equity Research. Retrieved February 3, 2009, from http://www.morganstanley.com/institutional/techresearch/pdfs/b2bp1a.pdf

Santarelli, E., & D'Altri, S. (2003). The diffusion of e-commerce among SMEs: Theoretical implications and empirical evidence. *Small Business Economics*, *21*(3), 273–283. doi:10.1023/A:1025757601345

Stevenson, B. (2006). *The impact of the Internet on worker flow*s. Unpublished manuscript, The Wharton School, University of Pennsylvania. Retrieved February 3, 2009 from http://bpp.wharton.upenn.edu/betseys/papers/Stevenson_Internet.pdf

Stevenson, B. (2009). The Internet and job search. In D. H. Autor (Ed.), *Studies of labor market intermediation*. Chicago: University of Chicago Press.

Streitfeld, D. (2000, September 27). On the web, price tags blur. *Washington Post,* A01.

Su, B. (2008). Characteristics of consumer search on-line: how much do we search? *International Journal of Electronic Commerce*, *13*(1), 109–129. doi:10.2753/JEC1086-4415130104

UNCTAD. (United Nations Conference on Trade and Development). (2007). *Information economy report 2007-2008: Science and technology for development: the new paradigm of ICT*. New York and Geneva: United Nations.

US Department of Commerce. (2008). *US Census Bureau E-Stats Report*. Retrieved February 3, 2009 from http://www.census.gov/eos/www/2006/2006reportfinal.pdf

US Department of Commerce. (2009). *Quarterly retail e-commerce sales 4th quarter 2008* (news release). Retrieved February 25, 2009 from http://www.census.gov/mrts/www/data/html/08Q4.html

Vulkan, N. (2003). *The economics of e-commerce: A strategic guide to understanding and designing the online marketplace*. Princeton, NJ: Princeton University Press.

Walter, Z., Gupta, A., & Su, B.-C. (2006). The sources of on-line price dispersion across product types: An integrative view of on-line search costs and price premiums. *International Journal of Electronic Commerce*, *11*(1), 37–62. doi:10.2753/JEC1086-4415110102

## ADDITIONAL READING

Adams, F. G. (2004). *The e-business revolution & the new economy: E-conomics after the dot-com crash*. Mason, OH: South-Western Educational Publishing.

Andam, Z. R. (2003). *E-commerce and e-business*. Kuala Lumpur: UNDP-APDIP. Retrieved February 3, 2009, from http://www.apdip.net/publications/iespprimers/eprimer-ecom.pdf

Anderson, W. P., Chatterjee, L., & Lakshmanan, T. R. (2003). E-commerce, transportation, and economic geography. *Growth and Change*, *34*(4), 415–432. doi:10.1046/j.0017-4815.2003.00228.x

Ayers, R. M., & Collinge, R. A. (2001). *Economics by design: Guide to economic commerce and e-business*. Upper Saddle River, NJ: Pearson Prentice Hall

Bakos, J. Y. (1997). Reducing buyer search costs: Implications for electronic marketplaces. *Management Science*, *43*(12), 1676–1692. doi:10.1287/mnsc.43.12.1676

Bhansali, S., & Brynjolfsson, E. (2008). Measuring the impact of electronic data management on information worker productivity. *MIT Center for Digital Business Research Brief, X*(2). Retrieved February 3, 2009 from http://ebusiness.mit.edu/research/Briefs/Brynjolfsson_Measuing_Impact_Electronic_Data.pdf

Deak, E. J. (2004). *The economics of e-commerce and the Internet*. Mason, OH: South-Western Educational Publishing.

Evans, P., & Wurster, T. S. (2000). *Blown to bits: How the new economics of information transforms strategy*. Boston, MA: Harvard Business School Press.

Kalakota, R., & Whinston, A. B. (1997). *Electronic commerce: A manager's guide*. Boston, MA: Addison Wesley Longman.

Leinbach, T. R., & Brunn, S. D. (Eds.). (2001). *Worlds of e-commerce: Economic, geographical and social dimensions*. Hoboken, NJ: Wiley.

Liebowitz, S. (2002). *Re-thinking the network economy: The true forces that drive the digital marketplace*. New York: AMACOM.

Low, L. (2000). *Economics of information technology and the media*. Singapore: World Scientific/Singapore University Press.

McKenzie, R. B. (2003) *Digital economics: How information technology has transformed business thinking*. Westport, CT: Praeger Publishers.

Ng, Y.-K., Shi, H., & Sun, G.-Z. (Eds.). (2004). *The Economics of E-Commerce and Networking Decisions: Applications and Extensions of Inframarginal Analysis*. New York: Palgrave Macmillan.

Pohl, J. (2000). E-commerce and economics. *Alaska Business Monthly*, *16*(1), 56.

VanHoose, D. D. (2003). *E-commerce economics*. Mason, OH: South-Western/Thomson Learning.

Varian, H. R., Farrell, J., & Shapiro, C. (2005). *The economics of information technology: An introduction*. Cambridge, UK: Cambridge University Press

Vulkan, N. (2003). *The economics of e-commerce: A strategic guide to understanding and designing the online marketplace*. Princeton, NJ: Princeton University Press.

Wood, M. (2000). *E-business and e-commerce economics*. Upper Saddle River, NJ: Prentice Hall.

## KEY TERMS AND DEFINITIONS

**Disintermediation:** The reduction or elimination of the use of market intermediaries that match producers to ultimate buyers in product markets or employers to employees in the labor market.

**Elasticity of Demand:** A characterization of the sensitivity of the quantity demanded of a good to changes in price (in percentage terms).

**Network Effect:** The effect whereby an economic agent's valuation of a product (e.g., a trading platform) increases with the number of consumers of the product (e.g., the number of other traders on the platform).

**Off-Contract Procurement:** A firm's purchase of inputs or materials from a source other than the approved supplier with which the firm has negotiated volume discounts or other concessions.

**Price Discrimination:** The practice of charging customers different prices for the same good.

**Total Factor Productivity:** Productivity growth not explained by increases in inputs such as capital and labor. TFP captures all other factors influencing growth, such as improved uses of the measurable inputs and general technological progress.

## ENDNOTES

[*] This chapter was written while the first author was visiting the Federal Communications Commission. The views expressed in this chapter are those of the authors and do not necessarily reflect the views of the FCC or any of its Commissioners or other staff.

[1] The official estimates are likely to be lower than the actual figures because the census misses many small "e-tailers".

[2] The worldwide estimate is for 2002 (cited by Bertscheck, *et al*., 2006). The US estimate is for 2006 (US Dept. of Commerce, 2008). Most B2B e-commerce in the US is done through proprietary EDI systems rather than over the Internet.

[3] Vulkan (2003) defines content aggregators as agents that connect buyers and sellers through direct negotiation in markets that would otherwise be fragmented. Content aggregators bring together buyers and sellers in the same industry who trade in a variety of goods or services. Exchanges, in contrast, are for clearing the market for one particular good.

[4] Other things equal, a study that finds a positive result (i.e., that e-commerce increases productivity) generally is more likely to be published in an academic journal than a study with a negative result (i.e., that e-commerce does not affect productivity). Thus, any specific empirical literature may provide a false consensus.

[5] They control for the endogeneity (non-random nature) of the firms' choices to use B2B.

[6] Some impacts of lowering search costs may be negative. When application costs falls, firms may receive more low quality applications, which burden the screening process.

[7] However, online resume and job posting and other matching services do not necessarily allow risk to be shifted among parties in the labor market, as do some traditional forms of intermediation. For example, internships transfer risk (defined as bearing the cost of an unexpected outcome) from the employer to the employee, while internal labor markets with long-term contracts or on-the-job training transfer risk in the other direction (Harrington & Velluzzi, 2008).

[8] The program, *AlmaLaurea*, is an online clearinghouse for information concerning college graduates' characteristics and coursework. *AlmaLaurea* sells the information to employers (Bagues & Sylos Labini, 2009).

[9] See book 1, chapter 1 of Adam Smith's *An Inquiry into the Nature and Causes of the Wealth of Nations*.

[10] Some other studies come to other conclusions (see ch. 3 of UNCTAD (2007)), but the results covered here are representative of the bulk of the literature, which generally finds positive productivity impacts from adoption of ICT and e-business.

[11] We discuss e-commerce and total factor productivity further in the companion article on macroeconomic impacts of e-business.

# Chapter 3
# The Power Laws of Enterprise 2.0

**Jacques Bughin**
*McKinsey &Company, Belgium, Free University of Brussels, Belgium, and Katholieke University Leuven, Belgium*

## ABSTRACT

*Parallel to the consumer social web, a myriad of companies are adopting social software either for internal or external collaboration with suppliers and customers. This article provides key stylized facts around the adoption, use and success of social software, a phenomenon dubbed "enterprise 2.0". We observe that social software usage within companies is heavily concentrated with a long tail companies claiming limited business use and success. The head of "enterprise 2.0" distribution, composed of a small hub of high performing companies, is to be found in some sectors like high-tech, but more crucially, the success is driven by debottlenecking of organizational barriers to fully exploit "enterprise 2.0" for improved economic performance.*

## INTRODUCTION

The web as a collaborative platform has quickly spread in the consumer space (Bughin, 2008). More than 100 million internet users have been claimed to contribute to the social web development, -be it by writing comments and recommendations on Amazon, forwarding links of YouTube videos, or co-designing games like The Sims, applications on MySpace or developing open source codes for Linux (Pew Internet, 2006). This social web has also led to major global social networks companies. YouTube, Blogger and Facebook today are currently visited monthly by more than 200 million users.

The extension of participation in the enterprise space, dubbed by some as "enterprise 2.0", is rather new (McAfee, 2006).

On one hand, this extension is natural, given the possible large benefits of harnessing distributed collaboration through the web. For example, prediction markets tools can help aggregate a vast amount of information from employees within organizations to better guide company actions. An example of this is the sales forecast at HP through prediction

DOI: 10.4018/978-1-61520-611-7.ch003

markets as reported in Chen & Plott (2002). Procter & Gamble, through its 'Connect and Develop' platform opened to inputs from company alumni, current employees and even customers, has successfully secured a large stream of new product innovations (Huston & Sakkab, 2006). Also, new organization models linked to enterprise 2.0 are being developed, shaping successfully entire new markets. An example is Blade.org, a collaborative community-based organization initiated by IBM around its blade server technology, in the hope to accelerate its market development (Miles et alii, 2007).

On the other hand, skepticism clearly exists as to how enterprise 2.0 can truly be exploited, either because technologies are complex, or because of major organizational bottlenecks of hierarchy and control (Davenport, 2007)). High profile case of failures of the "enterprise 2.0" model exists. For example, Cambrian House failed in its crowd-sourcing model. While operating a fully open architecture for collaboration, no-one in the company had received the full responsibility for ideas development, leading to major waste and limited business development opportunities (Schonfledon, 2008). A study of large corporation's social networks was recently quoted by the Wall Street Journal, leading to the conclusion that less than 25% of corporate social software initiatives could gather more than 1,000 members despite the majority spending millions of dollars on "enterprise 2.0" developments (Worthen, 2008).

Obviously, gauging the importance of enterprise 2.0 as a major business trend requires more than just anecdotes. After a summary review of the business and academic evidence to date, this article relies upon two major surveys performed in 2007 and 2008 to provide early stylized facts regarding the "enterprise 2.0" phenomenon (Bughin & Manyika (2007a; 2008)); (Bughin, 2008 and Bughin & alii, 2008).

To our knowledge, our surveys have been the most exhaustive to date. They cover a large array of web 2.0 technologies (from RSS feeds, to web services, mash-ups, wikis, blogs, etc), including a large range of industries and countries, as well as a large diversity of companies features (large versus smaller, publicly quoted versus private, national versus multinational, companies, etc), to derive some good empirical basis of "enterprise 2.0" to date.

We concentrate especially on the "power laws" of enterprise 2.0 occurrence.

In general, one is used to describe the occurrence of many phenomena with a bell curve, that is, occurrence is much larger in the center, and extremes have very low probability of occurrence. In our cases, those will mean most of companies will cluster in their adoption and usefulness of social software, and any deviation from this cluster will be quite rare.

However, more and more, people recognize that most phenomena exhibit power law, whereby a few extreme events happen and concentrate the phenomena, together with a much longer tail of much less popular events. In our case, that would mean that a few companies are much more prone to enterprise 2.0 than others, while a long tail of companies are still not leveraging the power of "enterprise 2.0". Power laws seem to be everywhere- be it the distribution of movies hits, of open source participation, of earthquakes magnitude, of firms size, or still of consumer web sites traffic (Barabasi, 2003).

The underlying reasons besides power law distribution could be many. Regarding the web, Barabasi (2003) shows that it is driven by a preferential attachment of nodes, whereby bigger nodes continue to have more links to them than others, through social clusters. Other reason is simply intended adoption-in their model of connection model, Jackson and Wolinski (1996), show that people will connect depending on the difference between utilities derived to connect and cost of making and nurturing the link. If obviously the cost is low versus benefit, the adoption is fast and the network is fully efficient—in the case of medium costs, the network will exhibit islands of star networks, while the rest could be empty (non-adopting).

We find similar power laws on enterprise 2.0, in terms of adoption, participation/usage and satisfaction—with 20% of companies concentrating the usage and benefits of "enterprise 2.0, in contrast to the long tail of the next 80% of companies. We find that many factors explain how companies can reach the head of this power law distribution. A crucial element is linked to internal organizational and managerial changes, confirming the critical importance of organizational enablers to succeed in enterprise 2.0 (Davenport, 2007).

## BACKGROUND

### What is Enterprise 2.0?

The power of social participation has been recently visible through web 2.0 and associated models such as user generated video content à la YouTube, or open application platform development on the I-phone or through Facebook.

Social participation within and across enterprise is yet to be fully studied, but should hold great promises, especially in the context of reducing information costs in an increasingly growing knowledge and service economy. They should plenty of benefits, such as better coordination of team, faster throughput of innovation, etc. The term "enterprise 2.0" has been coined by Andrew McAfee (2006). In his seminal article published in the Sloan Management Review, the author emphasizes the potential value of adopting social software to reduce the asymmetry in information and knowledge flows.

There is however limited synopsis of "enterprise 2.0" findings, let alone *formal statistical evidence of its importance and its strategic relevance*. Most of the literature on "enterprise 2.0" remains confined to either business articles, or a few web blogs, at the exception of a few formal case studies of social software adoption such as Dogear (Millen et alii, 2007).

Reviewing blog entries and other case studies, the sense emerges that "enterprise 2.0" is neither a business fad nor confined to pure web companies. High-profile companies, from Siemens, Lockeed Martin and Motorola, to IBM or Cisco have adopted enterprise 2.0 tools, and claim to derive strong competitive advantages from it. However, it is also felt that converting social software tools adoption into real performance and productivity impact is not easy (Davenport, 2007). Corporate culture, process, etc often act as roadblock to leverage those technologies at full.

### Research Methodology

As an alternative to case studies, major company surveys offer a potential to assess the relevance of "enterprise 2.0".

There have been a few rare studies trying to size the magnitude of the "enterprise 2.0". However, these studies have suffered from limitations too. The sample collection has usually been restricted to a few hundred companies. The sample concentrates on US-based companies, and the sample bias is likely very large (Economist, 2007).

In order to alleviate those shortcoming in the survey, a team of colleagues at McKinsey, with this author, developed a major global survey with the aim to have a fully, unbiased, sample, representative of the global economy. This sample covers 60 countries, 16 industry sectors, and companies of all sizes, and owner control. The data were collected in 2007 and 2008, and if needed, were reweighted according to each economy, sector and firm size distribution.

The analysis of the business use of Web 2.0 cover the main 7 social software tools, e.g. corporate wikis, blogs, collective intelligence tools, mash ups, peer-to-peer networking, social networking, podcasts, and RSS (see Table 1).

The full questionnaire, a snapshot of the results and the full sample details are beyond the scope

*Table 1. Enterprise 2.0 taxonomy*

| |
|---|
| **Wikis**. Wikis are systems for collaborative publishing. They allow many authors to contribute to an online document or discussion, and usually add to centrally managed content management systems. *Adobe Systems, IBM* and *Intel* are companies in the top end use of corporate wikis. |
| **Blogs** (short for web logs). Blogs are online journals or diaries, hosted on a website and often distributed to other sites or readers using RSS. *Boeing, Monster* and *Kodak* are companies in in the top end use of corporate blogs. |
| **Collective intelligence tools**. Collective intelligence refers to any system that attempts to reach a higher level of consensus or decision making by tapping the expertise of a group rather than an individual. Collective intelligence may include collaborative publishing or common databases for sharing knowledge, or prediction markets. *HP, Corning, Eli Lilly, Pfizer* or *Masterfoods* are public cases of corporate collective intelligence use |
| **Mash-ups**. Mash-ups are aggregations of contents from different online sources to create a new service. One example includes pulling apartment listings from one site and displaying them on Google maps to create a map showing where the listings are located. *Salesforce.com* is an example of companies hosting and integrating corporate mash-ups |
| **Peer-to-peer networking** (P2P). P2P is a technique for efficiently sharing files (music, videos or text) over the internet or within a closed set of users. Unlike the traditional method of storing a file on one machine (which can become a bottleneck if many people try to access it at once), P2P distributes files across many machines, often those of the users themselves. Retrieving a file may actually gather together and assemble pieces of the file from many |
| machines. *Intel* and *Microsoft* are cases examples of corporate P2P network usage |
| **Social networking**. Social networking refers to systems that allow users to learn about |
| other members ’ skills, talents, knowledge or preferences. Commercial examples include *LinkedIn* or *Dogear*. *Nike+* is a typical case of social communities with customers. |
| **Podcasts**. Podcasts are audio or video recordings, a multimedia form of a blog or other content. They are often distributed through an aggregator like iTunes. *Whirpool* or *Johnson & Johnson* are extensively leveraging podcasting to their customers. |
| **Really Simple Syndication** (RSS). RSS is a method that allows people to subscribe to online distribution of news, blogs, podcasts or other information. |

of this article. The interest reader is referred to Bughin & Manyika (2007 a,b) and Bughin & Manyika (2008) and Bughin (2008) for more details and detailed questionnaire alpha’s, etc . The idea of the sample is to provide a much more comprehensive view of the development of “enterprise 2.0”. We claim to have the largest, most representative sample to date for this matter, and the survey has been maintained for 3 years now, favoring a time-series evolution pattern of the phenomenon.

Accordingly, we wanted to test a few hypotheses regarding social software adoption- those are described her-after in five empirical observations. The hypotheses we wanted to check were as follows:

**Hypothesis 1.** There is wide adoption of social software in enterprise—but it is rarely deep.

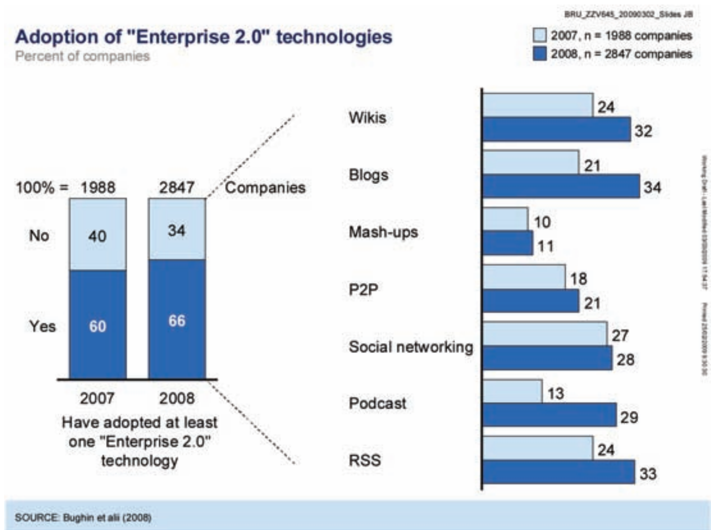
This hypothesis is the consequence of the fact that many software tools exist, from internal wikis to web services, etc. Usually, companies will not adopt the full suite, but will target the ones closer to their needs

**Hypothesis 2.** Social software adoption will be more than internal.

This hypothesis follows from the fact that most companies have already developed networks of preferred suppliers, or are trying to get closer and closer to their customers. Leveraging those networks is likely a critical objective of enterprise 2.0

**Hypothesis 3.** Technology adoption is much ahead of technology use

*Figure 1.*




Cycles of technology used are typically multi-years, that is it takes a few years for usage to percolate across all the layers of the organization

**Hypothesis 4.** Impact on performance will only be visible at scale

This is a consequence of hypothesis 3- without scale of adoption, difference will not be visible

**Hypothesis 5.** Enterprise 2.0 exhibits power laws

Again this is a consequence of the above—some companies are faster and quicker in absorbing new technologies, either because of competitive pressure or because of foresights on how to better compete. Also, technology rarely has effect in company performance if organization is not aligned, and technology can be leveraged for go to market differentiation or lower cost curve

## FIVE EMPIRICAL FACTS AROUND ENTERPRISE 2.0

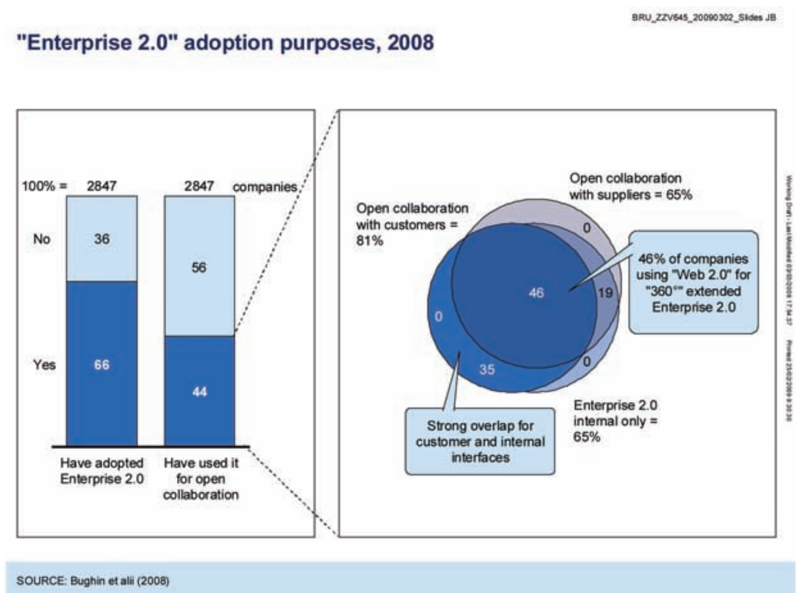
### Fact N°1: Broad, Yet Not Deep, Adoption of Web 2.0 Technologies

Figure 1 details the current adoption of social software technologies within the enterprise.

Out of the list of 8 collaborative tools surveyed, 66% of companies have adopted at least one of the technologies. While this may reveal large appetite for enterprise 2.0, a deeper look at the adoption shows that the adoption is only broad, but not that deep. By 2008, companies have adopted two and half tools on the 7 surveyed; that is, on average, 65% of web 2.0 technologies are *not being* incorporated as software tools.

Comparing the 2007 and 2008 surveys' answers, the adoption rate has evolved, from 55% to 66% (+20%), while the average number of tools has grown to 2.5 tools, from 2.2 in 2007. This is about a 10% increase, smaller than the increase in total adoption rate, meaning that companies start to experiment with a few tools, before expanding the range within their organization.

*Figure 2.*




## Fact N°2: The Rise of the "Extended" Enterprise 2.0.

Figure 2 details the purpose of adoption of web 2.0 technologies within the enterprise.

Companies can leverage Web 2.0 technologies for many purposes, such as better communication and knowledge management flows within employees, or for the aim to develop more open collaboration among suppliers and customers. Not surprisingly, the average number of tools for internal purpose is slightly higher than for external purposes (10%), but on average web 2.0 tools are used 65% of time for collaboration with suppliers and 81% for customers' collaboration.

For 46% of the cases, that is the bulk of the cases, it is used for both customers and suppliers, that is, a large part of external use is 360 degrees in the company value chain.

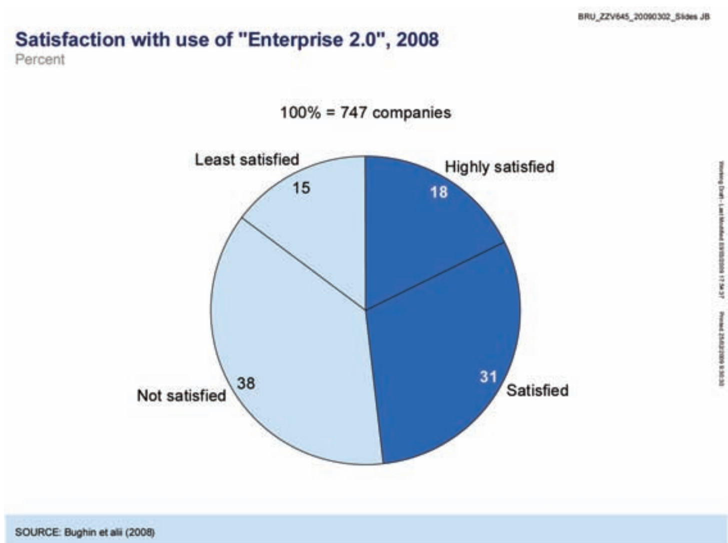
## Fact N°3: Usage Diffusion of Web 2.0 Under Critical Mass

Figure 3 provides statistics regarding the employees usage of those technologies.

Adoption of enterprise 2.0 tools does not tell us much about far how broad it is used by the company major constituents, i.e., employees. Anecdotal evidence suggests that the diffusion spread is not complete, yet some companies have witnessed very good success of usage among their employees. IBM is reported to have deployed mash-ups throughout their company, with great success, e.g., 50% of IT people and 12% of business people having created a mash-up. More than 90% of Serena Software's employees participate in its Facebook-based social network to build better relationships with their peers (Ward, 2007).

Our survey demonstrates that the diffusion use of a technology used is roughly at 25% of employees, thus not yet at critical mass despite high profile success such as IBM case reported above. The average use of blogs is 20% of employees, and up to 31% for wikis. Also, the the usage rate is very polarized, with about 25% (respectively 15%) of companies reporting that 5% only, (respectively, 50%) of their employees use either wikis, social network tools, or blogs.

*Figure 3.*




## Fact N°4: Jury is Still out Regarding Enterprise 2.0 Performance

Does technology adoption and usage truly affect corporate performance, or this is a real distraction for company profitability? Figure 4 provides statistics regarding the corporate success of "enterprise 2.0".

Whatever metric we use for gauging success, the overall satisfaction with Web 2.0 tools and technologies remain relatively small. 0nly twenty-one percent of the companies surveyed are extremely or very satisfied with them for most internal and external uses.

Metrics of satisfaction include better communication, better quality of interaction etc, but also financial return on investment—this last measure holds the lowest score, with about one company out of every six claiming to be extremely or highly satisfied with their leverage of web 2.0 technologies.

In effect, inside and outside companies, many barriers to Web 2.0 persist. Dissatisfied respondents are likely to note more of them, including unresponsive corporate cultures, less-than-enthusiastic leaders or lack of incentives to diffuse the use of the technologies for the companies.

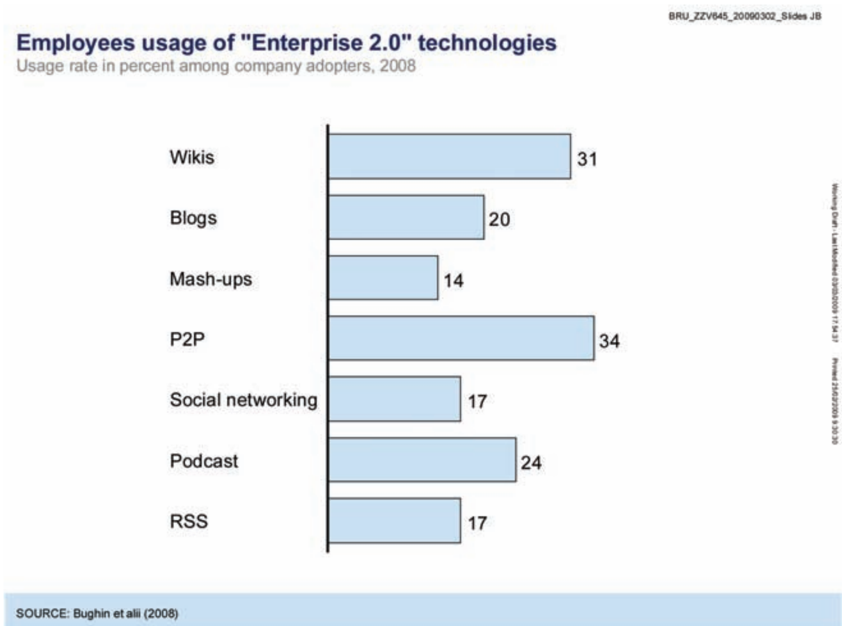
Consequently, some companies have not been able to sustain participation and are abandoning the use of some of the enterprise 2.0 tools. We find that the average churn rate is between 4% (social networks) to up to 21% (for blogs)—and the churn rate is up to 2.5 times higher for those not satisfied with the performance of their tools.

## Fact n°5: Power Laws in Enterprise 2.0

As for the web (Barabasi, 2003), we expect "power laws" to be present along many dimensions of enterprise 2.0, whether it is the total of technologies adopted, the proportion of employees using enterprise 2.0 technologies, or still the probability of satisfaction versus the number of technology used.

In fact, the top 20% of companies makes respectively 69%, 58% and 82% of the total adoption, internal use diffusion and satisfaction, and the power law exponent regression estimates via log-log rank plots are respectively 1.7, 1.35 and 2.1, and highly statistically significant (Figure 5).

*Figure 4.*




Power laws typically emerge in systems that are growing, reflecting for instance difference in adoption posture. In our case, the top 10% companies claiming to be the earliest technology adopters, whether it is ERP, email systems, or others have *six times* more likelihood to adopt any enterprise 2.0 technology than the bottom 10%, calling themselves late adopters.

This asymmetry between so called early adopters and late adopters is very large, meaning that adoption posture alone may not fully explain the power law distributions observed. Others elements should be present besides early moves, like a "rich gets richer" phenomenon. As symptom of this, we find in our sample that companies adopting more technologies are also the ones who tend to actively promote the use to their employees; that companies which are satisfied by the return on investing in social technologies have also twice more employees using them inside the companies, etc.

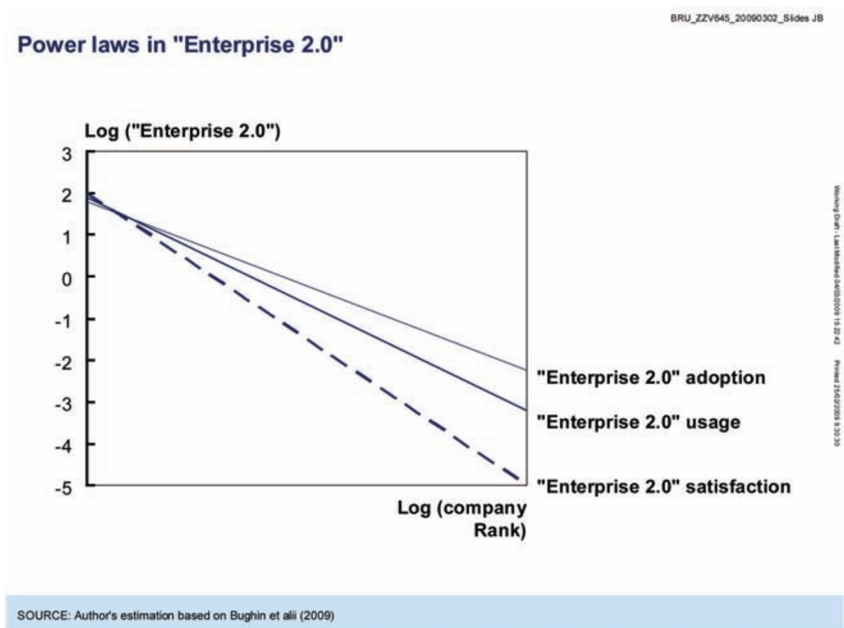
Clearly, this "rich get richer" phenomenon is not random. It is further assessed in the next section.

## WHEN ENTERPRISE 2.0 WORKS

Are there common features of "enterprise 2.0" that could be observed, and hence leveraged by other companies to reach better success? In order to assess this, we have developed a simple statistic of "enterprise 2.0" performance. This statistic is the product of the proportion of technology adopted, multiplied by the proportion of employees use, and still multiplied by the satisfaction rate of web 2.0 on company performance. Loosing speaking, this statistic converges towards 100% if enterprise 2.0 is used comprehensively and generates full company satisfaction; reversely, the variable converges to zero, if adoption is very limited, employees, customers and suppliers do not use it, and the company satisfaction is very low.

As to be expected from above, we find that the average performance is barely 4.5%, obviously far off from the 100% maximum. Comparing web 2.0 technologies performance success with more traditional ones within our companies surveyed, a more mature technology deployed like web services reaches a value of 42%, while corporate email

*Figure 5.*




services reaches 57%. That is more established technologies seems to be "8-10" times better than "enterprise 2.0" technologies, giving a clear idea of the success gap.

Second, the distribution exhibits a strong power law, with exponent of 2.5, close to what is observed for the web link structure (Barabasi, 2003), and rejecting the hypothesis that this power law is purely random.

To give an example of non-random extremes in our sample [1], a global leader in mobile handset manufacturer, which has publicized its use of "enterprise 2.0" and how it helps the enterprise for mobility among its employees, reaches a performance of 18%, that is, four to five times the value achieved by the average of the thousand companies we surveyed. Now contrast this company with another lead pan-European bank. The bank has publicly resisted the use of corporate blogs and social networks, and blocked the use of collaboration tools with employees. Not surprisingly, this company only achieved a performance value of "enterprise 2.0" of 1%.

What then, leads companies to reach the head of the "enterprise 2.0" power law?

Table 2 provides some early insights, based on correlating the "enterprise 2.0" performance index with three family of factors. The first factor is the external environment (e.g., the industry). The second factor captures company features such as size/revenue, or geography of operations. The third factor concerns active management towards web 2.0, such as actively promoting open collaboration with suppliers and customers, or actively seeking to remove any organization barrier to enable web 2.0 such as IT limited deployment of technologies, blocking of tools on the company intranet, limited pilots and organization promotion of social software, etc.

Our correlations explain 64% of the "enterprise 2.0" performance distribution [2]. Typically, companies in high-tech and telecom have better performance compared to financial services. US, private-based companies fare better than others, but mostly, removing organization barrier and favoring open collaboration within and outside the

*Table 2. Explaining enterprise 2.0 success*

| Average value = 4% | + marginal effect | +proportionate effect |
|---|---|---|
| External environment factors | | |
| **High-tech**** | +3.1 | +69% |
| **Telecom**** | +2.6 | +56% |
| **Manufacturing*** | +0.6 | +13% |
| **Competitive pressure**** | +2.8 | +63% |
| Firm features control factors | | |
| **US*** | +1.1 | +25% |
| **Europe*** | +0.6 | +13% |
| **Sales <1 billion**** | +1.9 | +43% |
| **Sales >10 billion**** | +1.0 | +22% |
| **Private*** | +0.5 | +10% |
| **Global**** | +0.1 | +2% |
| Entreprise 2.0 management factors: | | |
| **Early adopters**** | +3.7 | +82% |
| **Late adopters**** | -2.6 | -56% |
| **No barrier to web 2.0**** | +4.0 | +88% |
| **Open collaboration**** | +2.6 | +58% |
| **Grass-root adoption**** | +1.6 | +34% |

enterprise seem to create a major uplift in performance. Further, in terms of relative contribution to the power law, the third factor (management and organization) is the most relevant, explaining roughly 55% of the effects, with industry effects explaining 28%, and 17%, for company features such as location, or size. Clearly, performance differences can be explained, and a large part of it is driven by management, not by good or bad luck.

## FURTHER RESEARCH DIRECTIONS

Our results suggest extensive "power laws" in "enterprise 2.0" performance, yet those distributions are not random and are more reflective of a "rich gets richer" phenomenon.

Based on the analyses above, one can now even prototype profile of companies. On one hand, let us consider a publicly-quoted global High-technology company with US headquarters and more than 10 billion US sales, promoting open collaboration tools with its customers and suppliers- everything being equal, this company will derive a performance index *three* times the value of other companies.

On the other hand, let us consider the case of a late mover, mid-size retail company originating from a developing country, with limited adoption and sporadic internal use of enterprise 2.0, and no proactive organization management of enterprise 2.0. This company will be reaching a value *half* the value of other companies regarding "enterprise 2.0" performance.

This prototyping we find, explains 2/3 of the distribution, albeit with still low performance, of "enterprise 2.0". Further research is clearly warranted from this prototyping. Open questions are many. Five examples are:

1. How can "enterprise 2.0" performance catch up with the one of more established corporate social technologies such as web and communication services?
2. What can explain the 1/3 of distribution not explained by our prototyping—is this random noise, luck, or some other factors?
3. How large is actual performance and ROI of those social technologies?
4. The typical view is that US and Europe seem to fare better in terms of "enterprise 2.0", but this is not what we find as a major driver in our prototyping. Clearly web 2.0 innovators exist in other countries and continents than the US, such as ICICI doing banking on a total open source architecture. Who else are they? What do they do? What can we learn from those organizations?
5. Organization barriers are a real impediment to the success of "enterprise 2.0. What are the best practice organizational forms to promote? What can we derive from new forms observed like the collaborative enterprise (Miles, Miles &Snow, 2007)?
6. What will be the development of enterprise 2.0 and how will it shift current power law observed in the success of it?

## CONCLUSION

Web 2.0 is slowly being adopted as new technology tools in the enterprise, but still exhibits a long tail of limited critical mass, and success, as feared by some (Davenport, 2007).

If satisfaction is not widespread yet, a small cluster of companies are both heavily using and being satisfied with those technologies, especially companies from industries in more turbulent changes (High-tech, etc). However, the major driver of company performance in "enterprise 2.0" comes from organization changes to enable web 2.0 capabilities and reap maximum benefits. Among others, organizations are much more fluid, and organization boundaries are more opened to customers and supplier interaction, creating more network-based models of operations that traditional models of organization.

Given the success of the long tail, and the " rich get richer" phenomenon observed in this development (e.g., broader and deeper adoption, leading to better satisfaction, etc), the race is on, and there is likely no way back. As for the consumer web, we might expect new network-based organization forms of extended enterprise to emerge in the medium term.

## ACKNOWLEDGMENT

The author thanks his colleagues from the MTI initiative at McKinsey &Company for their support. This article stands for the view of the author alone, and are not necessarily shared by his affiliated institutions

## REFERENCES

Barabasi, A.-L. (2003). *Linked*. New-York: Penguin.

Bughin, J. (2007 September). How enterprise 2.0 can learn from user-generated video. *McKinsey Quarterly*.

Bughin, J. (2008). The rise of enterprise 2.0. *Journal of Direct . Data and Digital Marketing Practice*, *9*, 251–259. doi:10.1057/palgrave.dddmp.4350100

Bughin, J., Chui, M., & Manyika, J. (2008 June). The business of enterprise 2.0. *McKinsey Quarterly*.

Bughin, J., & Manyika, J. (2007a, March). How businesses are using Web 2.0: A McKinsey global survey. *McKinsey Quarterly*.

Bughin, J., & Manyika, J. (2007b). The rise of telecom 2.0- learning from a global survey — why Telecom 2.0 matters. *McKinsey Telecommunications Extranet*.

Chen, K., & Plott, C. (2002). *Information Aggregation Mechanisms: Concept, Design and Implementation for a Sales Forecasting Problem.* California Institute of Technology, Division of the Humanities and Social Sciences. Working Paper No. 1131

Davenport, T. (2007). Why enterprise 2.0 won't transform organizations. *Harvard Business Review.* Retrieved January 2009, from http://discussionleader.hbsp.com/davenport/ 2007/03/why_enterprise_20_wont_transfo.html

Economist. (2007). *Serious business: Web 2.0 goes corporate*. Report from the Economist Intelligent Unit. Retrieved October 2008 from http://fastforwardblog.com/category/enterprise-20/.

Huston, L., & Sakkab, N. (2006, March). Connect and Develop: Inside Procter & Gamble's New Model for Innovation. *Harvard Business Review*, *84*(3).

Jackson, M. O., & Wolinsky, A. (1996 October). A Strategic Model of Social and Economic Networks. *Journal of Economic Theory, 71*(1), 44-74.

Hollenstein, H. (2002). *Determinants of the adoption of ICT: A panel data survey for Switzerland.* Paper presented at the DRUID summer conference on industry dynamics of new and old technology, 6–8 June, Copenhagen.

McAfee, A. (2006, Spring). Enterprise 2.0: The dawn of emergent collaboration. *MIT Sloan Management Review*, *47*(3), 21–28.

Miles, R., Miles, G., & Snow, Ch. (2007). *Collaborative Entrepreneurship: How Communities of Networked Firms Use Continuous Innovation to Create Economic Wealth*. Stanford, CA: Stanford University Press.

Millen, D. R., Feinberg, J., & Kerr, B. (2007). *Dogear: social bookmarking in the enterprise*. Retrieved January 22, 2009, from http://portal.acm.org

Schonfeld, E. (2008). When crowdsourcing fails: Cambrian house headed to deadpool. *Techcrunch*. Retrieved December 12, 2008, from http://www.techcrunch.com/2008/05/12/when-crowdsourcing-fails-cambrian-house-headed-to-the-deadpool/

Ward, T. (2007). *Serena Software Adopts Facebook as Corporate Intranet*. Retrieved February 25, 20009 from http://intranetblog.blogware.com/blog/_archives/2007/11/5/3336073.html

Worthen, B. (2008). Why most online communities fail, Wall Street Journal online. Retrieved February 25th, 2008 from: http://blogs.wsj.com/biztech/2008/07/16/why-most-online-communities-fail/

## ADDITIONAL READING

Bughin, J. (2008). *Going Digital: Essays in digital transformation*. Philadelphia, PA: McKinsey & Company.

Huberman, B. (2003). *The Laws of the Web: Patterns in the Ecology of Information*. Cambridge, MA: MIT Press.

Newman, A., & Thomas, J. (2008). *Enterprise 2.0 implementation*. San Francisco: McGraw-Hill Osborne Media.

## KEY TERMS AND DEFINITIONS

**Enterprise 2.0:** Term coined by Andrew McAfee (2006) to define the use of web 2.0 social technologies in the enterprise space.

**Power Laws:** Power laws feature many networks of interaction- their distribution is typically skewed like 80/20 where 20% (the very dense head) make up 80% of the distribution analyzed (e.g., contributions to Wikipedia). Outside the head, the rest (80%) is typically long tail and contribute much less in the distribution (20%).

**Social Web/Software:** Term encompassing all new software applications that enabled any forms of collaboration and sharing.

## ENDNOTES

1 Regression completed on a set of 980 companies for which all data are available. Adjusted R-square measure of fit = 64%

2 Constant not reproduced; only statistically significant variables reported; * (**) means significant at 5% (1%) risk

3 Industry normalization is versus financial services; Continent normalized on Asia; technology adoption posture normalized on follower posture, competitive pressure normalized versus low pressure

4 Open collaboration is the proportion of software tools used for customer and supplier interaction; competitive pressure

5 All other variables are dummy variables, (1/0). Grassroot adoption is the company response on how web 2.0 technologies have invaded their corporation versus IT centralization.

6 Companies are disguised due to confidentiality of the sample collection to the outsiders of the survey studies.

7 Econometrically, we have estimated a semi-log function of the form, log (performance)= a+b'(X)+u, with, a and b' are coefficients estimated from regressing enterprise 2.0 performance on a vector, X of factors, capturing three separate families above.

# Chapter 4
# Prices on the Internet

**Jihui Chen**
*Illinois State University, USA*

## INTRODUCTION

In the pre-Internet era, consumers relied on media such as Sunday newspapers and flyers for product and price information. Such a search process is time-consuming and unlikely to be exhaustive. Existence of incomplete information has been shown to lead to price dispersion (Stigler, 1961). Recent advances in information technology have dramatically changed the manner by which consumers and businesses gather and transmit information. With a few mouse-clicks, consumers are able to compare price information from a wide range of vendors. With the advent of the Internet, especially the introduction of price comparison sites or shopbots, competition among online retailers escalates and we might expect prices to converge in the new economy. However, substantially decreased transaction cost has apparently not led to online price convergence.

An extensive literature on Internet pricing has documented persistent price dispersion in online markets. In this chapter, I review price dispersion and related literatures, and discuss future research directions.

DOI: 10.4018/978-1-61520-611-7.ch004

## BACKGROUND

When e-commerce was initially introduced, retailers selling (often inexpensive) search goods emerged first. The rise of consumer confidence in e-commerce, coupled with the development of information technology, has introduced (usually expensive) experience goods to e-commerce, as indicated by the delayed entrance of luxury goods onto the online marketplace. One direct benefit of e-commerce is cost savings, but it is unclear whether any of these are passed to consumers. One strand of early studies compares prices of matched products sold in both online and brick-and-mortar stores. Most of these studies report lower online prices (see Table 1), indicating the relative efficiency of e-commerce.

Many online shoppers now enjoy enhanced search capability through “Shopbots” such as Bizrate.com. A recent comScore Media Matrix monthly

*Table 1. Empirical studies comparing online and offline sellers*[6]

| Article | Data Duration | Product Category | Main Findings | |
|---|---|---|---|---|
| | | | Price Level | Price Dispersion |
| Bailey (1998)<br>Brynjolfsson and Smith (2000)<br>Garicano and Kaplan (2001)<br>Morton et al. (2001)<br>Lee and Gosain (2002)<br>Clay et al. (2002)<br>Brown and Goolsbee (2002)<br>Lee et al. (2003)<br>Ancarani and Shankar (2004)<br>Stylianou et al. (2005)<br>Zettelmeyer et al. (2006)<br>Chellappa et al. (forthcoming)<br>Sengupta (2007)<br>Ghose and Yao (2008) | 1996-1997<br>Feb 1998 - May 1999<br>1999 – 2000<br>Jan 1999 - Feb 2000<br>Feb 1999 - Jan 2000<br>April 1999<br>1992-1997<br>2000 (Korea)<br>2002 (Italy)<br>Sept 2002 - April 2003<br>April - May 2002<br>3rd quarter 2004<br>2004<br>2000 | Books, CDs, software<br>Books, CDs<br>Used-cars auctions<br>New cars<br>CDs<br>Books<br>Life insurance<br>CDs<br>Books and CDs<br>Over-the-counter pharmaceuticals<br>New cars<br>Airfares<br>Airfares<br>Hardware tools, office supplies, packaging materials | Higher online<br>Lower online<br>Higher online<br>Lower online<br>Comparable (current-hits)<br>Comparable<br>Lower online<br>Lower online<br>Lower online<br>Lower online<br>Lower online | Higher online<br>Higher online<br>Comparable<br>Higher online<br>(much) Lower online<br>Higher online<br>Higher online<br>Lower online<br>Lower online<br>Near-zero online dispersion |

analysis reports that more than 35.7 million unique users visited CNET Networks site (i.e., Shopper.com) in November 2007.[1] Search sites such as Google and Yahoo are also useful to savvy online shoppers.[2] One might expect these search tools to intensify online competition and eventually lead to Bertrand pricing. To date, several studies have documented persistent price dispersion in various product markets (e.g., Brynjolfsson and Smith, 2000; Clemons et al., 2002; Baye et al., 2004). A plausible explanation is that although the Internet eliminates physical barriers, other barriers that lead to incomplete information still exist.

When the "law of one price" fails to hold, price range, percent price range, coefficient of variation, price gap, and value of information are often used as measures of price dispersion. In a given product market, *price range* is defined as the difference between the highest and the lowest price, *percent price range* is the ratio of price range to the lowest price, *coefficient of variation* is the ratio of the standard deviation to the average price, *price gap* is the price difference between the two lowest-priced firms, and *value of information* is the percentage difference between the average and lowest prices.[3]

## PRICES ON THE INTERNET

The Internet provides an ideal environment for empirical studies of comparative prices.[4] In this article, I review research on pricing issues concerning e-retailers and shopbots. In general, we may sort e-retailers into two categories: web-based e-retailers (Dotcoms) such as eBay and Amazon, which exclusively conduct their business on the Internet but have no brick-and-mortar presence,[5] and multi-channel retailers (MCR), such as Best Buy's online branch, which are extensions of their brick-and-mortar presence. Tables 1 and 2 summarize results of price and price dispersion comparisons between online and brick-and-mortar sellers, and between Dotcoms and MCRs, respectively.

*Table 2. Empirical studies comparing dotcoms and MCRs*

| Article | Data Duration | Product Category | Main Findings | |
|---|---|---|---|---|
| | | | Price Level | Price Dispersion |
| Carlton and Chevalier (2001)<br>Tang and Xing (2001)<br>Pan et al. (2002)<br>Dewan and Hsu (2004)<br>Xing and Tang (2004)<br>Xing et al. (2004)<br>Tang and Gan (2004)<br>Xing et al. (2006)<br>Gan et al. (2007) | June, Oct 2000<br>July – Aug 2000 (Singapore)<br>Nov 2000<br>Jan and Sept 2000<br>July 2000 - June 2001<br>Dec 2000 – Apr 2001<br>Oct 2000 – Jan 2001<br>July 2000 – June 2001<br>Sept 2004 - Jan 2005 | Fragrances, DVD players, and refrigerators<br>DVDs<br>Books, CDs, DVDs, computer software and hardware, electronics<br>Stamps<br>DVDs<br>Electronics<br>Toys<br>DVDs<br>Groceries | Dotcoms lower<br>Dotcoms lower<br>Dotcoms lower<br>Dotcoms lower<br>Dotcoms lower<br>Dotcoms higher<br>Comparable<br>Dotcoms lower<br>Comparable | Dotcoms lower<br>Dotcoms lower<br>Dotcoms lower<br>Dotcoms lower<br>Dotcoms Higher |

## Determinants of Price Dispersion

The literature has documented persistent price dispersion. Here, I identify a number of potential explanations for observed comparative pricing patterns.

- Branding/Reputation

Due to the nature of online transactions, consumers have to submit the payment before receiving an order. To avoid potential risks, online shoppers prefer more reputable stores. Thus, even for many price-sensitive online shoppers, branding plays a role in decision-making (Smith and Brynjolfsson, 2001). Contrary to conventional wisdom, consumers actually conduct very limited online search despite low search cost (Brynjolfsson and Smith, 2000; Adamic and Huberman, 2001; Johnson et al., 2004). Consumer awareness and sensitivity to branding allow some sellers to charge premia (Baylis and Perloff, 2002; Dinlersoz and Li, 2006), resulting in price dispersion (Chen and Hitt, 2002).

- Channel Conflict/Substitution

Price dispersion may also be due to differences in seller types. MCRs offer more convenience than Dotcoms for post-sale services (e.g., returns and exchanges). Carlton and Chevalier (2001) argue that internalization of free-riding problems leads to higher online prices at MCRs. Moreover, MCRs and Dotcoms differ in price adjustments over time. Dotcoms typically change prices more frequently due to lower menu costs. To avoid channel conflict, MCRs need to coordinate between online and offline prices (Xing et al., 2004). In contrast, Dotcoms are more flexible in terms of frequent adjustments according to market need. Goolsbee (2001) finds evidence of channel conflict when consumers buy computers between channels. In a more recent study, Chu et al. (2008) find grocery buyers display lower price sensitivities when shopping online than when shopping offline. Using transaction data, studies find significant effects on online sales of distance to offline stores (Bell and Song, 2007; Chu et al., 2008; Forman et al, 2009).

- Consumer heterogeneity

In the theoretical literature, scholars use different terms to describe consumer heterogeneity (Salop and Stiglitz, 1977; Wilde and Schwartz, 1979; Varian, 1980; Rosenthal, 1980; Narasimhan, 1988; Baye and Morgan, 2001). In general, consumers can be sorted into two groups: those loyal to a store/brand and those who always search for the best (lowest) price. Such consumer heterogeneity allows sellers to price-discriminate. For example, sellers may offer promotions (e.g., e-coupons and mail-in rebates) to attract price-sensitive consumers, while charging the full price to loyal customers.

- Dynamic Pricing

Market efficiency, reduced menu costs, and effective monitoring capability allow online sellers to adjust prices fairly easily according to the changing marketplace (Kannan and Kopalle, 2001; Jayaraman and Baker, 2003). One type of dynamic pricing refers to adjusting posted prices over time through targeted promotions. The second type of dynamic pricing involves online auctions through active consumer participation. Priceline.com and eBay.com are popular auction sites where consumers obviously could pay different prices for the same item. The third type of dynamic pricing is price/product bundling. The choice of a bundle would affect the final price that a consumer pays.

- Market Evolution

Online sellers' pricing strategies may evolve over time. During the early days of e-commerce, online sellers faced less competition and enjoyed considerable market power. To capture the effect of evolution on firms' strategies, studies usually compared data at different points in time to examine the effect of market evolution (Pan et al., 2003). Brown and Goolsbee (2002) find declining price dispersion in life insurance prices throughout the 1990s. Scholten and Smith (2002) document comparable price dispersion for 70 products sold in conventional stores in 1976 and online stores in 2000. Chen's (2006) findings contrast those of Clemons et al. (2002), suggesting price convergence in the online airfare market. Taking an innovative approach, Bock et al. (2007) use data from the U.S. and China to proxy different stages of e-commerce maturity. They conclude that more mature online markets are associated with lower prices and lower price dispersion.

- Market Structure

The level of competition may determine sellers' pricing strategies. With only a handful of competitors, high prices can be sustained through tacit collusion. More sellers would drive down prices as well as price dispersion. Evidence from various online markets suggests that competition leads to lower prices (Clay et al., 2001; Brown and Goolsbee, 2002; Baye et al., 2004; Haynes and Thompson, 2008) and lower price dispersion (Clay et al., 2001; Morton et al., 2001; Nelson et al., 2007).

- Product Popularity

Market conditions vary with product popularity. When a product is first released, prices are higher because of low availability and early-adopters' willingness to pay. As the product becomes more available due to increased production, competition drives down the price and price dispersion. Clay et al. (2001) and Xing et al. (2006) find greater dispersion for more popular products in their studies. In the electronics market, Akimoto and Takeda (2008) report that dispersion first rises and later declines.

- Oligopoly Strategies

Everything else equal, consumers would choose the lowest price. In markets for homogeneous products, profit-maximizing sellers engage in mixed pricing strategies to blunt competition (Varian, 1980; Yan, 2008). This randomization strategy effectively prevents both buyers and competing sellers from locating the lowest price. Periodical sales are good examples. Baye and Morgan (2001) show that, even at price comparison sites, sellers randomize their prices to avoid head-on competition. This provides one explanation for the existence of persistent online price dispersion. Lin (2007) shows the existence of equilibrium price dispersion with competing gatekeepers. Kocas and Bohlmann (2008) consider an asymmetric oligopoly model, and find supportive evidence in the online book market that segmented switchers discourage competition. Sometimes, online sellers engage in product differentiation with differentiated products (Clemons et al., 2002). Some systematically offer low-quality products while others offer high-quality ones.

- Price partitioning

Online sellers separate surcharges including shipping and handling, taxes, and various fees from the base price (Xia and Monroe, 2004). This strategy allows online sellers to further differentiate from each other. Even if they charge the same price for an item, sellers may soften competition by varying the surcharges. As a result, the final price can be quite different depending on where a buyer shops. For instance, "free-shipping" with minimum purchase is an effective way to increase demand (Brynjolfsson and Smith, 2000; Dinlersoz and Li, 2006).

## FUTURE RESEARCH DIRECTIONS

Online business models constantly evolve to adapt to the changing consumer demand. For example, Amazon.com was launched as an online bookseller in 1995, but today it sells practically everything.[7] Priceline.com started as a "name-your-own-price" site hosting travel bidding services, but later expanded its business to fixed-price products as a regular online travel agency. Similarly, eBay introduced Express Store in April, 2006, an effort to attract general online shoppers. In such a dynamic marketplace, it may be interesting to examine the effects of such changes on price competition.

Research is still lacking on the relationship between Internet maturity, price levels and price dispersion. Longitudinal (panel) data are more appropriate than cross-sectional data for such studies, because products and sellers collected from different points in time may vary considerably, due to changing market conditions.

A major impediment to empirical studies is data availability, especially of transaction data (Pan et al., 2005). Existing studies often use price quotes or clickstream data, which do not reflect actual consumer valuations. Researchers typically use aggregated household surveys (Johnson et al., 2004) or laboratory experiments (Lynch and Ariely, 2000; Deck and Wilson, 2002) to study individual-level search behavior. These studies have largely relied on reduced-form models, which cannot reveal structural details. Clearly, there is a need for structural modeling of consumer behavior in e-commerce.

Compared to an extensive literature on price levels, online pricing dynamics is currently understudied. Comparisons of dynamic price adjustments between online and conventional retailers and/or between dotcoms and MCRs would do much to provide a more a complete picture of online pricing strategies. Dynamic price partitioning studies would also be useful, and it would be particularly interesting to extend vertical product differentiation analysis to markets where shipping options are complex (Dinlersoz and Li, 2006).

Understanding consumer behavior is another potential topic of interest. Future research may study consumer pre-purchase search behavior using information on actual shopping experiences, not self-reported surveys (Johnson et al., 2004), and then test whether the previous results on study of limited consumer search still prevail. Study of competitive implications of interactions between search and targeting online by incorporating strategic aspects of consumer search (Chen and Sudhir, 2004) should also be useful. In addition, it would be useful to study the impact of non-refundable surcharges on rebates or price-matching requests to determine effects on post-purchase behavior (Xia and Monroe, 2004). Finally, it would be interesting to study redemption rates of price-matching requests, online coupons, and/or promotion codes in e-commerce compared to the rates in conventional stores (Moorthy and Winter, 2006).

## CONCLUSION

This article offers various interest groups a useful reference on online pricing strategies, including price levels, price dispersion, and price adjustments, to better prepare them for future challenges and opportunities in e-commerce.

## REFERENCES

Adamic, L. A., & Bernardo, A. H. (2001). The Web's hidden order. *Communications of the ACM*, *44*(9), 55–59. doi:10.1145/383694.383707

Ancarani, F., & Shankar, V. (2004). Price levels and price dispersion within and cross multiple retailer types: Further evidence and extension. *Journal of the Academy of Marketing Science*, *32*(2), 176–187. doi:10.1177/0092070303261464

Bailey, J. P. (1998). Electronic commerce: Prices and consumer issues for three products: books, compact discs, and software. *Organization for Economic Co-Operation and Development*.

Baye, M. R., & Morgan, J. (2001). Information gatekeepers on the Internet and the competitiveness of homogeneous product markets. *The American Economic Review*, *91*(3), 454–474.

Baye, M. R., Morgan, J., & Scholten, P. (2004). Persistent price dispersion in online markets. In D. Jansen (Ed.), *The New Economy*. Chicago: University of Chicago Press.

Baylis, K., & Perloff, J. M. (2002). Price dispersion on the Internet: Good firms and bad firms. *Review of Industrial Organization*, *21*(3), 305–324. doi:10.1023/A:1020415304514

Bell, D. R., & Song, S. (2007). Neighborhood effects and trial on the Internet: Evidence from online grocery retailing. *Quantitative Marketing and Economics*, *5*(4), 361–400. doi:10.1007/s11129-007-9025-5

Bock, G., Lee, S., & Li, H. Y. (2007). Price Comparison and Price Dispersion: Products and Retailers at Different Internet Maturity Stages. *International Journal of Electronic Commerce*, *11*(4), 101–124. doi:10.2753/JEC1086-4415110404

Brown, J. R., & Goolsbee, A. (2002). Does the Internet make markets more competitive? Evidence from the life insurance industry. *The Journal of Political Economy*, *110*(3), 481–507. doi:10.1086/339714

Brynjolfsson, E., & Smith, M. D. (2000). Frictionless Commerce? A Comparison of Internet and Conventional Retailers. *Management Science*, *46*(4), 563–585. doi:10.1287/mnsc.46.4.563.12061

Carlton, D. W., & Chevalier, J. A. (2001). Free Riding and Sales Strategies for the Internet. *The Journal of Industrial Economics*, *49*(4), 441–461.

Chellappa, R. K., Sin, R. G., & Siddarth, S. (in press). (n.d.). Price-formats as a source of price dispersion: A study of online and offline prices in the domestic US airline market. *Information Systems Research*.

Chen, J. (2006). Differences in average prices on the Internet: Evidence from the online market for air travel. *Economic Inquiry*, *44*(4), 656–670. doi:10.1093/ei/cbj040

Chen, P., & Hitt, L. M. (2002). Measuring switching costs and the determinants of customer retention in Internet-enabled businesses: A study of the online brokerage industry. *Information Systems Research*, *13*(3), 255–274. doi:10.1287/isre.13.3.255.78

Chen, Y., & Sudhir, K. (2004). When shopbots meet emails: Implications for price competition on the Internet. *Quantitative Marketing and Economics*, *2*(3), 233–255. doi:10.1023/B:QMEC.0000037078.02232.76

Chu, J., Chintagunta, P. K., & Cebollada, J. (2008). A comparison of withinhousehold price sensitivity across online and offline channels. *Marketing Science*, *27*(2), 283–299. doi:10.1287/mksc.1070.0288

Clay, K., Krishnan, R., & Wolff, E. (2001). Prices and price dispersion on the web: Evidence from the online book industry. *The Journal of Industrial Economics*, *4*, 521.

Clay, K., Krishnan, R., Wolff, E., & Fernandes, D. (2002). Retailer strategies on the Web: Price and non-price competition in the online book industry. *The Journal of Industrial Economics*, 3.

Clemons, E. K., Hann, I., & Hitt, L. M. (2002). Price dispersion and differentiation in online travel: An empirical investigation. *Management Science*, *48*(4), 534–549. doi:10.1287/mnsc.48.4.534

Deck, C. A., & Wilson, B. J. (2002). The effectiveness of low price matching in mitigating the competitive pressure in low friction electronic markets. *Electronic Commerce Research*, *2*(4), 385–398. doi:10.1023/A:1020567515249

Dewan, S., & Hsu, V. (2004). Adverse selection in electronic markets: Evidence from online stamp auctions. *The Journal of Industrial Economics*, *52*(4), 497–516. doi:10.1111/j.0022-1821.2004.00237.x

Dinlersoz, E. M., & Li, H. (2006). The shipping strategies of internet retailers: Evidence from internet book retailing. *Quantitative Marketing and Economics*, *4*(4), 407–438. doi:10.1007/s11129-006-9010-4

Forman, C., Ghose, A., & Goldfarb, A. (2009). Competition between Local and Electronic Markets: How the benefit of buying online depends on where you live. *Management Science*, *54*(1), 47–57.

Gan, L., He, S., Juang, T., & Tan, J. (2007). A comparative analysis of online grocery pricing in Singapore. *Electronic Commerce Research and Applications*, *6*, 474–483. doi:10.1016/j.elerap.2007.02.006

Garicano, L., & Kaplan, S. N. (2001). The Effects of Business-to-Business E-Commerce on Transaction Costs. *The Journal of Industrial Economics*, *49*(4), 463–486.

Ghose, A., & Yao, Y. (2008). *Goodbye price dispersion? New evidence from transaction prices in electronic Markets.* Working Paper.

Goolsbee, A. (2001). Competition in the computer industry: Online versus retail. *The Journal of Industrial Economics*, *49*(4), 487–499.

Haynes, M., & Thompson, S. (2008). Price, price dispersion and number of sellers at a low entry cost shopbot. *International Journal of Industrial Organization*, *26*(2), 459–472. doi:10.1016/j.ijindorg.2007.02.003

Jayaraman, V., & Baker, T. (2003). The Internet as an Enabler for Dynamic Pricing of Goods. *IEEE Transactions on Engineering Management*, *50*(4), 470–477. doi:10.1109/TEM.2003.820134

Johnson, E. J., Moe, W. W., Fader, P. S., Bellman, S., & Lohse, G. L. (2004). On the depth and dynamics of online search behavior. *Management Science*, *50*(3), 299–308. doi:10.1287/mnsc.1040.0194

Kannan, P. K., & Kopalle, P. K. (2001). Dynamic Pricing on the Internet: Importance and Implications for Consumer Behavior. *International Journal of Electronic Commerce*, *5*(3), 63–83.

Kocas, C., & Bohlmann, J. D. (2008). Segmented switchers and retailer pricing strategies. *Journal of Marketing*, *72*, 124–142. doi:10.1509/jmkg.72.3.124

Lee, H. G., Lee, S. C., Kim, H. Y., & Lee, R. H. (2003). Is the Internet making retail transactions more efficient? Cmoparison of online and offline CD retail markets. *Electronic Commerce Research and Applications*, *2*(3), 266–277. doi:10.1016/S1567-4223(03)00030-9

Lee, Z., & Gosain, S. (2002). A longitudinal price comparison for music CDs in electronics and brick-and-mortar markets: Pricing strategies in emergent electronic commerce. *The Journal of Business Strategy*, *19*(1), 55–71.

Lin, Y. C. (2007). Competing gatekeepers. *The B.E. Journal of Theoretical Economics*, *7*(1).

Lynch, J. G. Jr, & Ariely, D. (2000). Wine on-line: Search costs affect competition on price, quality, and distribution. *Marketing Science*, *19*(1), 83–103. doi:10.1287/mksc.19.1.83.15183

Moorthy, S., & Winter, R. (2006). Price-matching guarantees. *The Rand Journal of Economics*, *37*(2), 449–465. doi:10.1111/j.1756-2171.2006.tb00025.x

Morton, F. S., Zettelmeyer, F., & Silva-Risso, J. (2001). Internet car retailing. *The Journal of Industrial Economics*, *49*(4), 501–519.

Narasimhan, C. (1988). Competitive promotional strategies. *The Journal of Business*, *61*, 427–449. doi:10.1086/296442

Nelson, R. A., Cohen, R., & Rasmussen, F. R. (2007). An analysis of pricing strategy and price dispersion on the Internet. *Eastern Economic Journal*, *33*(1), 95–110. doi:10.1057/eej.2007.6

Pan, X., Ratchford, B. T., & Shankar, V. (2005). Price dispersion on the Internet: A review and directions for future research. *Journal of Interactive Marketing*, *18*(4), 116–135. doi:10.1002/dir.20019

Pan, X., Shankar, V., & Ratchford, B. T. (2002). Price Competition between Pure Play vs. Bricks-and-Clicks e-Tailers: Analytical Model and Empirical Analysis. In M. R. Baye (Ed.), *Advances in Applied Microeconomics: Economics of the Internet and e-Commerce*, 11, 29–61.

Pan, X., Shankar, V., & Ratchford, B. T. (2003). The Evolution of Price Dispersion in Internet Retail Markets. In M. R. Baye (Ed.), *Advances in Applied Microeconomics: Organizing the New Industrial Economy* (Vol. 12, pp. 85–105).

Rosenthal, R. W. (1980). A model in which an increase in the number of sellers leads to a higher price. *Econometrica*, *48*, 1575–1580. doi:10.2307/1912828

Salop, S., & Stiglitz, J. E. (1977). Bargains and ripoffs: A model of monopolistically competitive price dispersion. *The Review of Economic Studies*, *44*(3), 493–510. doi:10.2307/2296903

Scholten, P. A., & Smith, A. (2002). Price dispersion then and now: Evidence from retail and e-tail markets. In M. R. Baye (Ed.) *Advances in Microeconomics*: *Economics of the Internet and e-Commerce*, 11, 63-88.

Sengupta, A. (2007). *Do Internet converge prices to the "law of one price"? Evidence from transaction data for airline tickets.* Working paper.

Smith, M. D., & Brynjolfsson, E. (2001). Consumer decision-making at an Internet shopbot: Brand still matters. *The Journal of Industrial Economics*, *49*(4), 541–558.

Stigler, G. J. (1961). The economics of information. *The Journal of Political Economy*, *69*(3). doi:10.1086/258464

Stylianou, A., Kumar, R., & Robbins, S. (2005). Pricing on the Internet and in conventional retail channels: A study of over-the-counter pharmaceutical products. *International Journal of Electronic Commerce*, *10*(1), 135–148.

Tang, F. F., & Gan, L. (2004). Pricing convergence between dotcoms and hybrids: empirical evidence from the online toy market. *Journal of Targeting . Measurement and Analysis for Marketing*, *12*(4), 340–352. doi:10.1057/palgrave.jt.5740121

Tang, F. F., & Xing, X. (2001). Will the growth of multi-channel retailing diminish the pricing efficiency of the Web? *Journal of Retailing*, *77*(3), 319–333. doi:10.1016/S0022-4359(01)00049-5

Varian, H. R. (1980). A model of sales. *The American Economic Review*, *70*(4), 651–659.

Wilde, L. L., & Schwartz, A. (1979). Equilibrium comparison shopping. *The Review of Economic Studies*, *46*(3), 543–553. doi:10.2307/2297020

Xia, L., & Monroe, K. B. (2004). Price partition on the Internet. *Journal of Interactive Marketing*, *18*(4), 63–73. doi:10.1002/dir.20017

Xing, X., & Tang, F. F. (2004). The growth of multi-channel retailing does diminish the pricing efficiency of the Web: Further evidence from the online DVD market. *Journal of Retailing and Consumer Services*, *11*(3), 141–147. doi:10.1016/S0969-6989(03)00013-4

Xing, X. L., Tang, F. F., & Yang, Z. L. (2004). Pricing dynamics in the online consumer electronics market. *Journal of Product and Brand Management*, *13*(6), 429–441. doi:10.1108/10610420410560316

Xing, X. L., Yang, Z. L., & Tang, F. F. (2006). A comparison of time-varying online price and price dispersion between multichannel and dotcom DVD retailers. *Journal of Interactive Marketing*, *20*(2), 3–20. doi:10.1002/dir.20058

Yan, R. (2008). Pricing strategy for companies with mixed online and traditional retailing distribution markets. *Journal of Product and Brand Management*, *17*(1), 48–56. doi:10.1108/10610420810856512

Zettelmeyer, F., Morton, S., & Silva-Risso, H. (2006). How the Internet Lowers Prices: Evidence from Matched Survey and Auto Transaction Data. *JMR, Journal of Marketing Research*, 168–181. doi:10.1509/jmkr.43.2.168

## ADDITIONAL READING

Baye, M. R. (Ed.). (2003). *Advances in Applied Microeconomics: Organizing the New Industrial Economy*. Amsterdam: Elsevier/JAI Press.

Baye, M. R., & Morgan, J. (2004). Price dispersion in the lab and on the Internet: Theory and evidence. *The Rand Journal of Economics*, *35*(3), 449–446. doi:10.2307/1593702

Phlips, L. (1989). *The Economics of Price Discrimination* (1st ed.). Cambridge, UK: Cambridge University Press.

Smith, M., Bailey, J., & Brynjolfsson, E. (2000). Understanding digital markets. In E. Brynjolfsson, B. Kahin (Ed.), *Understanding the Digital Economy*. Cambridge, MA: MIT Press.

Stiglitz, E. J. (2000). The contributions of the economics of information to twentieth century economics. *The Quarterly Journal of Economics*, *115*(4), 1441–1478. doi:10.1162/003355300555015

## KEY TERMS AND DEFINITIONS

**Channel Conflict:** When a seller is present in multiple distribution channels, it needs to coordinate seamlessly across channels regarding store policies and prices.

**Free-Riding:** Online shoppers may still rely on expertise of in-store salespersons to learn about a product and other essential information, but choose to purchase online (for lower prices).

**Law of One Price:** In a homogeneous product market, all firms price at the marginal cost.

**Mixed Pricing Strategy:** Profit-maximizing firms randomize equilibrium prices to discourage undercutting.

**Multichannel Retailers:** Retailers conduct businesses through multiple distribution channels.

**Price Discrimination:** Firms charge different prices to different consumers for an identical product.

**Price Dispersion:** In a homogeneous product market, prices charged by different sellers are different.

**Price Partitioning:** Retailers divide the total product price into different components – a base price and surcharges including shipping and handling, taxes, and other fees.

**Shopbot:** A useful online search tool helps shoppers collect product information.

## ENDNOTES

1 Source: Retail Sites See Surge in Traffic as Holiday Season Kicks Off, comScore Inc. Retrieved March 2, 2009, from http://www.comscore.com/press/release.asp?press=1974.

2 Recently, websites tracking online deals come into existence. For instance, PriceSpider.com alerts subscribers with the latest price drops on specific electronics that a consumer is interested in; farecast.com offers travelers advice on the timing of ticket purchase.

3 Baye and his colleagues define a set of Internet indices, including price gap and value of information on their website (www.nash-equilibrium.com).

4 In this literature, studies often use electronic agents to automate data collection (Clay et al., 2001; Baye et al., 2004).

5 Supporting services for these e-retailers including call centers and warehouses are not considered as part of the core business.

6 "Lower (Higher) online" in the last column indicates that either price level or price dispersion is lower (higher) among online sellers than among offline sellers.

7 Source: E-commerce report: Luxury goods e-tailers hope new credit plans will move pricey merchandise, by Bob Tedeschi, October 2000. Retrieved March 2, 2009, from http://query.nytimes.com/gst/fullpage.html?res=9B05E4D8133CF93AA35753C1A9669C8B63

# Chapter 5
# Price Dispersion on the Internet:
## A Further Review and Discussion

**Fang-Fang Tang**
*Peking University, People's Republic of China*

**Xiaolin Xing**
*Fannie Mae, USA*

## ABSTRACT

*The emergence and explosive growth of e-commerce have ushered in a new era of retail business, which has in turned triggered an increased research interest in studying online pricing behavior. Online retailing promises the potentials of low barrier of entry, easy access of information, and low transactions costs. These features of online retailing imply that the growth of e-commerce has the potential of realizing often stated economic ideals for a truly competitive market: low search costs, fierce price reactions, low margins, and weak market power. Such benefits might provide significant welfare benefits to consumers. Early studies in the literature mainly focused on comparing price levels and price dispersion between offline and online competitors (e.g. Bailey 1998, Brynjolffson & Smith 2000). As online markets become more mature and more data on e-tailing become available, empirical studies have shifted from analyzing cross-sectional data to longitudinally investigating market dynamics in terms of price levels and price dispersions. Since customers can obtain price information in online markets easily and inexpensively, it might be expected that online price dispersion should be small. However, empirical studies have found significant price differences and persistent price dispersions in the Internet markets, for which we are going to review in the following sections.*

## INTRODUCTION

Pan, Ratchford and Shankar (2004) have extensively reviewed the existing literature on price dispersion research on the fast-growing Internet selling channel and also provided the profession with excellent insights on future research. However, their paper contains some critical points of misunderstanding on a field of research issues, and, even more importantly, such misunderstanding has been unfortunately widespread in the research community. Therefore, we feel a pressing urgency to clarify

DOI: 10.4018/978-1-61520-611-7.ch005

on these points and try to provide an additional review of other studies which were not included in this paper.

It is quoted in the above review paper (p.122): "Although Brynjolffson and Smith (2000) data contain both multichannel and pure Internet retailers, they did not specify test compare their relative price and dispersion levels. Tang and Xing (2001) compared the pricing behavior of these two types' retailers in the DVD market, with a data set containing 4,896 price observations for 51 DVD titles sold at six top pure play e-tailers and four top multichannel retailers, during the period of July-August 2000 in Singapore. They found that the multichannnel retailers had significantly higher price than pure play e-tailers (14% on average). Moreover, price dispersion among the pure play e-tailers was much smaller (less than half of that among multichannel retailers)." First of all, Tang and Xing (2001) data is on DVD prices in the United States, rather than in Singapore. It is a beautiful example of how Internet has exhibited its global power, since the data in Tang and Xing (2001) paper were collected then by the researchers from Singapore on the United States online DVD market, with all price quotes in US dollar. Second, it was six top pure play e-tailers versus six top multichannel retailers (rather than four). Third, but most importantly, Tang and Xing (2001) studied the price comparison issues between the pure play e-tailers versus the *online branches of multichannel retailer*, not the multichannel retailers in general. Pan et al (2004) are right about the research question of Brynjolffson and Smith (2000), which is the price comparison between the online prices versus *offline* prices of books and CDs, but critically wrong in conception about the research question by Tang and Xing (2001). Brynjolffson and Smith (2000) is a study on *inter-channel* (online versus offline) price comparison, but Tang and Xing (2001) is a study on *intra-channel* price comparison, that is, a comprehensive price comparison between two types of online sellers (the pure play e-tailers versus the online branches of multichannel retailers, both being online operations selling DVDs on the Internet channel), in terms of absolute and relative price levels and price dispersion levels. Unfortunately, this misunderstanding to treat Tang and Xing (2001) study as a follow-up work to the research question raised by Brynjolffson and Smith (2000) has been widespread, without noting the critical differences between these two studies. The two research questions were fundamentally different. The distinct research question raised by Tang and Xing (2000) on the different pricing behavior patterns of the two different types of online sellers (both solely using the Internet channel) was historically due to the data collection problem. Based then in Singapore, they could only collect data purely on Internet, and accidentally, this exploratory attempt has yielded some surprisingly interesting results. In fact, this research methodology started from a much earlier study by Tang and Ho (2003) who collected data by three online branches of multichannel retailers (BarnesandNoble.com, Borders.com and Wordsworth.com) versus two pure play e-tailers (Amazon.com and Books.com) on 50 titles of books, from February 6 to March 6, 1999 once every two days (thus 3750 price observations). A puzzling price difference pattern similar to Tang and Xing (2001) was discovered (average price of US$16.07 of online branches of multichannel retailers versus US$17.22 of pure play e-tailers, or 73% versus 78% in terms of percentage prices), thus they continued to collect price data by five online branches of multichannel retailers versus five pure play e-tailers from April 29 to June 3, 2000 (once every week following the convention in Brynjolffson and Smith 2000), with a total of 2,900 price observations during this second stage (updating only the bestseller titles while keeping the random titles unchanged). The price difference patterns that were discovered in the first stage remained robust in the second stage, in fact, amplified: average price of US$15.06 versus US$16.98, or 66.62% versus 75.1% in terms of percentage prices and price dispersions around 20-30% less among the pure play e-tailers than the price dispersions among the online branches of multichannel retailers, in every sense from dollar price ranges or standard deviations to percentage price ranges or standard deviations[1].

## BACKGROUND

A series of completed studies and ongoing studies have followed and continue to follow this methodology proposed by Tang and Ho (2003) since then, to explore various categories of products (e.g., books, CDs, DVDs, pre-recorded videotapes, electronics, toys) and across different geographic regions (e.g. the United States, South Korea, the mainland of China, Australia). We want to highlight that the studies to be summarized in the following have been using exactly matched products, and over a relatively long time span whenever possible. These goals have been achieved by labor-intensive work: All the data of price observations have been collected by human research personnel (not through automatic software agents or from Internet shopbots), therefore only the commonly available products on the Web sites and the actual selling prices have been recorded. (Only for extremely occasional out-of-stock items by one or two of the online sellers at one time point, the list price was used as a proxy.) Features of products have been carefully matched to ensure that the product prices to be compared come from the exactly matched items, not from another version or branded variants, etc.

Tang and Lu (2001) compared the pricing behavior of six top pure play e-tailers versus six online branches of multichannel retailers in the CD market of the United States, using a data set collected (once every four days) from June 7 to July 9, 2000 for 34 titles (half bestsellers and half random titles), with a total of 3,774 price observations. They found that the pure play e-tailers charged on average around 2.4%-2.7% lower than the online branches of traditional retailers[2], but the price dispersion among the pure play e-taliers are about 4% higher than among the online branches of multichannel retailers. Further examination revealed that this larger price dispersion mainly came from the random titles, in the sense that all statistic test results for the random title category were highly significant ($p<0.025$) but not significant at all for the popular title case (except one weak significance of 0.08 in the data on July 5, 2000). Further data on CDs have been collected and are under analysis.

Tang and Xing (2003) researched the pre-recorded videotapes market of the United States, using a data set collected (once every five days) from July 12 to August 16, 2000 for 50 titles (half bestsellers and half random titles) from six top pure play e-tailers versus six online branches of multichannel retailers, with a total of 4,800 price observations. They found that the pure play e-tailers priced on average 6.4% lower in terms of posted prices, and 3% lower in terms of full prices (including shipping costs). Price dispersions among the pure play e-tailers were around 5% lower than among the online branches of multichannel retailers and this pattern was also clearly exhibited when they further examined the title categories of popular versus random. Further data in this product category have been collected and are under analysis.

Tang and Gan (2004) analyzed a data set collected between October 19, 2000 to January 4, 2001 (weekly during twelve weeks), on 42 toy and game items (20 bestsellers and 22 random), with a total of 4,032 price observations, for four top pure play e-tailers versus four top online branches of multichannel retailers. They found that the online branches of traditional retailers priced slightly lower than the pure Internet players, on average, by only 0.4% in posted prices and 1.4% in full prices, and these differences were statistically insignificant, indicating some price convergence was emerging in the online toy market. In conformity with this pattern, price dispersions were found to be similar between the pure Internet players and the online branches of the multichannel retailers, exhibiting statistically insignificant difference during most of the weeks throughout the study period. Nevertheless, the dispersions of both posted and full prices across the online branches of the multichannel retailers appear remarkably larger than the case of the pure Internet players, but somehow smaller for the random titles. They suggested that this phenomenon probably reflected pricing strategy difference between the two types of retailers online, the dot.coms putting more sales emphasis on the popular items, probably due to the higher risk of inventory costs for the dot.coms which do not have brick and mortar branches offline. Further data have been collected and are under analysis.

Xing, Tang and Yang (2004) searched hundreds of electronic products in nearly thirty online stores and found 14 common items in eight of them, and collected weekly a data set on these 14 common items from four top pure play e-tailers versus four top online branches of multichannel retailers, from December 9, 2000 to June 9, 2001. After 28 weeks, some common items became missing in some of these online retailers, and thus they stopped the data collection. It is a valuable longitudinal data set for analyzing market dynamics, a total of 2,016 price observations after excluding some weeks with missing products. By constructing two econometric models for the analysis of price movements (one for the average price and the other for the price dispersion), they found that the pure Internet players priced higher on average, but the prices across the online branches of multichannel retailers were 35.3% more dispersed than the prices across the pure play e-tailers in terms of full prices (and 33.1% in terms of percentage prices). Their results showed that the electronics prices decreased over the period of study in general, but the price dispersion moved up with time in general, with no significant difference in the speeds between these two types of online sellers. They also cautioned the readers about the small sample size of their product choices, because it was extremely difficult to find sufficient number of exactly common items carried by all these online retailers.

Xing and Tang (2004) obtained a weekly price dataset of twelve US online DVD retailers (again, six top pure play e-tailers versus six top online branches of multichannel retailers), from November 16, 2001 to January 11, 2002, covering the Christmas and New Year period, with a total of 5,508 price observations. The dataset included 51 titles, with 26 being bestsellers. They found that the pure play e-tailers charged on average 6.8% lower than the online branches of traditional retailers in the sense of posted prices, while the per item shipping cost by the former is on average (US$1.56) lower than the latter (US$1.64). That is, including shipping costs would only enhance their results. This finding is consistent with Tang and Xing (2001). They also found a larger price dispersion among the online branches of multichannel retailers than among the pure play e-tailers, for example, the dollar-price range cross the former cases averages US$6.58 (or corresponding to an average percentage price range of 24.1%) while US$5.70 (or 21.1%) for the latter. However, they observed an interesting pattern when they examined the popular and random categories separately. Both the dollar and percentage price ranges are higher for the online branches of multichannel retailers with the popular titles than for the pure play e-tailers, more than 1.5 times larger in magnitude, but it is completely reversed with the random titles although the difference in magnitude is smaller. As the most popular titles are newly issued, they argued, this counter-intuitive result may reflect the fact that competition will result in price convergence over time.

Xing, Yang and Tang (2003) used an error component model with serial correlation to analyze a data set of online DVD prices in the United States collected weekly between July 5, 2000 and June 26, 2001 (a total of 15,708 price observations over 51 weeks). They found that the online branches of multi-channel retailers price significantly higher than their online-only counterparts, but the Dotcom prices went up much faster, which implies that the prices on average converge over time between the two types of retailers. They also found that overall market prices went up, implying that retailers collectively raised their prices during their sample period. This result may reflect the tough adjustment period of online retailing during the sample period. Their results also showed that difference in price dispersions between the two types of retailers decline over the sample period. Their findings showed that although the two types of retailers had different price levels and different price dispersions at the beginning, such differences are getting smaller over time, implying that the two types of retailers would have the similar price behavior in a long run. Therefore, the persistent price dispersion cannot be explained only by possible differences in pricing between the two types of retailers. Their results showed that brand name makes a significant difference on prices, which is consistent with Brynjolfsson and Smith (2000) and Pan, Ratchford, and Shankar (2002). Nevertheless, further data collection and analysis have been under progress, thus it is yet too early to draw any definite conclusion. The Internet channel and the online markets are still evolving towards maturity, as Pan, Ratchford and Shankar (2004) already pointed out.

For other geographic markets, Liu and Tang (2003) collected a weekly data set on 52 Chinese (mainland) book titles (25 bestsellers and 27 random titles) from January 7 to March 11, 2001, for six top pure play e-tailers versus six top online branches of multichannel retailers, with a total of 5,616 price observations after deleting missing data points. They found that the pure play e-tailers charged on average substantially less than the online branches of mulichannel retailers, by 2.84 RMB Yuan or 13.8% less in posted prices and 1.41 RMB Yuan or 6.4% less in full prices. The difference in price dispersions was even more significant, with the price dispersions among the online branches of multichannel retailers being around 1/3 to ½ of the price dispersions among the pure play e-tailers, depending on whether posted, percentage or full prices are used as the measure. This pattern is also robustly exhibited when they examined the popular and random categories separately, or even after excluding the highest-pricing pure play e-tailer (the only one that always priced much higher than any other dot.com or most online branches of multichannel retailers). This finding is contrary to most previous studies in this line, and puzzling, since the extent of price dispersion reflects the power of the market to force sellers to a single price. They tentatively attributed the reason to the fact that the Internet retailing market was still very small and immature in the mainland of China compared to the United Stated level, which might have played a role for this anomaly. Further data collection and analysis have been under progress to see whether the market evolution process will change such a puzzling anomaly.

Tang (2004) collected weekly a data set of 60 South Korean book titles (30 bestsellers and 30 random titles) between December 14, 2001 to February 2, 2002, from six top pure play e-tailers versus six top online branches of multichannel retailers (based on their market shares), with a total of 5,760 price observations. Consistent with most previous findings, he found that the pure play e-tailers charged significantly lower prices than the online branches of multichannel retailers in the South Korean online book market as well, with 1,504.12 Won or 17.41% less in posted prices and 1,330.47 Won or 14.79% less in full prices. However, the price dispersions among the pure play e-taliers and among the online branches of multichannel retailers were almost indistinguishable, by various measurements, and this pattern was also clearly exhibited when he further examined the title categories of popular versus random. He argued that, in the short run, the emergence of B2C online market may lower entry barriers relative to the conventional market, but in the longer run, as the key drivers (such as profit margin, volumes, brand and location in conventional retailing) and strategic assets gradually clear the competitive landscape, the online market is likely to succumb to the market power of the dominant players, especially in markets like the South Korean books where a few traditional large stores led the market. As all the key drivers (optimized volumes, margins, brand and access) move the online marketspace towards long-term equilibrium, it is possible that conventional retailers' online branches tend to exhibit price change and price dispersion patterns closer and closer to their online-only rivals and vice versa for the online-only retailers. Li, Tang, Huang and Song (2009) studied the online DVD market in Australia, Tang and Zong (2008) and Zong, Tang, Huang, and Ma (2009) studied the online price dispersion of hotel rooms in Mainland China and found mixed results as above (Clemens et al. 2002 studied the US online travel market for air tickets from a product differentiation perspective with mixed findings).

To compare degrees of price dispersion between different product categories and between different national markets, Gatti and Kattuman (2003) collected weekly data for five distinct product categories sold online between October 2001 to June 2002, from seven European countries. They found significant and systematic differences in the degree of price dispersion observed in online markets, both between countries and across product categories. More specifically, they found that cheaper goods had relatively bigger price dispersion than more expensive items, and France and Spain had significantly smaller price dispersion than the other sampled European countries.

To summarize the above findings (in supplement to the reviews of Pan, Ratchford and Shankar 2004, Ancarani & Shankar 2004, Lindsey-Mulliken & Grewal 2006)), empirical results so far are still mixed, across various product categories and across geographic market regions, showing that the Internet retailing market is still evolving rapidly. Any conclusion, either empirical or theoretical, has to be careful with interpretation. In our view, theoretical constructs must be built based on robust empirical findings. Any theory without empirical foundation would be somehow dubious. The profession certainly needs more empirical studies on longer time periods, across more product categories and across more geographic market regions, to help identify the stable pricing patterns in the online markets.

## FUTURE RESEARCH DIRECTIONS

The mixed findings of online price levels and price dispersions require further research both in theoretical and empirical sides. First of all, more data mining is needed to examine the critical factors which contribute to the identifiable patterns so far. Second, more theoretical research is badly needed. Pan Ratchford and Shankar (2004, p.117), like many others, have quoted Bakos(1997)with significant attention: "Finally and most importantly, research on online price dispersion can help us understand whether this new retail format really does provide the gains in informational efficiency that many have predicted (e.g., Baks 1997)". Unfortunately, this often-cited cornerstone study (Bakos 1997) is in fact fatally wrong, as Harrington (2001) proved that the two major results in Bakos (1997) are either mathematically wrong or based on an implausible assumption. No breakthrough as we know has been made in this theoretical side yet although Lu, Xing and Tang (2008) has made certain progress. Third, experimental studies on consumer and retailer behavior are also needed in controlled laboratory settings to scrutinize the causality of such price dispersion puzzles. Field data mining, theoretical research and experimental studies can supplement each other to help depict a clearer picture in this field which also challenges a fundamental principle in economics: "the law of one price".

## ACKNOWLEDGMENT

Corresponding author, Director of National Policy Lab, China Center for Economic Research, National School of Development, Peking University. This research is supported by a grant from China Natural Science Foundation (Project. No. 70972014) for which we are grateful.

## REFERENCES

Ancarani, F., & Shankar, V. (2004). Price Levels and Price Dispersion within and across Multiple Retailer Types: Further Evidence and Extension. *Journal of the Academy of Marketing Science*, *32*(2), 176–187. doi:10.1177/0092070303261464

Bailey, J. (1998). Electronic Commerce: Prices and Consumer Issues for Three Products: Books, Compact Dics, and Software. *Organisation for Economic Co-Operation and Development*, OCDE/GD(98), 4.

Bakos, Y. (1997). Reducing Buyer Search Costs: Implications for Electronic Marketplaces. *Management Science*, *43*(12), 1676–1692. doi:10.1287/mnsc.43.12.1676

Brynjolfsson, E., & Smith, M. D. (2000). Frictionless commerce? A Comparison of Internet and Conventional Retailers. *Management Science*, *46*(4), 563–585. doi:10.1287/mnsc.46.4.563.12061

Clemons, E., Il-Horn, H., & Hitt, L. M. (2002). Price Dispersion and Differentiation in Online Travel: An Empirical Investigation. *Management Science*, *48*(4), 534–549. doi:10.1287/mnsc.48.4.534

Gatti, R. J., & Kattuman, P. (2003). Online Price Dispersion within and between Seven European Countries. *Advanced in Applied Microeconomics: Organizing the New Industrial Economy*, *12*, 106.

Harrington, J. E. Jr. (2001). Comment on Reducing Buyer Search Costs: Implications for Electronic Marketplaces. *Management Science*, *47*(12), 1727–1732. doi:10.1287/mnsc.47.12.1727.10244

Li, H., Tang, F.-F., Huang, L., & Song, S. (2009). (forthcoming). A Longitudinal Study on Australian Online DVD Pricing. *Journal of Product and Brand Management*.

Lindsey-Mullikin, J., & Grewal, D. (2006). Imperfect Information: The Persistence of Price Dispersion on the Web. *Journal of the Academy of Marketing Science*, *34*(2), 236–243. doi:10.1177/0092070305283366

Liu, Y., & Tang, F.-F. (2003). (forthcoming). An Empirical Analysis on Pricing Patterns in China's Online Book Market. *Journal of International Consumer Marketing*.

Pan, X., Ratchford, B. T., & Shankar, V. (2004). Price Dispersion on the Internet: A Review and Directions for Future Research. *Journal of Interactive Marketing*, *18*(4), 116–135. doi:10.1002/dir.20019

Tang, F.-F. (2004). Hybrids vs. Doctors: Some Online Pricing Patterns in the South Korean Book Market. *International Journal of Marketing and Advertising*, *1*(3), 316–328. doi:10.1504/IJIMA.2004.005021

Tang, F.-F., & Gan, L. (2004). Pricing Convergence between DocComs and Hybrids: Empirical Evidence from the Online Toy Market. *Journal of Targeting . Measurement and Analysis for Marketing*, *12*(4), 340–352. doi:10.1057/palgrave.jt.5740121

Tang, F.-F., & Ho, H. P. (2003). A Puzzle in Online Pricing: Early Evidence from the Book Market. *Review of Business Research*, *1*(2), 1–11.

Tang, F.-F., & Lu, D. (2001). Pricing Patterns in the Online CD Market: An Empirical Study. *Electronic Markets*, *11*(3), 171–185. doi:10.1080/101967801681008013

Tang, F.-F., & Xing, X. (2001). Will the Growth of Multi-Channel Retailing Diminish the Pricing Efficiency of the Web? *Journal of Retailing*, *77*(3), 319–333. doi:10.1016/S0022-4359(01)00049-5

Tang, F.-F., & Xing, X. (2003). Pricing Differences between DocComs and Multi-Channel Retailers in the Online Video Market. *Journal of Academy of Business and Economics*, *2*(1), 152–161.

Tang, F.-F., & Zong, J. (2008). Hotel Electronic Marketing and Online Price Dispersion in Mainland China. *China Economic Journal*, *1*(3), 303–315. doi:10.1080/17538960802567776

Xing, X., Lu, Y., & Tang, F.-F. (2008). Retailers' Incentive to Sell through a New Selling Channel and Pricing Behavior in a Multi-channel Environment. *Annals of Economics and Finance*, *9*(2), 315–343.

Xing, X., & Tang, F.-F. (2004). Pricing Behavior in the Online DVD Market. *Journal of Retailing and Consumer Services*, *11*(3), 141–147. doi:10.1016/S0969-6989(03)00013-4

Xing, X., Tang, F.-F., & Yang, Z. (2004). Pricing Dynamics in the Online Consumer Electronics Market. *Journal of Product and Brand Management*, *13*(6), 429–441. doi:10.1108/10610420410560316

Zong, J., Tang, F.-F., Huang, W., & Ma, J. (2009). (forthcoming). Online Pricing Dispersion of China Hotels. *Journal of China Travel Research*.

## ADDITIONAL READING

Baye, M., & Morgan, J. (2001). Information Gatekeepers on the Internet and the Competitiveness of Homogeneous Product Markets. *The American Economic Review*, *91*(3), 454–474.

Baye, M., Morgan, J., & Scholten, P. (2004a). Persistent Price Dispersion in Online Markets. In D. W. Jansen (Ed.), *The New Economy*. Chicago IL: The University of Chicago Press.

Baye, M., Morgan, J., & Scholten, P. (2004b). (forthcoming). Price Dispersion in the Small and in the Large: Evidence from an Internet Price Comparison Site. *The Journal of Industrial Economics*.

Baylis, K., & Perloff, J. M. (2002). Price Dispersion on the Internet: Good Firms and Bad Firms. *Review of Industrial Organization*, *21*, 305–324. doi:10.1023/A:1020415304514

O'Connor, P. (2003, February). On-line Pricing: An Analysis of Hotel-company Practices. *The Cornell Hotel and Restaurant Administration Quarterly*, 89–96.

Pan, X., Ratchford, B. T., & Shankar, V. (2002). Can Price Dispersion in Online Markets Be Explained by Differences in E-Tailer Service Quality? *Journal of the Academy of Marketing Science*, *30*(4), 433–445. doi:10.1177/009207002236915

## KEY TERMS AND DEFINITIONS

**Australia Market:** Online exchanges of goods by the Australian online retailers with customers for money in terms of Australian dollars.

**Mainland China Market:** Online exchanges of goods by the Mainland China online retailers with customers for money in terms of RMB Yuan.

**Online Pricing Dynamics:** Price movements of online retailers for the same goods

**Online Pricing:** Retailers set prices online.

**Online Retailing:** Retailers sell goods online.

**Price Dispersion:** Price differences of online retailers for the same goods selling online.

**South Korea Market:** Online exchanges of goods by the South Korea online retailers with customers for money in terms of Won.

**Taiwan Market:** Online exchanges of goods by the Taiwan online retailers with customers for money in terms of NTW Yuan.

**US Market:** Online exchanges of goods by the US online retailers with customers for money in terms of US dollars.

## ENDNOTES

1 Ho, who was a student of Tang, now works for JP Morgan Chase Bank (Singapore).

2 They also found that the difference in per item shipping costs by either type of these online retailers is not significant in any statistical sense, on average. That is, any consumer who shops randomly among these retailers with a random basket of purchase would find out that the per-item shipping cost difference she would pay is in fact negligible.

# Chapter 6
# The Electronic Law of One Price (eLOP)

**Camillo Lento**
*Lakehead University, Canada*

**Alexander Serenko**
*Lakehead University, Canada*

**Nikola Gradojevic**
*Lakehead University, Canada*

**Lorne Booker**
*McMaster University, Canada*

**Sert Yol**
*Kwantlen Polytechnic University, Canada*

## ABSTRACT

*The recent growth in the breadth of products sold in electronic commerce markets has created fertile grounds to investigate the Electronic Law of One Price (eLOP). Violations of this law are now more puzzling because many of the traditional frictions should no longer be relevant. This empirical study tests the eLOP by utilizing two datasets with online price data. Pairwise comparison tests reveal that the eLOP does not hold true for any of the product price categories tested.*

## INTRODUCTION

The Law of One Price (LOP) states that homogenous goods should sell for the same price in distinct markets. As such, the price of a commodity-like product in different countries should be identical after adjusting for the exchange rate. A significant amount of research has been conducted on the LOP (Office, 1976; Froot and Rogoff, 1996). The research on the LOP is inconclusive since some scholars have found support for the theory (Baldwin and Yan, 2004) while others have not (Asplund and Friberg, 2001; Crucini and Shintani, 2008).

The rise of international electronic commerce ("e-commerce") has created novel possibilities for investigating the LOP. Internet search engines and shopping bots allow consumers to easily locate accurate and timely information about products

DOI: 10.4018/978-1-61520-611-7.ch006

and prices. Retailers can use these techniques to keep informed about their competitors. E-tailing websites allow online sellers to change their prices very rapidly. Theoretically, the e-commerce environment is relatively close to the state of perfect competition. In fact, most products bought online may be quickly delivered to the customers regardless of their geographical location. Therefore, it may be assumed that, after adjusting for the exchange rate, prices of online products should be the same in different countries, as stated in the LOP.

Overall, the LOP has been the subject of extensive interest in brick-and-mortar markets. However, the LOP has not been formally defined and tested in the e-commerce environment. The purpose of this paper is to bridge this gap and test the LOP in the e-commerce sector. In the e-commerce environment, the LOP is referred to as the Electronic Law of One Price (eLOP).

## BACKGROUND

This section first explores the origins of the LOP, as it evolved in brick-and-mortar markets, and then uses the original concepts and principles to develop the eLOP.

### Origins of the Law of One Price

The LOP was first explored by the scholars of the Salamanca school in sixteenth century in Spain. In a departure from their theological roots, they applied natural philosophy to the economic problems of their inflation ridden era. Each nation experienced different rates of inflation which made it difficult to determine how to value foreign goods and currencies. The Napoleonic Wars triggered another phase of inflation which caused the LOP to be invoked, albeit ambiguously (Balassa, 1964). David Hume explored the effect of inflation on prices, and David Ricardo developed theories about the comparative advantage and the effect of production costs on prices. Together, they clarified the core elements of the LOP.

During the $20^{th}$ Century, the LOP came to prominence. Prior to the World War I, governments converted their currencies to gold at a fixed rate (Flandreau et. al. 1998). Since gold had a defined common value, the exchange rates were set by the value of gold. During the war, the gold standard was abandoned. Each nation experienced different rates of inflation (Cassel, 1916). After the war, the question of how to set exchange rates became a problem. Swedish economist Gustav Cassel wrote a number of articles in which he advocated the use of the LOP for setting exchange rates (Cassel, 1922). Readers are encouraged to review McKinnon (1979) for addition information on the origins of the LOP.

The LOP states that identical products should sell for the same price in different markets after adjusting for exchange rates. In other words, the same goods should have one price. The LOP can be expressed by the following equation:

$$P_i = EP^*_i \qquad (1)$$

where, $P_i$ is the domestic-currency price of good $i$; $P^*_i$ is the foreign-currency price of good $i$; and $E$ is the exchange rate between the two currencies (Rogoff, 1996). As such, under perfect market conditions (i.e., no market frictions, such as transaction costs or taxes, and the availability of perfect information), the price of the same product should be identical regardless of point of sale.

The LOP has become the focus of substantial controversy and the subject of a growing body of literature (Froot and Rogoff, 1996). Most studies in traditional markets have rejected the LOP (Ceglowski, 1994; Fuez, et al. 2008). The volatility and persistence of the deviations from the LOP is one of the most conspicuous empirical regularities in international finance (Froot, Kim and Rogoff, 2001). There are many factors that may partially explain these deviations. For example, distance between cities accounts for a significant amount of the variation in prices between pairs of cities (Engel and Rogers, 2001).

## Developing the eLaw of One Price

Spatial arbitrage is widely accepted as a mechanism that enforced the LOP. Spatial arbitrage requires the simultaneous purchase and sale of commodities in two distinct markets. The arbitrageur takes advantage of price differentials to obtain nearly risk-free profit. However, market frictions (e.g., taxes, transaction and transportation costs, and imperfect information) increase the size of the price differential that must exist before a profit opportunity emerges.

Despite the dot com crash in the beginning of the century, e-commerce has been growing at an average rate of 15% per year (Scheleur, King and Shimberg, 2006) in the United States. In Canada, online sales were $26.5 billion (CAD) in 2004, representing 25% of retail sales volume (Uhrback, 2005). This trend towards selling products in e-commerce markets has created new grounds to develop our understanding of the LOP. It has created an opportunity to test the LOP in a setting where many of frictions of traditional markets are not as significant. The rationale is that e-commerce markets better resemble perfect competition conditions, with a high level of intra-industry competition and customer purchasing power. Electronic commerce should make markets globally integrated and more competitive (Bakos, 2001). Following this line of reasoning, the LOP should hold true in the 'perfect' e-commerce world.

It is important to further highlight the attributes that should make e-commerce markets perfect, frictionless, and efficient (Kuttner, 1998). First, Internet technologies may reduce the time and effort required to learn about product features and prices (Bakos, 1997). Inefficiencies due to inadequate information should not exist. Second, brand loyalty should become less important. Since distance is not a factor in the Internet, consumers should be indifferent about the location of sellers. Third, economic rents should not exist, increased competition should drive prices down, and price dispersion should be limited. Therefore, the LOP, regardless of how it behaves in traditional markets, is expected to hold true in the e-commerce markets. This leads to the notion of the Electronic Law of One Price (eLOP).

## Empirical Evidence from E-Commerce Markets

The eLOP has not been formally defined and tested in any past study. However, indirect evidence can be inferred from projects that investigated price dispersion. Initially, it was found that significant price dispersions existed in e-commerce markets. Price dispersion was found to remain significant after correcting for differences in service offerings (Pan, Ratchford, and Shankar, 2002). In some cases, price dispersion was as high as 47%, much greater than retail price dispersion (Brynjolfsson and Smith, 2000). Price dispersion appears to vary systematically with the number of firms competing in the market (Baye, Morgan, and Scholten, 2004). Electronic markets exhibit greater volatility than traditional markets (Bailey, 1998a; Bailey, 1998b), but their price dispersion is smaller (Brynjolfsson and Smith, 2000).

The LOP was tested for retail bank interest rates (Martin-Oliver et al., 2007). Interest rates appear to adjust rapidly to external changes. This is consistent with the relative version of the LOP; however, the results do not support the absolute version of the LOP. The LOP may not hold for interest rates amongst retail bankers because of differences across credit risks and loan products.

Online competition is stronger for common products and lower for less common ones (Clay, Krishnan, and Wolff, 2001). However, some large online retailers seem to act cooperatively (Smith, 2001), thereby reducing competition. For example, the market for books is dominated by a few large e-tailers who set similar prices (Brynjolfsson and Smith, 2000). That behavior may potentially affect the eLOP.

In addition, there is evidence to argue that low search costs provided by the Internet are being under-utilized. The online retailer with the lowest price does not always enjoy the highest sales (Brynjolfsson and Smith, 2000). This suggests that consumers are not using price comparison facilities offered by the Internet very effectively (Clay, Krishnan, and Wolff, 2001). Search costs are largely a function of a consumer's mental awareness of online retailers (Smith, 2001). It takes time for people to learn to use the Internet, shopping sites, search engines, and shopping bots. As a result, some online vendors may successfully charge higher prices.

The literature reveals two key points. First, no studies have formally tested the LOP in e-commerce markets (i.e., the eLOP). Only a handful explicitly mention the LOP in regards to the Internet (e.g., see Baye, Morgan, and Scholten, 2004). Secondly, the literature is not consistent on the LOP, or price dispersion, in e-commerce markets. Some investigations proposed that the Internet may be evolving towards a more perfect market (Baye, Morgan, and Scholten, 2004), while other studies suggest that price discrepancies may potentially exist. Therefore, the following research question is proposed:

*Does the Law of One Price, referred to as the Electronic Law of One Price (eLOP), hold true with respect to the electronic commerce markets?*

## THE ELECTRONIC LAW OF ONE PRICE

Pairwise price comparison of identical products was conducted with two distinct datasets to answer the research question. The first dataset contains prices from various retailers in the e-commerce marketplace, and the second focuses solely on Amazon. The null hypothesis of the pairwise comparison test is that the average difference between the international prices is zero. A paired test is used to compare the values of the same variable collected from two different sources, or at two different points in time. In the present project, it was suitable since the prices of the same products were obtained from different locations. It was also assumed that the data follow normal distribution.

### E-Commerce Marketplace

The first test is on prices from e-commerce companies that have international divisions in Canada, the U.S. and the U.K. This makes it possible to compare the price of identical products in different countries. Canada, the U.S. and the U.K. were selected because they are major trading partners and use the English language. Using e-commerce companies that have international divisions eliminates any price dispersion resulting from differing levels of search costs, switching costs, risks and value/service offering.

Exchange rates were obtained from the Bank of Canada[1] and the Federal Reserve Bank of America[2]. To minimize any potential distortions, which result from the fact that exchange rates are volatile in the short-term while the commodity prices are sticky, the average of daily average exchange rates was used for a three-month-period during the study.

Shipping costs vary considerably based on delivery time and the number of items shipped. The shipping costs used for this dataset were based on the three-to-five business day delivery option; one item shipped per package. Shipping costs may also vary from city to city within a country. To avoid this potential discrepancy, shipping costs were calculated by arbitrarily assuming the shopper is located in the country's capital. Tax rates are sensitive to the item price and destination. The tax rates were also calculated assuming that each item is being delivered to the nation's capital. The following products were selected: DVDs, CDs, books, software and textbooks. First, they are frequently sold over the Internet, making them a good representative of all online sales. Second, they are commodity-type products. As such, buyers do not have to physically view the item before making a purchasing decision. Third, these items may be easily identified by using ISBN and ASIN codes. Only new items were considered (i.e., even though Amazon offers used products, those were excluded in the present project).

The results of the paired-sample t-tests, such as mean difference, t-statistic and significance levels (2-tailed), are presented in Table 1. Friberg, Ganslandt, and Sandstrom (2001) consider the possibility of shipping costs as being a fee for the service of having a product shipped directly to a customer's home, rather than having to visit a conventional store. They also argue that including shipping costs into a price analysis requires very detailed information regarding opportunity costs of shopping in a conventional store as opposed to online. In the absence of such data, they presented their analysis for two price sets (with and without transaction costs). With respect to this study, the same approach is followed, and three price sets are presented: (1) item prices alone, (2) item prices plus shipping charges, and (3) item prices plus shipping charges and taxes.

Based on a 5 percent significance level, violations to the eLOP are evident in 44 of the 54 pairwise comparison tests. Of the 10 product price sets where the eLOP held, 7 are between Canada and the U.K. After adjusting for the exchange rate, the average price difference between Canada and the U.K. is zero for Amazon books and DVDs (standalone prices), Wiley textbooks (standalone and shipping costs) and for all three Pearson textbook prices.

The average standalone international price difference is zero for Amazon CDs between Canada and the U.S. After adjusting for shipping cost and taxes, the average international price difference is also zero for Amazon DVDs and Wiley textbooks between the U.S. and the U.K.

The data also reveals that prices in the U.S. are lower than those in Canada and the U.K. for 34 of the 36 product pricing categories. Furthermore, aside from DVDs, the Canadian Amazon price levels are lower than those in the U.K.

## Amazon Marketplace

The second test deals specifically with items sold through Amazon in Canada and the U.S. Amazon was chosen because it is an e-commerce leader generating a large amount of all online sales in North America. For example, half of all online book sales in the U.S. come from Amazon. One the one hand, it is acknowledged that there are other market players in North America; on the other, it is believed that Amazon accurately represents the North American online market with respect to the products selected in this investigation due to the magnitude of this seller. Seven categories of products were selected: books, DVDs, XBOX games, PS2 games, CDs, PC games, and GameBoy Advance games.

For each of the selected type of products, a list of 100 items was constructed. Books were chosen based on the New York Times Bestseller list, the Man Booker Prize Longlist, and the Amazon.com editor's picks. The items from the remaining categories were selected randomly from the best sellers list. Data was collected at two particular points in time one month apart. The same product list was utilized in each month's data collection. Product price and shipping cost for each item were recorded simultaneously at Amazon.com and Amazon.ca. Overall, 1,400 unique price data points were recorded.

The same exchange rate and shipping cost methodology applied to the first test was applied to the Amazon test. Table 2 reports the mean price differences and corresponding p-values of the test statistic for the Amazon dataset. Violations of the eLOP for all product categories are evident.

*Table 1. Pairwise comparison tests (mean = mean price difference)*

| | Prices | Prices w/ Shipping | Prices w/ Shipping and Taxes |
|---|---|---|---|
| | Mean/t-stat/(sig.) | Mean/t-stat/(sig.) | Mean/t-stat/(sig.) |
| ***Amazon DVDs*** | | | |
| Can-US | 4.90/7.49/(.000) | 6.21/9.84/(.000) | 6.45/9.22/(.000) |
| Can-UK | 1.92/1.35/(.186) | 3.52/2.47/(.019) | 5.68/3.90/(.000) |
| US-UK | -2.99/-2.43/(.021) | -2.70/-2.19/(.035) | -0.78/-0.63/(.535) |
| ***Amazon CDs*** | | | |
| Can-US | -1.21/-0.21/(.833) | 1.19/2.08/(.045) | 2.82/4.29/(.000) |
| Can-UK | -6.80/-11.50/(.000) | -5.21/-8.80/(.000) | -6.65/-9.68/(.000) |
| US-UK | -6.69/-11.69/(.000) | -6.40/-11.19/(.000) | -9.47/-14.14/(.000) |
| ***Amazon Books*** | | | |
| Can-US | 3.03/4.91/(.000) | 4.07/6.58/(.000) | 6.24/8.78/(.000) |
| Can-UK | -2.04/-1.88/(.069) | -2.48/-2.28/(.029) | -3.56/-2.78/(.009) |
| US-UK | -5.08/-4.07/(.000) | -6.55/-5.25/(.000) | -9.80/-6.68/(.000) |
| ***Amazon Software*** | | | |
| Can-US | 26.85/3.81/(.001) | 25.49/3.62/(.001) | 36.99/3.99/(.000) |
| Can-UK | -35.45/-2.53/(.016) | -35.64/-2.56/(.015) | -45.18/-2.66/(.012) |
| US-UK | -62.30/-3.58/(.001) | -61.14/-3.51/(.001) | -82.16/-3.60/(.001) |
| ***Pearson Textbooks*** | | | |
| Can-US | 18.99/6.98/(.000) | 23.99/8.82/(.000) | 25.19/8.69/(.000) |
| Can-UK | -2.11/-0.52/(.606) | 2.89/0.72/(.480) | 8.75/2.00/(.055) |
| US-UK | 21.09/-6.72/(.000) | -21.10/-6.72/(.000) | -16.44/-4.91/(.000) |
| ***Wiley Textbooks*** | | | |
| Can-US | 8.98/6.35/(.000) | 8.98/6.35/(.000) | 8.51/5.98/(.000) |
| Can-UK | -0.89/-0.34/(.733) | 0.41/0.16/(.876) | 10.73/3.69/(.001) |
| US-UK | -9.88/-4.04/(.000) | -8.58/-3.51/(.001) | 2.23/0.99/(.329) |

The mean price differentials reveal that the prices in the U.S. are consistently lower than those in Canada. In Month 1, the smallest average price differences were found for CDs ($1.60), while the largest discrepancies were found between prices of PC Games in Canada and the U.S. ($7.14). However, in

Month 2, while the price differences are still the smallest for CDs ($1.72), the largest price differences are observed for XBOX Games ($7.21).

## CONCLUSION

This study's research questions asked whether the LOP holds true with respect to the North American e-commerce market, referred to as eLOP. For this,

*Table 2. Paired t-test between the average prices for Canada and the U.S.*

| | **Prices Mean diff./ p-value** | **Prices with Shipping Mean diff./ p-value** |
|---|---|---|
| **Month 1** | | |
| Books (n = 100) | 3.7768/ 0.0000 | 5.1234 / 0.0000 |
| DVDs (n = 100) | 4.3982 / 0.0000 | 5.7941 / 0.0000 |
| XBOX Games (n = 100) | 6.3377 / 0.0000 | 6.3665 / 0.0000 |
| PS2 Games (n = 100) | 6.1269 / 0.0000 | 5.9385 / 0.0000 |
| CDs (n = 100) | 1.6028 / 0.0000 | 3.1276 / 0.0000 |
| PC Games (n = 100) | 7.1351 / 0.0000 | 6.7866 / 0.0000 |
| GB Advance (n = 100) | 5.5090 / 0.0000 | 5.9596 / 0.0000 |

pertinent literature was reviewed and two empirical studies were conducted. The results reveal the eLOP does not hold true.

The results from both the e-commerce marketplace and Amazon datasets reveal violations to the eLOP. For example, Pearson was selling a new book entitled "Complete Internet & WWW Programming Training" for approximately $90 (CAD) more in Canada than in the U.S. after adjusting for the exchange rate and shipping costs. The $90 savings would more than offset the intangible costs in terms of shipping time lost.

One may also be inclined to suggest that the results may be partially explained by a combination of the rapidly appreciating Canadian Dollar relative to that of the U.S. and menu costs. Menu costs refer to costs of changing prices. Although menu costs are not a very important factor to e-commerce companies (Bailey, 1998a), the fact that the Canadian Dollar has been rapidly appreciating during the time period investigated makes the price of goods in the U.S. less expensive for Canadian shoppers. However, Brynjolfsson and Smith (2002) revealed that Internet retailers regularly made prices changes of $0.01 - $0.05. Therefore, Amazon would likely change the prices of its products in conjunction with the exchange rate to earn a desired profit level in the U.S. Dollars.

A more likely explanation of the results may be related to the two assumptions discussed earlier in the paper. The eLOP assumes that both brand loyalty and economic rents do not exist in the e-commerce market. These results may demonstrate that these two critical assumptions regarding online markets may not hold true. This conclusion is consistent with some other studies. For example, Rindova and Kotha (1999) describe the brand development strategy that is used by Amazon. In addition, Chakrabarti and Scholnick (2002) suggest that economic rents do exist, explaining that shipping cost differentials between Chapters.ca and Amazon.com act as a form of economic rent.

Another explanation of the findings is the optimal price setting strategies and the behavior of multinational businesses. Various pricing factors that have been identified in offline markets could lead to violations of the eLOP. These factors include the market share levels, competitor strategic actions, and distribution channels.

Furthermore, the types of products sold by e-tailers, such as Amazon, are not always conducive to the possibility of spatial arbitrage. For example, if there is a price variation of two dollars between a book sold by Amazon.ca and Amazon.com, it is unlikely that any individual would be able to purchase enough of these books to take advantage of the price differential and create pricing pressure to bring the prices back into the state of equilibrium. This can be said for virtually all of pricing categories tested.

## FUTURE RESEARCH DIRECTIONS

To the best of our knowledge, this is the first attempt to discuss and empirically investigate the Electronic Law of One Price. We hope that future scholars will continue this line of inquiry to shed some light on online pricing phenomena. These empirical results can be furthered in various ways, most significantly by testing the eLOP with a more sophisticated statistical technique on a panel data set for various e-tailers. Short-term deviations from the eLOP can also be eliminated by utilizing longitudinal data sets.

Future research may also focus on incorporating the soft costs to Internet customers shopping across international divisions of an e-tailer. The possibility of shipping delays, hold-ups for inspection at the borders, and uncertainty regarding receipt are all additional soft costs of purchasing from an international division. Because shoppers who require the product in a short time period may not wish to incur these, and other soft costs, a more robust model may be developed to incorporate these factors into the analysis.

## REFERENCES & ADDITIONAL READING

Asplund, M., & Friberg, R. (2001). The law of one price in Scandinavian duty-free stores. *The American Economic Review*, *91*(4), 1072–1083.

Bailey, J. P. (1998a). Intermediation and electronic markets: aggregation and pricing in internet commerce. In *Department of Electrical Engineering and Computer Science* (pp. 180). Cambridge, MA: Massachusetts Institute of Technology.

Bailey, J. P. (1998b). Electronic commerce: prices and consumer issues for three products: books, compact discs, and software. *Organisation for Economic Co-Operation and Development, OCDE/GD*, 98(4).

Bakos, J. Y. (1997). Reducing buyer search costs: implications for electronic marketplaces. *Management Science*, *43*(12), 1676–1692. doi:10.1287/mnsc.43.12.1676

Bakos, J. Y. (2001). The emerging landscape for retail E-commerce. *The Journal of Economic Perspectives*, *15*(1), 69–80.

Balassa, B. (1964). The purchasing-power parity doctrine: a reappraisal. *The Journal of Political Economy*, *72*(6), 584–596. doi:10.1086/258965

Baldwin, J. R., & Yan, B. L. (2004). The law of one price: A Canada/US exploration. *Review of Income and Wealth*, *1*, 1–10. doi:10.1111/j.0034-6586.2004.00108.x

Baye, M. R., Morgan, J., & Scholten, P. (2004). Price dispersion in the small and in the large: evidence from an internet price comparison site. *The Journal of Industrial Economics*, *52*(4), 463–496. doi:10.1111/j.0022-1821.2004.00236.x

Brynjolfsson, E., & Smith, M. D. (2000). Frictionless commerce? A comparison of Internet and conventional retailers. *Management Science*, *46*(4), 563–585. doi:10.1287/mnsc.46.4.563.12061

Cassel, G. (1916). The present situation with the foreign exchanges. *The Economic Journal*, *26*(103), 319–323. doi:10.2307/2221918

Cassel, G. (1922). *Money and Foreign Exchange after 1924*. London: Constable.

Ceglowski, J. (1994). The law of one price revisited: new evidence on the behavior of international prices. *Economic Inquiry*, *32*(3), 407–418. doi:10.1111/j.1465-7295.1994.tb01339.x

Chakrabarti, R., & Scholnick, B. (2002). International price competition on the Internet: A clinical study of the on-line book industry. In *International Business, Adjusting to New Challenges and Opportunities*. Basingstoke, UK: Palgrave/UK Chapter, Academy of International Business.

Clay, K., Krishnan, R., & Wolff, E. (2001). Prices and price dispersions on the web: evidence from the on-line book industry. *The Journal of Industrial Economics*, *49*(4), 521–539.

Crucini, M., & Shintani, M. (2008). Persistence in law of one price deviations: Evidence from micro-data. *Journal of Monetary Economics*, *55*(3), 629–644. doi:10.1016/j.jmoneco.2007.12.010

Engel, C., & Rogers, J. (2001). Violating the law of one price: should we make a federal case out of it? *Journal of Money, Credit, and Banking*, *33*(1), 1–15. doi:10.2307/2673869

Feuz, D., Harris, C., Bailey, D., & Halverson, G. (2008). Transportation and Quality Adjusted Basis: Does the Law of One Price Hold for Feeder Cattle? *Journal of Agriculture and Resource Economics*, *33*(3), 498–498.

Flandreau, M., Le Cacheux, J., Zumer, F., Dornbusch, R., & Honohan, P. (1998). Stability without a pact? Lessons from the European gold standard, 1880-1914. *Economic Policy*, *13*(26), 115–162. doi:10.1111/1468-0327.00030

Friberg, R., Ganslandt, M., & Sandstrom, M. (2001). Pricing strategies in E-commerce: bricks and clicks. *The Research Institute of Industrial Economics* (Working Paper No. 559).

Froot, K., Kim, M., & Rogoff, K. K. (2001). *The law of one price over 700 years*. Revised NBER Working Paper, No. 5132.

Froot, K. A., & Rogoff, K. (1996). Perspectives on PPP and long-run real exchange rates. *Handbook of International Economics*, 3.

Kuttner, R. (1998, May 11). The net: A market too perfect for profits. *Business Week*, 20.

Martin-Oliver, A., Salas-Fumas, V., & Saurina, J. (2007). A Test of the Law of One Price in Retail Banking. *Journal of Money Credit and Banking*, *39*(8), 2021–2040. doi:10.1111/j.1538-4616.2007.00096.x

McKinnon, R. I. (1979). *Money in International Exchange: The Convertible Currency System.* Cambridge, UK: Cambridge University Press.

Office, L.H. (1976). *The purchasing power parity puzzle theory of exchange rates: A review article*. IMF Staff Papers, No. 23.

Pan, X., Ratchford, B. T., & Shankar, V. (2002). Can price dispersion in online markets be explained by differences in e-tailer service quality? *Journal of the Academy of Marketing Science*, *30*(4), 433–445. doi:10.1177/009207002236915

Rindova, V., & Kotha, S. (1999). *Building reputation on the Internet: lessons from Amazon.com and its competitors.* Working paper, University of Washington (pp. 1-45).

Rogoff, K. (1996). The purchasing power parity puzzle. *Journal of Economic Literature*, *34*(2), 647–668.

Scheleur, S., King, C., & Shimberg, M. (2006). *Quarterly retail E-commerce sales: 4th quarter 2005* (pp. 3). Washington, DC: US Census Bureau.

Smith, M. D. (2001). *The law of one price: the impact of IT enabled markets on consumer search and retail pricing*. Pittsburg, PA: Carnegie Mellon University.

Uhrbach, M. (2005). Analysis in brief: how business-to-business sales dominate E-commerce. *Statistics Canada* 11-621-MIE2005033.

## KEY TERMS AND DEFINITIONS

**E-Commerce Markets:** The Business-to-Consumer (B2C) online retailer market

**Electronic Law of One Price (eLOP):** all identical goods sold in e-commerce markets must have only one price in an efficient market.

**Law of One Price:** all identical goods must have only one price in an efficient market.

**Price Dispersion:** Differences in the price of a good across sellers, holding the good's characteristics fixed.

## ENDNOTES

1 http://www.bankofcanada.ca/en/

2 http://www.federalreserve.gov/

# Chapter 7

# Trust in Electronic Commerce:
## Definitions, Sources, and Effects

**Hongwei Du**
*California State University East Bay, USA*

**Albert Lederer**
*University of Kentucky, USA*

**Jiming Wu**
*California State University East Bay, USA*

## INTRODUCTION

In the past two decades, electronic commerce has been growing rapidly due to the increasing popularization of personal computers, expanding penetration of broadband, and continuing development of the Internet and World Wide Web. According to *eMarketer* (2009), an e-business and online market research company, the total U.S. e-commerce sales (excluding travel) will grow from $127.7 billion in 2007 to $182.5 billion in 2010. The firm also estimates that the number of online shoppers in U.S. will increase from 131.1 million—nearly four-fifths of Internet users—by the year 2007, to 148.7 million by the year 2010. The growth of e-commerce relies not only on the great convenience of conducting transactions over the Internet but also on consumers' willingness to trust an online merchant. This view is consistent with that advanced by Holsapple and Wu (2008): non-face-to-face, Internet-based transactions require an element of trust; in other words, trust is a foundation of e-commerce.

In general, trust is of great importance in the e-commerce context for the following reasons. First, consumers need to provide personal information for online transaction registration. Such personal information is subject to potential abuse; for example, the data might be used for marketing solicitations or shared with third parties. Thus, consumers worry about the misuse of personal information. Second, consumers usually need to provide bank account or credit card information to pay for online purchases. Therefore, they have concerns about bank account or credit card fraud. Third, online consumers are

DOI: 10.4018/978-1-61520-611-7.ch007

likely to worry about product quality because they are not able to actually see and touch the products. Finally, online vendors often promise a delivery time and a full refund or replacement of the products returned. Hence, consumers may have concerns about promise-keeping. In short, all these worries and concerns call for trust in the online shopping context. Thus, understanding the concept of trust and the ways to foster the formation of it is critical for both e-commerce researchers and practitioners.

As a subject of research and practice, trust—while considered by many as a simple concept—is actually complex. That is, on the one hand, trust has different definitions in different disciplines. For example, philosopher Annette Baier (1986) argues that trust includes a perception of others' trustworthiness and defines it as a kind of psychological state. However, in the discipline of sociology, trust is viewed as a driver of social efficiency and is defined as a belief (Kracher et al., 2005). On the other hand, trust can be of various kinds: knowledge-based, process-based, institution-based, and so forth. Different kinds of trust are usually based on different relationships and developed in different interaction stages (Holsapple and Wu 2007). In light of this complexity, we think that the concept of trust deserves more scholarly 'respect' and requires more discussion of its definitions and sources.

## DEFINITIONS OF TRUST

As an important research topic, trust has been studied in a variety of fields, including philosophy, psychology, sociology, economics, management, communications, marketing, and information systems (IS). While researchers agree that trust is essential for many human activities, they usually investigate it from their own disciplinary perspectives and in their own theoretical contexts. Therefore, researchers in different disciplines define trust differently.

Focusing on understanding the meaning and kinds of trust, philosophers have studied trust at personal, organizational, and social levels. Although trust can be regarded as either a moral concept or not, in the field of philosophy it has been distinguished from other concepts such as confidence, reliance, agreement, and cooperation (Soloman & Flores, 2001). Baier (1986) argues that interpersonal trust requires good grounds for one's confidence in another's good will, or at least the absence of grounds for expecting another's ill will. She conceptualizes trust as a three-way predicate among the trustor, the trustee, and the object that is entrusted. Based on this conceptualization, she views trust as to let trustees take care of something that the trustor cares about, while the trustor accepts vulnerability to the trustees' possible but not expected ill will (or lack of good will) toward him/her. This view indicates that trust can be seen as a kind of psychological state.

In general, psychologists agree that trust is an important concept and very difficult to define. This is because it has multiple dimensions, varies from context to context, and applies to many types of relationships (Kracher et al., 2005). Unlike that in philosophy, the work in psychology on trust is simplistic and fragmented, and sometimes confuses it with other concepts such as faith, confidence, cooperation, competence, and benevolence (Lewicki & Bunker, 1996). Although there is no one definition of trust that every psychologist agrees upon, many employ the one by Rotter (1971); that is, trust is an expectancy held by individuals or groups that the word, promise, or verbal/written statement of another can be relied on. This definition focuses on verbal and written elements and emphasizes the role of communication in trust.

Sociologists study trust in the context of social relationships and assert that it plays a key role in modern society. They also claim that trust is a complex concept and difficult to define, because it can be viewed from a wide range of social angles and through many different cultural apertures. Like psychologists, sociologists are likely to confuse trust with other concepts (i.e., faith, confidence, cooperation, competence, and benevolence) due to its complexity. Regarding it as social capital, some sociologists suggest that trust can improve efficiency of society by facilitating coordination and collaboration (Misztal, 1996). Others implicitly define trust as cooperation and have investigated how trust emerges between strangers (Macy & Skvoretz, 1998). In sociological research, trust mostly refers to a trustor's belief that the results of the trustees' actions will be appropriate from his or her point of view and that the trustees have the freedom to disappoint him/her (Kracher et al., 2005). An underlying assumption in this definition is that the belief must be in the context of a situation over which the trustees have control. Thus, this definition highlights the elements of belief, control, and a situational context.

In the field of economics, trust is viewed as a form of implicit contracting whereby one can rely on another for economic activities as expected (Arrow, 1974). This view indicates that the researchers focus on the trust at an interpersonal level. Economists examine gender difference in trusting behavior and find that women tend to trust less and be more sensitive to context. More importantly, they argue that trust plays a vital role in economic systems because it is essential to the process of exchange (Arrow, 1972). They also argue that trust may facilitate economic growth, for the reason that it can reduce transaction costs and solve collective action problems (Roth, 2009). This is in line with the notion that the development and use of trust in words and promises can be a very important ingredient of market success (Sen, 1999). Based on these arguments and notions, economists maintain that a country's well-being and ability to compete depend on the level of trust inherent in its society.

Management researchers focus their attention on interpersonal and organizational trust and assume that both individuals and organizations can be trusted. Striving for business success, they are especially interested in trust toward various stakeholders, inter-organizational trust, and trust in professional relationships (Kracher et al., 2005). In an investigation of trust in work relationships, Lewicki and Bunker (1996) argue that in a business context, trust does not begin with the development of intense emotionality but with the processes of information exchange and evaluation. A widely used definition in management field is given by Barney and Hansen (1994); they define trust as "the mutual confidence that no party to an exchange will exploit another's vulnerabilities" (p. 176). The focal elements of this definition are confidence, business relationship, and a future orientation.

Regarding trust as a multi-faceted term, scholars in communication assert that trust is built by consistently and reliably maintaining commitments over time (Maoz & Ellis, 2008). They contend that trust refers to the expectancy of positive (or non-negative) outcomes that one can reasonably expect based on the predictable action of another party in an interaction characterized by uncertainty (Chen et al., 2008). The communication literature suggests that trust is closely associated with three characteristics of a person or organization: ability, benevolence, and integrity. Communication scholars have investigated how communicative contact affects trust. They find that constructive discussion of each group member's ideas, thoughts, and perspectives can increase intra-group trust. They also suggest that trust is the most important emotional tie between two groups and that ineffective communication between the two can damage inter-group trust.

Because nowadays customers increasingly rely on the Internet for information and purchases, researchers in marketing are moving their attention from offline trust to online trust. However, no matter whether in an offline context or an online one, trust always plays a pivotal role in a transaction because it brings buyers and sellers together. In the marketing literature, trust is specifically viewed as consumers' willingness to accept vulnerability in a transaction due to their positive expectations for a merchant's future behaviors (Bramall et al., 2004). As an important research subject in relationship marketing, trust has been recognized as an important relationship lubricant, which evolves over time and is based on one's observation of another's honesty, reliability, and consistency. Marketing researchers generally agree that if consumers are provided with more information about an online merchant, they are likely to better predict the merchant's future behavior and hence develop a higher level of trust (Bramall et al., 2004).

Like marketing researchers, scholars in IS have studied trust primarily in the context of e-commerce. Consequently, their definition of trust is very similar to that from marketing. Specifically, they define trust as the "belief that a Web vendor will perform some activities in accordance with a consumer's confident expectation" (Holsapple & Wu, 2008, p. 48). IS researchers contend that online trust differs from offline trust because the object of online trust is a vendor's website and the Internet, i.e., the information technologies. Thus, they devote considerable research effort to identifying key website elements that are fundamental to the formation of online trust. Examples of such elements are website security and website interface design.

## SOURCES OF TRUST

Researchers have identified various sources of trust. In an integrated study, Lewicki and Bunker (1996) depict four sources of trust: deterrence, calculus, knowledge, and identification. In a separate integrated study, Zucker (1986) proposes that there are three other important sources of trust: personality, institution, and process.

Deterrence-based trust is formed under the circumstance that an individual strives to be trustworthy because the individual fears the consequence of violating others' trust. For example, a manager may have deterrence-based trust in his employees because he knows that the employees fear the consequence of violating his trust. Thus, this kind of trust is sustained through a deterrent that is clear, possible, and likely to occur if the trust is violated. In e-commerce, such deterrent often involves a merchant's reputation. Specifically, consumers may trust a merchant because they know the merchant fears the consequence of violating their trust; that is, they can hurt the merchant's reputation through their networks of relatives, friends, and coworkers.

Calculus-based trust, also known as calculative-based trust, is grounded in the rational calculation of the costs and benefits of another individual breaking and maintaining an interdependent relationship (Lewicki & Bunker, 1996). In other words, the trust is based on an economic analysis occurring in an ongoing association. If the cost outweighs the benefit of breaking the relationship or the benefit exceeds the cost of maintaining it, then trust is warranted because breaking the relationship is not in the best interest of the other party. Therefore, this trust is built on the recognition that the trusted party has nothing to gain from not being trustworthy. The underlying assumption here is that while individuals may not be necessarily good, they are rational and calculative, and act in their own best self-interest (Gefen et al., 2003). Calculus-based trust is relevant to most online transactions because being trustworthy is in the best interest of many online merchants.

Knowledge-based trust develops over time, largely as a function of repeated interactions that allow an individual to collect information about the other and develop a generalized expectation that the other's behavior is predictable (Rotter, 1971). This kind of trust involves direct knowledge about the object of trust, rather than indirect knowledge in the sense of recommendation or reputation (Holsapple & Wu, 2008). The more one knows another, the better one can trust what the other will do, because he/she can accurately predict how the other will respond in most situations. Focusing on building effective online gaming websites, Holsapple and Wu argue that knowledge-based trust is especially important for an online business environment where there are repeated transactions between fixed pairs of consumers and merchants.

Identification-based trust relies on "identification with the other's desires and intentions" to the extent that "…the parties effectively understand and appreciate the other's wants; this mutual understanding is developed to the point that each can effectively act for the other" (Lewicki & Bunker, 1996, p. 122). Such trust often develops among group members when each identifies with the goals espoused by the group. This salient group identification greatly enhances the frequency of cooperation and offers a solid basis for the formation of trust. In addition, identification-based trust usually permits an individual to serve as another's agent and substitutes for another in dealing with some issues. In e-commerce, this kind of trust often develops between online vendors having a close collaboration relationship, such as Amazon and the retailers who sell products at Amazon.com.

Personality-based trust is recognized as the general tendency to believe in others and develops as early as infancy when one seeks and receives help from his or her caretakers (Rotter, 1971). This kind of trust is based on a belief that others are typically good and reliable. Such belief is often given to others before experience can provide a more rational interpretation (Gefen et al., 2003). Therefore, personality-based trust plays a significant role in the initial stages of an online transaction. Later, as the consumers interact with the merchant, their personalities become less important because their formation of trust is more influenced by the nature of the interaction itself.

Institution-based trust has its root in one's sense of security provided by guarantees, safety nets, or other impersonal structures built into a specific context (Zucker, 1986). In other words, this kind of trust is based on the institution mechanism, which assures people that everything in the setting is as it should be and that a shared understanding of what is happening exists. Government regulation, certification, and third-party endorsement are identified as primary elements in an institution mechanism. Gefen and his colleagues (2003) suggest that institution-based trust is very important in e-commerce contexts where buyers and sellers have not interacted before and may come from different social and cultural backgrounds.

In general, process-based trust is developed in earlier stages of a relationship and is popular in pre-industrial economies. This kind of trust is grounded in past direct experience with others (e.g., gift-exchange) or in second-hand information about them (e.g., reputation and brands) (Zucker, 1986). To develop processed-based trust, a record of prior exchange, acquired secondhand or by imputation from outcomes of prior direct interactions, is usually necessary. When such a record does not exist, reputation or brand name is often used as a surrogate. Thus, an online vendor can facilitate its consumers' formation of process-based trust by reinforcing its positive reputations or promoting its brand names.

In an investigation of trust formation, Brewer (1981) proposes an additional source of trust—cognition. Cognition-based trust relies on one's first impressions or cognitive cues, as opposed to personal interactions with the other. This kind of trust sometimes involves a categorization process, whereby individuals place more trust in people similar to themselves (Gefen et al., 2003). In e-commerce, consumers' first impression of an online merchant is often through its website; they assess the merchant's trustworthiness by observing and attending to cues that are presented on the Web pages. The consumers develop cognition-based trust if they are truly impressed by such cues as the online merchant's refund/return and customer privacy policies.

## ANTECEDENTS AND EFFECTS OF TRUST

Prior e-commerce research focuses on developing conceptual models to identify the drivers and role of trust in online shopping. Applying sociological and economic theories about institution-based trust to online consumer behavior, Pavlou and Gefen (2004) propose that buyer trust in the community of online auction sellers can be established through three IT-enabled institutional mechanisms: feedback mechanisms, third-party escrow services, and credit card guarantees. The data collected from 274 buyers in Amazon's online auction marketplace confirm their predictions that these mechanisms engender trust, not only in some reputable sellers, but also in the entire community of sellers, and that such trust influences both transaction intentions and actual purchasing behavior.

In line with Pavlou and Gefen's work, Gefen and his colleagues (2003) also investigate the antecedents and effects of online trust and argue that online purchase intentions are the product of both consumer assessments of the IT itself and trust in the e-vendor. Their study on experienced repeat online shoppers shows that consumer trust is as important to e-commerce as the widely accepted technology acceptance variables, perceived usefulness and perceived ease of use. Their results also suggest that online trust can be built through (1) a belief that the vendor has nothing to gain by cheating, (2) a belief that there are safety mechanisms built into the website, and (3) a typical interface that is easy to use.

Acknowledging that trust can be grounded in knowledge about another party, Holsapple and Wu (2008) argue that knowledge-based trust is especially important for online business environments where there are repeated transactions between fixed pairs of consumers and merchants. They propose that online consumers' knowledge about website characteristics (i.e., security and interface design) and about website outputs (i.e., online game quality and service quality) increases the consumers' trust in the website. The results of 253 survey observations show that all these four classes of knowledge contribute to the formation of trust, which, in turn, helps develop effective e-commerce websites.

In summary, prior work relevant to online trust suggests: (1) safety mechanisms embedded in a website is necessary and important; (2) website design is a key driver of online trust; (3) online trust exists in various kinds and can be of different sources; and (4) online trust influences consumer behavior. In addition, the literature indicates that online trust formation is also highly related to the implementation of security technologies such as data encryption, access control, and trusted platform module (TPM), and to the foundation of organizations facilitating trust such as trust federations.

## CONCLUSION

This chapter focuses on the concept of trust in the context of e-commerce and presents its various definitions and sources. Thus, the chapter serves as a first step toward leveraging trust for further e-commerce growth. Arguing that trust deserves more scholarly 'respect,' we call for more research on its formation and on its role in e-commerce.

## REFERENCES

Arrow, K. (1974). *The limits of organization*. New York: W. W. Norton.

Baier, A. (1986). Trust and antitrust. *Ethics*, *96*(2), 231–260. doi:10.1086/292745

Barney, J. B., & Hansen, M. B. (1994). Trustworthiness as a source of competitive advantage. *Strategic Management Journal*, *15*(3), 175–190. doi:10.1002/smj.4250150912

Bramall, C., Schoefer, K., & McKechnie, S. (2004). The determinants and consequences of consumer trust in e-retailing: A conceptual framework. *Irish Marketing Review*, *17*(1/2), 13–22.

Brewer, M. B. (1981). Ethnocentrism and its role in interpersonal trust. In M. B. Brewer, B. E. Collins, & D. T. Campbell (Eds.), *Scientific Inquiry and the Social Sciences* (pp. 345-360). San Francisco: Jossey-Bass.

Chen, J. V., Ross, W., & Huang, S. F. (2008). Privacy, trust, and justice considerations for location-based mobile telecommunication services. *Info*, *10*(4), 30–45. doi:10.1108/14636690810887526

eMarketer. (2008). *June 2008: US retail e-commerce*. Retrieved from http://www.iab.net/insights_ research/530422/1675/334589

Gefen, D., Karahanna, E., & Straub, D. W. (2003). Trust and TAM in online shopping: An integrated model. *MIS Quarterly*, *27*(1), 51–90.

Holsapple, C. W., & Wu, J. (2008). Building effective online game websites with knowledge-based trust. *Information Systems Frontiers*, *10*(1), 47–60. doi:10.1007/s10796-007-9060-5

Kracher, B., Corritore, C. L., & Wiedenbeck, S. (2005). A foundation for understanding online trust in electronic commerce. *Journal of Information . Communication and Ethics in Society*, *3*(3), 131–141.

Lewicki, R. J., & Bunker, B. B. (1996). Developing and maintaining trust in work relationships. In R. M. Kramer & T. R. Tyler (Eds.), *Trust in organizations: frontiers of theory and research* (pp. 114-139). Thousand Oaks, CA: SAGE Publications.

Macy, M. W., & Skvoretz, J. (1998). The evolution of trust and cooperation between strangers: A computational model. *American Sociological Review*, *63*(10), 638–660. doi:10.2307/2657332

Maoz, I., & Ellis, D. G. (2008). Intergroup communication as a predictor of Jewish-Israeli agreement with integrative solutions to the Israeli-Palestinian conflict: The mediating effects of out-group trust and guilt. *The Journal of Communication*, *58*(3), 490–507. doi:10.1111/j.1460-2466.2008.00396.x

Misztal, B. A. (1996). *Trust in modern societies: the search for the bases of social order*. New York: Polity Press.

Pavlou, P. A., & Gefen, D. (2004). Building effective online marketplaces with institution-based trust. *Information Systems Research*, *15*(1), 37–59. doi:10.1287/isre.1040.0015

Roth, F. (2009). Does too much trust hamper economic growth? *Kyklos*, *62*(1), 103–128. doi:10.1111/j.1467-6435.2009.00424.x

Rotter, J. B. (1971). Generalized expectancies for interpersonal trust. *The American Psychologist*, *26*(5), 443–450. doi:10.1037/h0031464

Sen, A. K. (1999). *Development as freedom*. New York: Anchor books.

Solomon, R. C., & Flores, F. (2001). *Building trust in business, politics, relationships, and life.* New York: Oxford University Press.

Zucker, L. (1986). Production of trust: Institutional sources of economic structure, 1840-1920. In B. M. Staw & L. L. Cummings (Eds.), *Research in Organizational Behavior* (Vol. 8, pp. 53-111). Greenwich, CT: JAI Press.

## ADDITIONAL READING

Ba, S., & Pavlou, P. A. (2002). Evidence of the effect of trust in electronic markets: price premiums and buyer behavior. *MIS Quarterly*, *26*(3), 243–266. doi:10.2307/4132332

Baier, A. (1986). Trust and antitrust. *Ethics*, *96*(2), 231–260. doi:10.1086/292745

Bart, Y., Shankar, V., Sultan, F., & Urban, G. L. (2005). Are the drivers and role of online trust the same for all Web sites and consumers? A large-scale exploratory empirical study. *Journal of Marketing*, *69*(4), 133–152. doi:10.1509/jmkg.2005.69.4.133

Belanger, F., Hiller, J. S., & Smith, W. J. (2002). Trustworthiness in electronic commerce: the role of privacy, security, and site attributes. *The Journal of Strategic Information Systems*, *11*(3-4), 245–270. doi:10.1016/S0963-8687(02)00018-5

Chen, S. C., & Dhillon, G. S. (2003). Interpreting dimensions of consumer trust in e-commerce. *Information Technology and Management*, *4*(2-3), 303–318. doi:10.1023/A:1022962631249

Doney, P. M., & Cannon, J. P. (1997). An examination of the nature of trust in buyer-seller relationships. *Journal of Marketing*, *61*(2), 35–51. doi:10.2307/1251829

Fogg, B. J., Soohoo, C., Danielson, D. R., Marable, L., Stanford, J., & Tauber, E. R. (2003). How do users evaluate the credibility of Web sites? A study with over 2,500 participants. In *Proceedings of the 2003 Conference on Designing for User Experiences* (pp. 1-15).

Fung, R. K. K., & Lee, M. K. O. (1988). EC-trust: exploring the antecedent factors. In W. E. Haseman & D. I. Nazareth (Eds.), *Proceedings of the Fifth American Conference on Information Systems* (pp. 517-519).

Gefen, D. (2002). Reflections on the dimensions of trust and trustworthiness among online consumers. *The Data Base for Advances in Information Systems*, *33*(3), 38–53.

Gulati, R. (1995). Does familiarity breed trust? The implications of repeated ties for contractual choice in alliances. *Academy of Management Journal*, *38*(1), 85–112. doi:10.2307/256729

Hoffman, D. L., Novak, T. P., & Peralta, M. (1999). Building consumer trust online. *Communications of the ACM*, *42*(4), 80–85. doi:10.1145/299157.299175

Houston, R. W., & Taylor, G. K. (1999). Consumer perception of CPA WebTrust assurances: evidence of an expectation gap. *International Journal of Auditing*, *3*(2), 89–105. doi:10.1002/(SICI)1099-1123(199907)3:2<89::AID-IJA44>3.0.CO;2-5

Husted, B. W. (1998). The ethical limits of trust in business relations. *Business Ethics Quarterly*, *8*(2), 233–248. doi:10.2307/3857327

Jarvenpaa, S. L., & Tractinsky, N. (1999). Consumer trust in an Internet store: a cross-culture validation. *Journal of Computer-Mediated Communication*, *5*(2), 1–29.

Jarvenpaa, S. L., Tractinsky, N., & Vitale, M. (2000). Consumer trust in an Internet store. *Information Technology and Management*, *1*(1-2), 45–71. doi:10.1023/A:1019104520776

Keen, P. G. W. (1999). *Electronic Commerce Relationships: Trust by Design.* Englewood Cliffs, NJ: Prentice-Hall.

Kim, H. W., Xu, Y., & Koh, J. (2004). A comparison of online trust building factors between potential customers and repeat customers. *Journal of the Association for Information Systems*, *5*(10), 392–420.

Koufaris, M., & Hampton-Sosa, W. (2004). The development of initial trust in an online company by new customers. *Information & Management*, *41*(3), 377–397. doi:10.1016/j.im.2003.08.004

Lee, M. K. O., & Turban, E. (2001). A trust model for consumer Internet shopping. *International Journal of Electronic Commerce*, *6*(1), 75–91.

Lewicki, R. J., & Bunker, B. B. (1995). Trust in relationships: a model of development and decline. In B. B. Bunker & J. Z. Rubin (Eds.), *Conflict, Cooperation, and Justice: Essays Inspired by the Work of Morton Deutsch*, San Francisco, CA: Jossey-Bass Publishers

Lewicki, R. J., & Bunker, B. B. (1996). Developing and maintaining trust in work relationships. In R. M. Kramer & T. R. Tyler (Eds.), *Trust in Organizations: Frontiers of Theory and Research* (pp. 114-139). Thousand Oaks, CA: SAGE Publications.

Lewicki, R. J., & Stevenson, M. A. (1997). Trust development in negotiation: proposed actions and research agenda. *Business & Professional Ethics Journal*, *16*(1-3), 99–132.

Luhmann, N. (1979). *Trust and Power*. Chichester, UK: John Wiley & Sons.

McKnight, D. H., & Chervany, L. N. (2001). What trust means in e-commerce customer relationships. *International Journal of Electronic Commerce*, *6*(2), 35–59.

McKnight, D. H., Choudhury, V., & Kacmar, C. (2002). Developing and validating trust measures for e-commerce: an integrative typology. *Information Systems Research*, *13*(3), 334–359. doi:10.1287/isre.13.3.334.81

Pavlou, P. A. (2003). Consumer acceptance of electronic commerce: integrating trust and risk with the technology acceptance model. *International Journal of Electronic Commerce*, *7*(3), 69–103.

Rotter, J. B. (1971). Generalized expectancies for interpersonal trust. *The American Psychologist*, *26*(5), 443–450. doi:10.1037/h0031464

Sirdeshmukh, D., Singh, J., & Sabol, B. (2002). Consumer trust, value, and loyalty in relational exchanges. *Journal of Marketing*, *66*(1), 15–37. doi:10.1509/jmkg.66.1.15.18449

Wakefield, R. L., Stocks, M. H., & Wilder, W. M. (2004). The Role of Web site characteristics in initial trust formation. *Journal of Computer Information Systems*, *45*(1), 94–103.

Wingfield, N. (2002). E-commerce (a special report): cover story – a question of trust: online consumers are buying – but warily; here's how you can minimize the risk. *Wall Street Journal, 16*.

Yang, B., & Lester, D. (2004). Attitudes toward buying online. *Cyberpsychology & Behavior*, *7*(1), 85–91. doi:10.1089/109493104322820156

Zucker, L. (1986). Production of trust: institutional sources of economic structure, 1840-1920. In B. M. Staw & L. L. Cummings (Eds.), *Research in Organizational Behavior* (pp. 53-111). Greenwich, CT: JAI Press.

## KEY TERMS AND DEFINITIONS

**Calculus-Based Trust:** The trust grounded in the rational calculation of the costs and benefits of another individual breaking and maintaining an interdependent relationship.

**Cognition-Based Trust:** The trust relied on one's first impressions or cognitive cues, as opposed to personal interactions with the other.

**Deterrence-Based Trust:** The trust formed under the circumstance that individuals will do whatever they are told because they fear the consequence of not doing.

**Identification-Based Trust:** The trust relied on the identification with the other's desires and intentions, and on the appreciation of the other's needs.

**Institution-Based Trust:** The trust developed through one's sense of security provided by guarantees, safety nets, or other impersonal structures.

**Knowledge-Based Trust:** The trust developed through repeated interactions that allow an individual to collect information about the other and develop an expectation that the other's behavior is predictable.

**Personality-Based Trust:** The trust based on the general tendency to believe in others.

**Process-Based Trust:** The trust grounded in past direct experience with others or in second-hand information about them.

# Chapter 8
# Avatar Theory

**Ching-I Teng**
*Chang Gung University, Taiwan*

**Shao-Kang Lo**
*Chinese Culture University, Taiwan*

## INTRODUCTION

Online games are a popular application in electronic commerce. The number of customers playing a single online game has reached as high as 9,000,000 (Blizzard Entertainment, 2008), indicating the relevance of online games to marketers. When playing online games, customers focus on *avatars*, which represent them in the game world (Vasalou & Joinson, 2009). Recent studies have addressed the role of avatars in online game play (*i.e.*, Lo, 2008). However, few investigations have attempted to improve practitioner understanding of avatars, limiting the wider utilization of avatar design in improving customer satisfaction. This phenomenon is perhaps owing to the lack of avatar-related theories. Theoretical investigations are necessary to clarify how customers use avatars to satisfy their needs when playing online games.

This chapter thus presents Avatar Theory to outline fundamental propositions related to avatars. Avatar Theory can provide a background theory for subsequent avatar studies related to online games, demonstrating the value and potential impact of Avatar Theory within the literature on electronic commerce. Since gamers can select, play, change, discard and play multiple avatars, this chapter develops the Avatar Theory in order to understand these avatar use behavior.

DOI: 10.4018/978-1-61520-611-7.ch008

## BACKGROUND

### Understanding Online Game Customers

Online games are Internet applications that customers can play with other customers. Online games are very popular electronic businesses. A single online game can have as many as nine million customers worldwide (Blizzard Entertainment, 2008). The size of the online game market is expected to exceed $13 billion by 2011 (DFC Intelligence, 2006), demonstrating it is economically important and deserving of research attention.

Since online games are an important sector, recent studies have endeavored to understand online game customers. Knowledge of customer demographic variables is fundamental and intuitive. Griffiths, Davis, and Chappell (2003) found that most online game customers are male, and more adults than previously imagined play online games. Griffiths, Davis, and Chappell (2004) confirmed the findings of their previous study and further found that online game customers most appreciate the social aspects of online games.

Customer demographics are influential, as are customer personality traits. Personality traits are psychological sets that systematically influence individual behavioral and psychological patterns (Zimbardo & Weber, 1994). Teng (2008) may have been the first to discuss personality differences between online game customers and others. Controlling for the influences of gender and age, Teng (2008) found that online game customers reported higher scores than non-players in terms of openness (the tendency to be creative and imaginative), conscientiousness (the tendency to be efficient and systematic), and extraversion (the tendency to be talkative and assertive). Jeng and Teng (2008) further linked personality traits to customer motivations to play online games. Furthermore, Jeng and Teng (2008) found openness to be positively related to discovery and role-playing motivations, conscientiousness to be positively related to escapism motivation, and extraversion to be positively related to teamwork motivation. Jeng and Teng (2008) explained the findings of Teng (2008) using customer motivations as an explanation. Restated, the customer needs satisfied by online games are a crucial issue.

### What Customer Needs do Online Games Satisfy?

Online game literature has identified that playing online games satisfies player social needs (Lo, Wang, & Fang, 2005; Kim, Park, Moon, & Chun, 2002; Yee, 2006). In the role playing game context, Hsu and Lu (2007) indicated that perceived group cohesion brings customers positive feelings regarding certain games. Restated, customers enjoy games that make them feel affiliated to one or more groups. Jansz and Martens (2005) then identified social contact as the main reason for customers to play online games, contradicting the stereotype of game players being isolated. However, in the context of first-person shooting games, Jansz and Tanis (2007) also identified social contact as the factor that online game customers enjoy most. Earlier studies agreed that social aspect is the main driver leading online game customers to continue playing a certain game. Restated, online games satisfy customer social needs.

Besides social needs, online games also provide customer immersion (or flow) experiences. Hsu and Lu (2004) identified immersion experience as a predictor of customer intention to play online games. Moreover, Teng, Huang, Jeng, Chou, and Hu (2008) presented evidence that immersion experience contributes to customer loyalty, and utilized customer personality traits as predictors of customer tendency to experience immersion.

Online games can satisfy needs of online game customers. Jansz (2005) proposed that online games can provide a safe laboratory for customers to experiment emotionally, indicating another use of online games for customers. Yee (2006) further indicated that online games can satisfy customer achievement and immersion needs.

## PROPOSITIONS

### How Can Avatars Be Used for Needs Satisfaction?

Online game customers use avatars as their representations in games while experiencing the game world and interacting with each other. Thus avatars are key elements for satisfying customer needs. However, the literature on online games has neglected the importance of avatars (the representations of customers in the game world).

Avatars are user representations in game worlds (Vasalou & Joinson, 2009), and thus customers interact via their avatars. Generally, the outfits and clothes of avatars become increasingly attractive as avatars advance through the game. The body shape of male avatars becomes more muscular, while that of female avatars becomes more curvaceous, boosting interpersonal attraction for both sexes (Lo, 2008). Thus users with strong social motives may select attractive avatars, improve the body shape of their avatars, and improve the outfits and clothes of their avatars to enhance their interpersonal attraction.

**Proposition 1:** Customers select avatars to satisfy their needs.

Users can also meet their needs for immersion and achievement when selecting and improving outward appearances of avatars. For example, users can select avatars with very different appearances to their own real world appearances, or can play opposite-gender avatars. Following avatar selection, customers can enjoy representing themselves in a manner that helps them enjoy interactions with other players. Moreover, avatars in online games can be "leveled-up" (advanced to the next or a higher level), or transferred into another advanced "occupation" (classifications that endow affiliated avatars some special skills, power or privileges, or enable affiliated avatars to obtain these abilities during some later stage of the game). Customers with advanced skills, power or privileges can enjoy the achievements in games, satisfying their achievement needs.

**Proposition 2:** Customers play avatars to satisfy their needs.

Individual psychological needs can vary over time. Maslow (1943) proposed that human needs are hierarchical, and when low-level needs are satisfied, human seek satisfaction of high-level needs. The theory of Maslow (1943) applies to online gamers. When gamers have satisfied their low-level needs, they are likely to seek satisfaction of their high-level needs. For example, when gamers have satisfied their social needs, they are likely to seek satisfaction of achievement needs (which contribute to the self-esteem needs of Maslow). When gamers change their needs, they are likely to change their avatars to satisfy their needs in online games for two reasons. First, gamers have invested sunk costs in developing their avatars. Thus it is reasonable to change existing avatars rather than starting new avatars when their psychological needs change. Second, avatars have established reputations and relationships with other avatars (owned by other gamers), and consequently it makes more sense to change the features of an avatar than to change its name, in order to maintain the existing reputation of the current avatars and inter-avatar relationships. Thus, gamers can be expected to change avatars in response to changing needs.

**Proposition 3:** Customers change avatars to satisfy their needs.

Avatars are unique that they can be discarded, or in game terminology "suicide". Interestingly, customers devote considerable time and energy to cultivating or developing avatars. The time and energy devoted to these efforts should become sunk costs for customers that prevent them from discarding their avatars. However, customers are frequently observed to discard old avatars and create new ones. One possible reason for this behavior is that discarded avatars are imperfect. Certain gamers seek achievement (Yee, 2006) or advancement (Jeng & Teng, 2008) in games. These achievements or advancements generally result from the creation, possession and utilization of powerful, dominant or (in game terminology) "perfect" avatars. As in growth of any human kind, the growth and creation of game avatars cannot typically repeat from their births. Certain imperfect features cannot be changed after the completion of growth. One reasonable means for gamers to improve the quality of their avatars is to discard or abandon their current imperfect avatars and create new avatars. Experienced gamers can play more skillfully than novice gamers (Hong & Liu, 2003), and most probably have a higher likelihood of successfully creating near perfect avatars.

Another potential reason for customers discarding their avatars is that some avatars cannot satisfy all user needs. For instance, avatars with attractive outward appearances help gamers establish interpersonal relationships (Lo, 2008), satisfying their social needs. Game providers generally create avatar alternatives with balanced usefulness, and thus avatars with attractive outward appearances may not always be the most powerful avatars in games, blocking gamer satisfaction with game achievements. Thus gamers may discard their avatars and create new avatars to satisfy their alternative needs to satisfy more needs.

**Proposition 4:** Customers discard avatars to satisfy their needs.

Gamers were found to differ in gaming motivations and needs (Jeng & Teng, 2008; Yee, 2006). Since certain avatars may only satisfy certain needs, gamers may create and play multiple avatars to simultaneously satisfy multiple needs. Gamers may simultaneously own a good-looking avatar in order to attract friends and the opposite-sex (Lo, 2008), and a powerful avatar to enjoy the dominance within games associated with power.

**Proposition 5:** Customers play multiple avatars to satisfy their needs.

## DISCUSSION

Overall, this chapter proposes the Avatar Theory, which posits that customers utilize their avatars in multiple ways in online games to satisfy their needs. The Avatar Theory proposed in this chapter is new to the online game literature. Yee (2006) classifies the motivations of players of online games. However, Yee (2006) did not cover the role of gamer avatars in satisfying gamer needs. The Avatar Theory initiates the discussion of gamers using five means (select, play, change, discard, and use multiple avatars) regarding avatars in order to satisfy their needs. The present chapter proposes a theory explaining how gamers use avatars for needs satisfaction. That is, the present chapter extends the knowledge of Yee (2006) to game avatar usage.

The Avatar Theory is also new to the avatar design literature. Lo (2008) indicated the importance of avatar outward attractiveness. Lo (2008) shed light on the usefulness of avatars in satisfying gamer needs. However, Lo (2008) focused on social and interpersonal needs. The Avatar Theory presented in the present chapter can provide a general framework for explaining various needs satisfactions regarding avatar usage, and is not limited to social and interpersonal needs, as stressed by Lo (2008).

Avatar Theory fits the current online game literature by discussing gamer motivations (Jeng & Teng, 2008; Yee, 2006), needs fulfillment (Teng, in press) and avatar design (Lo, 2008). The Avatar Theory contributes to the current online game literature by linking avatar design and the satisfaction of multiple gamer needs, which is new and useful to game providers.

Previous documents have formulated certain theories regarding avatars. Castronova (2008) utilized an economic perspective to address demand for avatars, choices of avatar attributes, avatar choices in team-based scenarios, and the influence of avatar anonymity on social norm and reputation models. Castronova (2008) concluded that the use of avatars enhances human well-being. Castronova (2008) provided a solid economic basis for future virtual world studies by stating that individuals can select avatars to increase their well-being. The present chapter contributes to the avatar literature by detailing the psychological needs that people satisfy by selecting avatars. The present chapter further indicates that, besides choosing avatars, people can also employs alternative methods of using avatars to satisfy their needs. For example, the present study proposes that changing avatars, discarding avatars and using multiple avatars are alternative means for exploiting avatars to satisfy gamer psychological needs, extending the coverage of avatar literature. To summarize, this chapter differs from that of Castronova (2008) by adopting a psychological perspective, complimentary to the economic perspective adopted by Castronova (2008). Multiple perspectives can help improve understanding of avatars.

## FUTURE RESEARCH DIRECTIONS

This chapter proposes the Avatar Theory, a new theory to the literature. The present chapter invites future studies to empirically examine Avatar Theory. An emerging trend is to combine Internet marketing with online game applications. Teng, Lo, and Wang (2007) examined differences in information source and selection criteria for online games between current and potential customers of online games. Their study demonstrated that the application of marketing issues to the online gaming industry represents a promising means of enhancing the effectiveness of global e-business management.

Avatars are the representations of players in the game world. The usage of avatars thus may differ with individual personality traits. Extraverted individuals may use avatars to participate in social activities, while imaginative individuals may use avatars to explore the game world or experience immersion. Since personality traits are popular issues in social psychology, future studies can employ Avatar Theory and personality theories to bridge the social psychology and Internet marketing disciplines.

Avatar design is a new research area. Lo (2008) demonstrated the importance of avatar appearance in interpersonal attraction. However, how to design avatars to satisfy the needs of online game customers has seldom been addressed. Future studies are encouraged to utilize Avatar Theory as presented in this chapter, to pursue further research on effective avatar designs.

This chapter cited the number of customers for a single online game, as announced by Blizzard Entertainment (2008), to support the value of research on online games. The cited game is a popular online game, but numerous popular online games still exist. This chapter aims to demonstrate the general applicability of the Avatar Theory to multiple and multi-type online games, rather than to a single game only. Focusing on one or one type of online game is a fruitful approach, as demonstrated by Jansz and Tanis (2007), but is not employed in the present chapter.

A recent special issue of *Electronic Commerce Research* addressed the importance of avatars in online game contexts (Papagiannidis, Bourlakis, & Li, 2009). This special issue indicated that research on the value and use of avatars in online games is a current trend and worthy of continued future research.

## CONCLUSION

This chapter develops Avatar Theory, which comprises five propositions for examination by future studies. Avatar Theory can be used to create new knowledge regarding avatar design and effectiveness, promoting rapid e-business (online game businesses) development. Knowledge of avatars can also be used to satisfy customers and increase customer immersion in Internet applications, contributing to Internet marketers by improving customer loyalty.

## ACKNOWLEDGMENT

The author thanks Chang Gung University for financial support (UAPRD370031). Correspondence should be made to: Ching-I Teng, Associate

Professor, Department of Business Administration, Chang Gung University, 259, Wenhua 1st Rd, Gueishan Shiang, Taoyuan 333, Taiwan, chingit@mail.cgu.edu.tw.

## REFERENCES

Blizzard Entertainment, Inc. (2008). *World of WarCraft® surpasses 9 million subscribers worldwide.* Retrieved October 28, 2008 from http://www.blizzard.com/us/press/081028.html

Castronova, E. (2008). Theory of the avatar. In Jason Rutter (Ed.), *Digital Games Industries: Work, Knowledge, and Consumption*. London: Ashgate.

Griffiths, M. D., Davies, M. N. O., & Chappell, D. (2003). Breaking the stereotype: The case of online gaming. *Cyberpsychology & Behavior*, *6*(1), 81–91. doi:10.1089/109493103321167992

Griffiths, M. D., Davies, M. N. O., & Chappell, D. (2004). Demographic factors and playing variables in online computer gaming. *Cyberpsychology & Behavior*, *7*(4), 479–487. doi:10.1089/cpb.2004.7.479

Hong, J.-C., & Liu, M.-C. (2003). A study on thinking strategy between experts and novices of computer games. *Computers in Human Behavior*, *19*(2), 245–258. doi:10.1016/S0747-5632(02)00013-4

Hsu, C.-L., & Lu, H.-P. (2004). Why do people play on-line games? An extended TAM with social influences and flow experiences. *Information & Management*, *41*, 853–868. doi:10.1016/j.im.2003.08.014

Hsu, C.-L., & Lu, H.-P. (2007). Consumer behavior in online game communities: A motivational factor perspective. *Computers in Human Behavior*, *23*, 1642–1659. doi:10.1016/j.chb.2005.09.001

Intelligence, D. F. C. (2006). *Who will benefit from the growth of online game subscription revenue?* Retrieved from http://www.dfcint.com/game_article/mar06article.html

Jansz, J. (2005). The emotional appeal of violent video games for adolescent males. *Communication Theory*, *15*(3), 219–241. doi:10.1111/j.1468-2885.2005.tb00334.x

Jansz, J., & Martens, L. (2005). Gaming at a LAN event: The social context of playing video games. *New Media & Society*, *7*(3), 333–355. doi:10.1177/1461444805052280

Jansz, J., & Tanis, M. (2007). Appeal of playing online first person shooter games. *Cyberpsychology & Behavior*, *10*(1), 133–136. doi:10.1089/cpb.2006.9981

Jeng, S.-P., & Teng, C.-I. (2008). Personality and motivations for playing online games. *Social Behavior and Personality*, *36*(8), 1053–1060. doi:10.2224/sbp.2008.36.8.1053

Kim, K. H., Park, J. Y., Moon, H. I., & Chun, H. C. (2002). E-lifestyle and motives to use online games. *Irish Marketing Review*, *15*(2), 71–77.

Lo, S.-K. (2008). The impact of online game character's outward attractiveness and social status on interpersonal attraction. *Computers in Human Behavior*, *24*(5), 1947–1958. doi:10.1016/j.chb.2007.08.001

Lo, S.-K., Wang, C.-C., & Fang, W. (2005). Physical interpersonal relationships and social anxiety among online game players. *Cyberpsychology & Behavior*, *8*(1), 15–20. doi:10.1089/cpb.2005.8.15

Maslow, A. H. (1943). A theory of human motivation. *Psychological Review*, *50*, 370–396. doi:10.1037/h0054346

McMahan, A. (2003). Immersion, engagement, and presence: A method for analyzing 3-D video games. In M. J. P. Wolf & B. Perron (Eds.), *The Video Game Theory Reader* (pp. 67-86). New York: Routledge.

Murray, J. (1997). *Hamlet on the Holodeck: The Future of Narrative in Cyberspace*. Cambridge, MA: The MIT Press.

Papagiannidis, S., Bourlakis, M., & Li, F. (2009). Editorial: I have an avatar therefore I exist. *Electronic Commerce Research*, *9*, 1–2. doi:10.1007/s10660-009-9025-5

Teng, C.-I. (2008). Personality differences between online game players and non-players in a student sample. *Cyberpsychology & Behavior*, *11*(2), 232–234. doi:10.1089/cpb.2007.0064

Teng, C.-I. (in press). Online game player personality and real-life need fulfillment. [forthcoming]. *International Journal of Cyber Society and Education*.

Teng, C.-I., Huang, L.-S., Jeng, S.-P., Chou, Y.-J., & Hu, H.-H. (2008). Who are loyal customers in online games? In *2008 International Consortium for Electronic Business (ICEB 2008)*, International Consortium for Electronic Business, Hawaii, Sep 30th-Oct 1st, 2008.

Teng, C.-I., Lo, S.-K., & Wang, P.-C. (2007). How to know and choose online games: Differences between current and potential players. *Cyberpsychology & Behavior*, *10*(6), 837–840. doi:10.1089/cpb.2007.9944

Vasalou, A., & Joinson, A. N. (2009). Me, myself, and I: The role of interactional context on self-presentation through avatars. *Computers in Human Behavior*, *25*, 510–520. doi:10.1016/j.chb.2008.11.007

Yee, N. (2006). Motivations for play online games. *Cyberpsychology & Behavior*, *9*(6), 772–775. doi:10.1089/cpb.2006.9.772

Zimbardo, P. G., & Weber, A. L. (1994). *Psychology.* New York: HarperCollins.

## KEY TERMS AND DEFINITIONS

**Avatar Appearances:** The outward appearance of avatars, including outfits, facial appearance, hair-style, body shape, accessories, weapons, decorations, vehicles and halos around avatars.

**Avatar:** Player representations in online games.

**Customers:** Individuals who play online games.

**Discarding Avatars:** Gamer actions that permanently destroy the avatars they own.

**Gaming Motivations:** The psychological impulses that drive gamers to play online games.

**Online Game:** Online software application that allows customers to use their computers to play via the Internet.

**Theory:** Logically connected arguments that predict or explain phenomena.

# Chapter 9
# Relationship between Second Life and the U.S. Economy

**Rosemarie Reynolds**
*Embry-Riddle Aeronautical University, USA*

**Yusuke Ishikawa**
*Embry-Riddle Aeronautical University, USA*

**Amanda Macchiarella**
*Embry-Riddle Aeronautical University, USA*

## ABSTRACT

*Second Life is a virtual world designed to be a free, laissez-faire market economy in which Linden Dollars are used to buy and sell goods and services. This study investigated the relationship between the economies of Second Life and the United States, using financial data collected from Linden Lab and the Federal Reserve. Partial correlation analyses were computed between two pairs of economic measures, and our results indicated that there was a significant relationship between the two economies.*

## INTRODUCTION

After the dot-com crash in the 1990s, the only Internet-related industry that did not suffer a recession was the computer gaming industry (Hsu & Lu, 2004). Currently, there are more than 100 multiplayer online games with over 10 million players worldwide (Abate, 2005). The market for online gaming in the U.S. reached $1.9 billion in 2005 (Mintel, 2009), while global market reached $ 5.2 billion by 2006 (Hsu & Lu, 2007).

Due to the large number of users and the size of the market, the gaming industry has a large economic impact. However, it also has an enormous social impact, and online behavior may be as important as understanding behavior in the real world (Gillath, McCall, Shaver, & Blascovich, 2008). The focus of this study was to examine the relationship between player behavior in the virtual economy of *Second Life*, and the real world economy of the U.S.

## BACKGROUND

Research indicates that some motivators for online game playing are flow experience (cognitive absorption), imaginative responses such as fantasy and escapism, and emotional responses such as enjoy-

DOI: 10.4018/978-1-61520-611-7.ch009

ment and emotional involvement (Ducheneaut & Moore, 2004; Holsapple & Wu, 2007; Hsu & Lu, 2004; Hsu & Lu, 2007; Koo, 2009; Yee, 2006). However, the social affiliation aspect of games appears to be one of the primary motivators; in fact, Kim, Oh, and Lee (2005) found that the social characteristics of online games were more crucial to online game success than technological ones.

One aspect of online gaming, virtual worlds, is aimed directly at this need for social affiliation. These computer-generated virtual worlds may represent fantasy worlds or simulate the real world, but in either case, the virtual world allows users to interact with each other through their avatars.

One of the more successful online games is *Second Life,* created by *Linden Lab* in 2003 as an international multiplayer online game. In the U.S. alone, *Second Life* has been played for over 14 million hours (Linden Lab, 2009), and Wagner (2008) suggests that Linden Labs makes between 40 and 50 million a year in profit.

*Second Life* includes many realistic aspects of real life, including some aspects of real-world physics that need not apply to virtual worlds (Clavering & Nicols, 2007; Mennecke, McNeill, Ganis, Roche, Bray, & Konsynski, 2008). The game centers on commerce, the sale and resale of goods, and the advancement of its virtual economy; there are no set objectives designed into the game (Miano, 2007; Pollitzer, 2007). Virtual characters known as *Residents* run businesses, own land, travel, and buy and sell goods and services with the *Linden Dollar*. Users retain all intellectual property rights for objects they create, and can control whether a buyer will be able to resell, edit, or create copies of objects they sell (Clavering & Nicols, 2007; Seto, 2008). This key inclusion has enabled *Second Life's* economy to exhibit traits similar to real countries' economies, for, as Ondrejka (2008) pointed out, "… property rights are a key enabler of innovation and therefore per capita economic growth" (p. 237).

According to Landay (2008), the concept of virtual goods and its values has been around since 1984, when William Gibson coined the term *consensual hallucination*. This term described the process of giving "virtual world objects meaning, any value beyond dreams or fantasy, ascribed meta-material value to what is actually only code, digital information" (Landlay, 2008, p. 2). However, the boundary between virtual and real assets is not as clear as it once was. The currency of *Second Life*, the *Linden Dollar*, can be converted to and from the U.S. Dollar through *Linden Lab's* currency exchange market (Godfrey, 2008). Virtual items can be exchanged for real money on virtual item transaction websites such as *ItemBay* (Guo & Barnes, 2007), and some players have become successful enough at selling virtual goods that they have left their real-world jobs behind (Childers, 2009).

The permeable boundary between the virtual world and the real world is also evident in areas other than the economy. *Second Life* has been used in a variety of real-world applications, including telehealth, psychological research, engineering studies, virtual campuses, concerts, religion, therapy, art shows, and virtual presences for businesses such as IBM, Sun Microsystems, Vodaphone, Swisscom, Toyota, and Reuters (Antonijevic, 2008; Barry, 2008; Bessière, Ellis, & Kellogg, 2009; Cabiria, 2008; Childers, 2009; Chu & Joseph, 2008; Clavering & Nicols, 2007; De Lucia, Francese, Passero, & Tortora, 2009; Gaggioli & Riva, 2007; Gillen, 2009; Jeffers, 2008; Ritzema & Harris, 2008; Ryssdal, 2008). In fact, Childers (2009) noted that there is a new art form called *machinima*, which consists of movies made using nothing but *Second Life* avatars, tools and cameras.

Thus, while virtual worlds have an enormous economic impact, they have a powerful social impact as well, causing Gillath, et.al. (2008) to note that understanding behavior in these virtual environments may be as important as understanding behavior in the real world. The focus of this study was to examine the relationship between player behavior in the virtual economy of *Second Life*, and the real world economy of the U.S.

There are obvious differences between a virtual economy and one in the real world, including a lack of regulation by governing bodies such as local and state governments, the absence of marginal production costs, and symbolic, rather than use value of goods and services (Martin, 2008; Miano, 2007; Ondrejka, 2004; Shin, 2008).

However, there is also evidence to support the idea that consumer behavior in *Second Life* might mimic the real world; a study reported by Atlas (2009) replicated "classic economic experiments including the ultimatum, dictator, public goods, minimum effort, and guessing game" (p. 8). The results showed that *Second Life Residents* reacted the same way a real consumer would in a conventional economic experiment. Constantinides (2004) found that credibility, trust in the vendor, and aesthetic appeal influenced the buying behaviors of both online and real-world consumers, while Ryssdal (2008) reported that there have been big, virtual banks in *Second Life* that have recently defaulted, prompting *Linden Lab* to take action.

## EXAMINING THE RELATIONSHIP BETWEEN SECOND LIFE AND THE U.S. ECONOMY

Our goal was to determine if there was significant relationship between the *Second Life* and the U.S. economy. We chose *Second Life* as our virtual economy because the game was designed around market activities, and is considered better suited for economic experiments than other virtual worlds such as *EverQuest* (Ondrejka, 2004). The U.S. economy was used in this comparison because the majority of *Second Life* users were located in the United States.

### Economic Measures

Monthly economic information was gathered from *Linden Lab's Key Metrics* file and the Federal Reserve. Four measures, described in the following sections, were collected.

#### User-to-User Transactions

*Second Life's* user-to-user transactions consisted of the quantity of *Linden Dollars* exchanged by *Residents* to purchase and sell goods and services. We used this data as an indicator of how actively the *Second Life* economy spent its money and the level of consumer confidence within the virtual world.

#### Personal Consumption Expenditure

Personal consumption expenditure (PCE) consists of actual and imputed expenditures of U.S. households on durable and non-durable goods and services. This data was obtained from the U.S. Department of Commerce (2009). As with the user-to-user transaction, it measures consumer confidence in the economy.

#### Linden Dollar Supply

The supply of the *Linden Dollar* in *Second Life* is the total amount of currency that is available to *Residents* in the virtual economy, and was used as a measure of liquidity and ability to satisfy debts.

#### U.S. Dollar Supply

The M2 supply of the U.S. Dollar, which includes the money the public handles daily, accounts from which checks can be written, traveler's checks, savings accounts, balances in money market savings accounts, and time deposits, was used as our measure of liquidity in the real world economy. This data was collected from the Board of Governors of the Federal Reserve System (2009).

*Figure 1. Total user hours on Second Life from January 2005 to November 2008*

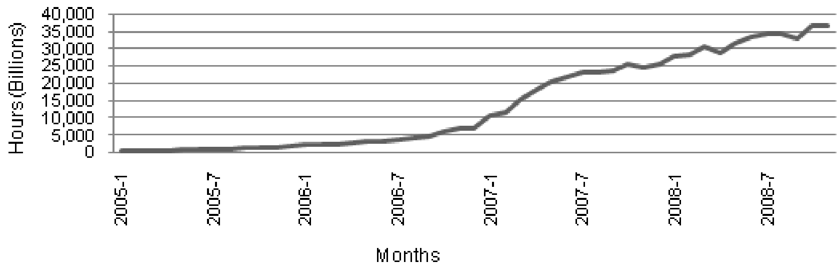
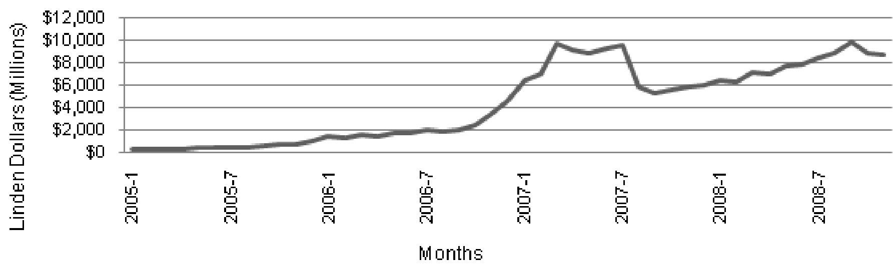



*Figure 2. Amount of Linden Dollars exchanged from January 2005 to November 2008*




## Results

In the following sections we present an overview of our data, followed by the results of our hypothesis testing.

### Overview

Figure 1 shows the total number of hours spent by users on *Second Life* from January 2005 to November 2008.

Figure 2 presents user-to-user transactions in *Second Life* from January 2005 to November 2008, while the initial increase and recent decrease in personal income expenditure is pictured in Figure 3.

Figure 4 shows the increase of the *Linden Dollar* supply in *Second Life* since September 2005, while the increase in the supply of U.S. Dollars is represented in Figure 5.

### Hypothesis Testing

In order to compensate for the increasing popularity of *Second Life* over time, the number of hours that users played *Second Life* was utilized as a covariate; thus both our hypotheses were tested using partial correlation coefficients to describe the linear relationship between the two variables, while controlling for the effect of the increasing number of players.

Our first hypothesis stated that "There will be a significant positive correlation between *Second Life* user-to-user transaction and the U.S. Personal Consumption Expenditure, controlling for millions of user hours as a covariate." We tested our hypothesis and found there was a statistically significant relationship, $r = .34$, $p = .01$.

Our second hypothesis was that "There will be a significant positive correlation between the *Linden Dollar* supply and the U.S. Dollar supply, controlling for millions of user hours as a

*Figure 3. Personal consumption expenditure from January 2005 to November 2008*

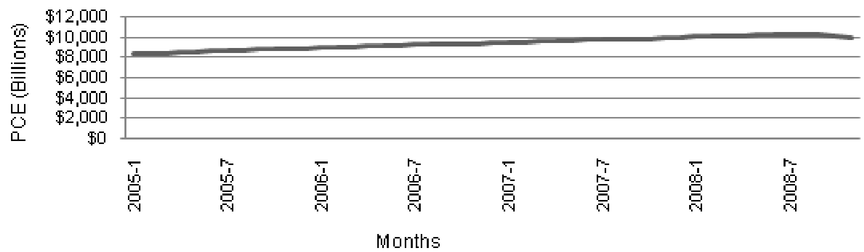



*Figure 4. Supply of Linden Dollars from September 2005 to November 2008*

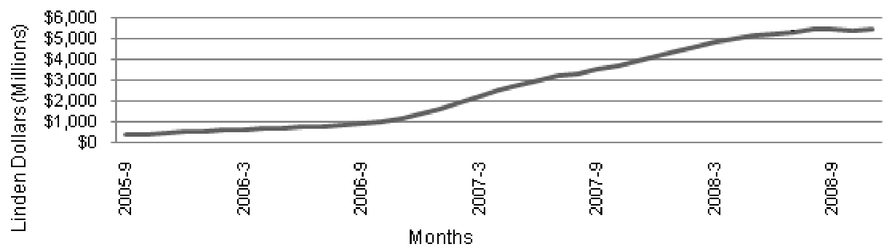
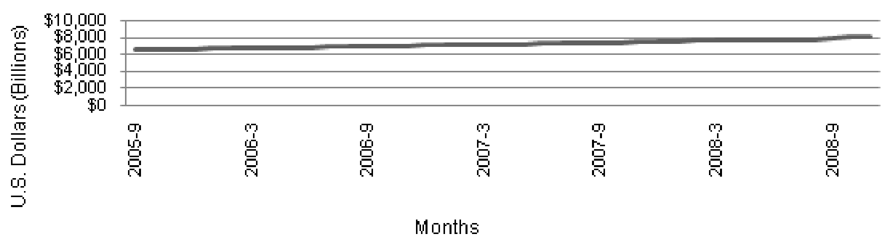



*Figure 5. Supply of U.S. Dollars from September 2005 to November 2008*




covariate." We tested our hypothesis and found there was a statistically significant relationship, $r = .39$, $p = .008$.

As a result of the significant relationships between our variables, we investigated the strength of the relationship when lagging the variables; i.e.; using different variables as the leading indicator over different time periods. The results of the lag analyses are shown in Tables 1 and 2.

## CONCLUSION

Both of our hypotheses were supported, suggesting that a significant relationship exists between the economies of *Second Life* and the U.S. Based on the lag-effect analysis, it appears that the strongest correlation for the money supply is when the amount of *Linden Dollars* predicts the amount of U.S. Dollars six months later. However, for personal consumption expenditure and user-to-user consumption, the correlation is stronger when

*Table 1. U.S. Dollars (USD) vs. Linden Dollars (LD)*

| Leading indicator | Trailing indicator | Lag Time (Months) | Correlation | p |
|---|---|---|---|---|
| USD | LD | 1 | .453 | .002 |
| USD | LD | 3 | 573 | .000 |
| USD | LD | 6 | .555 | .000 |
| LD | USD | 1 | .452 | .002 |
| LD | USD | 3 | .584 | .000 |
| **LD** | **USD** | **6** | **.772** | **.000** |

*Table 2. Personal consumption expenditure (PCE) vs. user-to-user transactions (UTU)*

| Leading indicator | Trailing indicator | Lag Time (Months) | Correlation | p |
|---|---|---|---|---|
| **PCE** | **UTU** | **1** | **.312** | **.018** |
| PCE | UTU | 3 | ,184 | .118 |
| PCE | UTU | 6 | .047 | .386 |
| UTU | PCE | 1 | .239 | .057 |
| UTU | PCE | 3 | .098 | .266 |
| UTU | PCE | 6 | .216 | .091 |

Personal Consumption Expenditure for the U.S. precedes user-to-user transaction by one month.

There are limitations that may have distorted our findings. As stated by Atlas (2008), selecting samples from a population consisting of only people who have the willingness, time, and ability to engage in an online game does not represent the entire U.S. population very well. Another limitation concerns the availability of economic data; information for *Second Life* can only be obtained back to January 2005, as *Linden Lab* did not record its financials from 2003 to 2005. Furthermore, the two pairs of economic data that were compared did not correspond exactly. Although great care was taken in selecting economic measures that were similar, user-to-user transactions and personal consumption expenditure are not computed in exactly the same way, and the supply of *Linden Dollars* and the M2 supply of U.S. Dollars do not include identical factors.

## FUTURE RESEARCH

Although we found a significant relationship exists between the economies of *Second Life* and the U.S., more research needs to be done to investigate just how closely the economies mirror each other; if the relationship is a very close one, then the virtual economy might allow for economic experimentation without real world economic impacts. This leads to interesting possibilities: could preventive measures implemented in the virtual economy stop economic recession from occurring in the real-world? could the real-world economy be stabilized through the virtual economy? It would also be of considerable value to see whether out findings can be generalized to other companies in the same domain like Entropia Universe, Active Worlds, and Kaneva.

In addition, our investigation of the lag effect suggests that there may be a lag from the time the economy enters a downturn to the time when consumers decide that they need to extend their parsimonious behavior to the virtual world, while it appears that the supply of *Linden Dollars* predicts the amount of the U.S. Dollars supply by six months; this implies that forecasting for one economy may be possible through the observation of the other. This information could be useful for companies who have a stake in both the virtual and real-world economy; based on consumer behavior observed in one economy, companies might be able to adjust their business strategy to coincide with changes in consumer behaviors.

Two other areas of interest are taxation and regulation. Although there is currently no taxation in the virtual world, people *are* making money in the virtual economy, some of which translates into income in the real-world. How should legislation tackle the issue of virtual world taxation?

Finally, as a virtual economy becomes larger, with a significant amount of money circulating and numerous people making a real world income off their virtual life, should one company be in control of the virtual economy? Should a third-party or government entity step in to maintain the stability of the economy, and at what point should this be implemented?

## REFERENCES

Abate, T. (2005, August 1). Economists to explore world of online games: Researchers could assess player's response to change. *San Francisco Chronicle*, E01. Retrieved February 3, 2009, from http://www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2005/08/01/BUGQADVKFD1.DTL

Antonijevic, S. (2008). Rhetoric, culture, and avatars: A microethnographic analysis of nonverbal communication in multiuser, three-dimensional virtual environments. *Dissertation Abstracts International Section A: Humanities and Social Sciences, 69*(6-A), 2253. Retrieved from http://www.csa.com

Atlas, S. A. (2008). Economic experiments in virtual worlds: Framing, reciprocity & trust. *Dissertation Abstracts International* (UMI No. 1450772). Retrieved from http://www.csa.com

Barry, R. (2008). SpaceTime - Second Life exhibition. *SIGGRAPH*, *2008*, 42.

Bessiere, K., Ellis, J., & Kellogg, W. (2009). Acquiring a professional "second life": Problems and prospects for the use of virtual worlds in business. In *Proceedings of the 27th International Conference on Human Factors In Computing Systems*, Boston, MA (pp. 2883-2898).

Board of Governors of the Federal Reserve System. (2009, March 4). *St. Louis Fed: Series: M2NS, M2 Money Stock*. Retrieved March 30, 2009, from http://research.stlouisfed.org/fred2/series/M2NS?cid=29

Cabiria, J. (2008). A second life: Online virtual worlds as therapeutic tools for gay and lesbian people. *Dissertation Abstracts International: Section B: The Sciences and Engineering, 69*(4-B), 2652. Retrieved from http://www.csa.com

Childers, B. (2009). Find yourself in Second Life. *Linux Journal*. Retrieved May 5, 2009 from http://www.linuxjournal.com/issue/178

Chu, K., & Joseph, S. (2008). Using Second Life to demonstrate a concept automobile heads up display (A-HUD). In *Proceedings of the 10th International Conference on Human Computer Interaction with Mobile Devices and Services*, Amsterdam, The Netherlands (pp. 497-498).

Clavering, R., & Nicols, A. (2007) Lessons learned implementing an educational system in Second Life. In *Proceedings of the 21st BCS HCI Group Conference 2*, Lancaster, UK (pp. 19-22).

Constantinides, E. (2004). Influencing the online consumer's behavior: The web experience. *Internet Research*, *14*, 111–126. doi:10.1108/10662240410530835

De Lucia, A., Francese, R., Passero, I., & Tortora, G. (2009). Development and evaluation of a virtual campus on second life: The case of SecondDMI. *Computers & Education*, *52*(1), 220–233. doi:10.1016/j.compedu.2008.08.001

Ducheneaut, N., & Moore, R. (2004). The social side of gaming: a study of interaction patterns in a massively multiplayer online game. In *Proceedings of the 2004 ACM Conference on Computer Supported Cooperative Work,* Chicago, Illinois, USA.

Gaggioli, A., & Riva, G. (2007). A second life for telehealth? *Annual Review of Cybertherapy and Telemedicine*, *5*, 29–36.

Gillath, O., McCall, C., Shaver, P. R., & Blascovich, J. (2008). What can virtual reality teach us about prosocial tendencies in real and virtual environments? *Media Psychology*, *11*, 259–282. doi:10.1080/15213260801906489

Gillen, J. (2009). Literacy practices in Schome Park: A virtual literacy ethnography. *Journal of Research in Reading*, *32*, 57–74. doi:10.1111/j.1467-9817.2008.01381.x

Godfrey, K. (2008). A new world for virtual reference. *Library Hi Tech*, *26*(4), 525–539. doi:10.1108/07378830810920879

Guo, Y., & Barnes, S. (2007). Why people buy virtual items in virtual worlds with real money. *ACM SIGMIS*, *38*, 69–76. doi:10.1145/1314234.1314247

Holsapple, C., & Wu, J. (2007). User acceptance of virtual worlds: the Hedonic framework. *ACM SIGMIS*, *38*, 86–89. doi:10.1145/1314234.1314250

Hsu, C., & Lu, H. (2004). Why do people play on-line games? An extended TAM with social influences and flow experience. *Information & Management*, *41*, 853–868. doi:10.1016/j.im.2003.08.014

Hsu, C., & Lu, H. (2007). Consumer behavior in online game communities: A motivational factor perspective. *Computers in Human Behavior*, *23*, 1642–1659. doi:10.1016/j.chb.2005.09.001

Jeffers, D. (2008). Is There a Second Life in Your Future? In *Proceedings of the 36th Annual ACM SIGUCCS Conference on User Services*, Portland, Oregon, USA (pp. 187-190).

Kim, Y., Oh, S., & Lee, H. (2005). What makes people experience flow? Social characteristics of online games. *International Journal of Advanced Media and Communication*, *1*, 76–92. doi:10.1504/IJAMC.2005.007724

Koo, D. (2009). The moderating role of locus of control on the links between experiential motives and intention to play online games. *Computers in Human Behavior*, *25*, 466–474. doi:10.1016/j.chb.2008.10.010

Landay, L. (2008). Having but not holding: Consumerism and commodification in Second Life. *Journal of Virtual Worlds Research*, *1*, 1–5.

Linden Labs. (2009). *What is Second Life?* Retrieved February 3, 2009, from ttp://lindenlab.com/pressroom/general/factsheets/sloverview

Martin, J. (2008). Consuming code: Use-value, exchange-value, and the role of virtual goods in Second Life. *Journal of Virtual Worlds Research*, *1*, 1–21.

Mennecke, B., McNeill, D., Ganis, M., Roche, E., Bray, D., Konsynski, B., & Townsend, A. (2008). Second Life and other virtual worlds: A roadmap for research. *Communications of the Association for Information Systems*, *22*, 317–388.

Miano, T. (2007). *Virtual world taxation: Theories of income taxation applied to the Second Life virtual economy*. Arlington, VA: George Mason University, School of Law. Retrieved February 3, 2009, from http://works.bepress.com/timothy_miano/1/

Mintel. (2009). *On-line and mobile gaming in the United States*. Retrieved May 7, 2009 from http://www.researchandmarkets.com/reports/339096

Ondrejka, C. (2004). *Aviators, moguls, fashionistas and barons: Economics and ownership in Second Life*. Los Angeles, CA: University of Southern California, Annenberg School for Communication. Retrieved February 3, 2009, from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=614663

Ondrejka, C. (2008). Education unleashed: Participatory culture, education, and innovation in Second Life. In K. Salen (Ed.), *The ecology of games: Connecting youth, games, and learning* (pp. 229-252). Cambridge, MA: The MIT Press.

Pollitzer, B. (2007). Serious business: When virtual items gain real-world value. *Law and Internet*, 1-51.

Ritzema, T., & Harris, B. (2008). The use of Second Life for distance education. *Journal of Computing Sciences in Colleges*, *23*, 110–116.

Ryssdal, K. (2008). Second Life's economy slows down, too. *Marketplace*. Retrieved February 3, 2009, from http://marketplace.publicradio.org/display/web/2008/01/22/second_life/

Seto, T. P. (2008). *When is a game only a game? The taxation of virtual worlds* (Legal Studies Paper No. 2008-24). Los Angeles, CA: Loyola Law School.

Shin, D. H. (2008). Understanding purchasing behaviors in a virtual economy: Consumer behavior involving virtual currency in Web 2.0 communities. *Interacting with Computers*, *20*, 433–446. doi:10.1016/j.intcom.2008.04.001

U.S. Department of Commerce. Bureau of Economic Analysis. (2009, March 27). *St. Louis Fed: Series: PCE, Personal Consumption Expenditures*. Retrieved March 30, 2009, from http://research.stlouisfed.org/fred2/series/PCE?cid=110

Wagner, J. (2008). *How Much Is Linden Lab Making From Second Life, Anyway?* (Updated). Retrieved May 7, 2009 from http://nwn.blogs.com/nwn/2008/05/how-much-is-lin.html

Yee, N. (2006). Motivations for play in online games. *Cyberpsychology & Behavior*, *9*, 772–775. doi:10.1089/cpb.2006.9.772

## ADDITIONAL READING

Barbour, M. K., & Reeves, T. C. (2009). The reality of virtual schools: A review of the literature. *Computers & Education*, *52*, 402–416. doi:10.1016/j.compedu.2008.09.009

Barlett, C. P., Vowels, C. L., Shanteau, J., Crow, J., & Miller, T. (2009). The effect of violent and non-violent computer games on cognitive performance. *Computers in Human Behavior*, *25*, 96–102. doi:10.1016/j.chb.2008.07.008

Baron, N. S. (2008). *Always on: Language in an online and mobile world*. New York: Oxford University Press.

Baylor, A. L., & Kim, S. (2009). Designing nonverbal communication for pedagogical agents: When less is more. *Computers in Human Behavior*, *25*, 450–457. doi:10.1016/j.chb.2008.10.008

Boellstorff, T. (2008). Coming of age in second life: An anthropologist explores the virtually human. Princeton, NJ: Princeton University Press.

Chai, X. J., & Jacobs, L. F. (2009). Sex differences in directional cue use in a virtual landscape. *Behavioral Neuroscience*, *123*, 276–283. doi:10.1037/a0014722

Chayko, M. (2002). *Connecting: How we form social bonds and communities in the internet age*. Albany, NY: State University of New York Press.

de Freitas, S., & Neumann, T. (2009). The use of 'exploratory learning' for supporting immersive learning in virtual environments. *Computers & Education*, *52*, 343–352. doi:10.1016/j.compedu.2008.09.010

Derks, D., Bos, A., & Grumbkow, J. (2007). Emoticons and social interaction on the Internet: The importance of social context. *Computers in Human Behavior*, *23*, 842–849. doi:10.1016/j.chb.2004.11.013

Hambley, L., O'Neil, T., & Kline, T. (2007). Virtual team leadership: The effects of leadership style and communication medium on team interaction styles and outcomes. *Organizational Behavior and Human Decision Processes*, *103*, 1–20. doi:10.1016/j.obhdp.2006.09.004

Inman, J. A., Reed, C., & Sands, P. (2004). *Electronic collaboration in the humanities: Issues and options*. Mahwah, NJ: Lawrence Erlbaum Associates Publishers.

Jacobson, A. R., Militello, R., & Baveye, P. C. (2009). Development of computer-assisted virtual field trips to support multidisciplinary learning. *Computers & Education*, *52*, 571–580. doi:10.1016/j.compedu.2008.11.007

Jara, C. A., Candelas, F. A., Torres, F., Dormido, S., Esquembre, F., & Reinoso, O. (2009). Real-time collaboration of virtual laboratories through the internet. *Computers & Education*, *52*, 126–140. doi:10.1016/j.compedu.2008.07.007

Joinson, A. N. (2003). *Understanding the psychology of internet behaviour: Virtual worlds, real lives*. New York: Palgrave Macmillan.

Katz, J. E., & Rice, R. E. (2002). *Social consequences of internet use: Access, involvement, and interaction.* Cambridge, MA: MIT Press.

Kiesler, S., Siegel, J., & McGuire, T. W. (1984). Social psychological aspects of *CMC. The American Psychologist*, *39*, 1123–1134. doi:10.1037/0003-066X.39.10.1123

Lea, M. (Ed.). (1992). *Contexts of computer-mediated communication*. Hertfordshire, UK: Harvester Wheatsheaf.

Lotan, M., Yalon-Chamovitz, S., & Weiss, P. (2009). Improving physical fitness of individuals with intellectual and developmental disability through a virtual reality intervention program. *Research in Developmental Disabilities*, *30*, 229–239. doi:10.1016/j.ridd.2008.03.005

Norman, K. L. (2008). *Cyberpsychology: An introduction to human-computer interaction*. New York: Cambridge University Press.

Penn, P. R., Rose, F. D., & Johnson, D. A. (2009). Virtual enriched environments in paediatric neuropsychological rehabilitation following traumatic brain injury: Feasibility, benefits and challenges. *Developmental Neurorehabilitation*, *12*, 32–43. doi:10.1080/17518420902739365

Qin, H., Rau, P. P., & Salvendy, G. (2009). Measuring player immersion in the computer game narrative. *International Journal of Human-Computer Interaction*, *25*, 107–133. doi:10.1080/10447310802546732

Reynolds, R., & Brannick, M. (2009). Effect of communication media on developmental relationships: Self-reported and observed behaviors. *Computers in Human Behavior*, *25*, 233–243. doi:10.1016/j.chb.2008.09.004

Reynolds, R., & Brannick, M. (2009) Outcomes of computer mentoring. In J. Salmons & L. Wilson (Eds.), *Handbook of Research on Electronic Collaboration and Organizational Synergy* (pp. 378-386). Hershey, PA: IGI Global.

Reynolds, R., & Fedorovich, S. (2007*).* Cohesion in virtual teams. In *Information Resources Management Association (IRMA) International Conference*, Vancouver, Canada.

Reynolds, R., & Williams, M. (2007). Computer-mediated peer mentoring. In *Southeastern Psychological Association Annual Conference*, New Orleans.

Rothbaum, B. O. (2009). Using virtual reality to help our patients in the real world. *Depression and Anxiety*, *26*, 209–211. doi:10.1002/da.20556

Sadowski-Rasters, G., Duysters, G., & Sadowski, B. M. (2006). *Communication and cooperation in the virtual workplace: Teamwork in computer-mediated-communication*. Northampton, MA: Edward Elgar Publishing.

Short, J., Williams, E., & Christie, B. (1976). *The social psychology of telecommunications*. New York: Wiley.

Sproull, L., & Kiesler, S. (1986). Reducing social context cues: Electronic mail in organizational communication. *Management Science*, *32*, 1492–1512. doi:10.1287/mnsc.32.11.1492

Sproull, L., & Kiesler, S. (1991). Connections: New ways of working in the networked *organization*. Cambridge, MA: MIT Press.

Talbot, K., Legge, E., Bulitko, V., & Spetch, M. (2009). Hiding and searching strategies of adult humans in a virtual and a real-space room. *Learning and Motivation*, *40*, 221–233. doi:10.1016/j.lmot.2009.01.003

Toronto, E. (2009). Time out of mind: Dissociation in the virtual world. *Psychoanalytic Psychology*, *26*, 117–133. doi:10.1037/a0015485

Vadillo, M., & Matute, H. (2009). Learning in virtual environments: Some discrepancies between laboratory- and internet-based research on associative learning. *Computers in Human Behavior*, *25*, 402–406. doi:10.1016/j.chb.2008.08.009

Wang, Z., Walther, J., & Hancock, J. (2009). Social identification and interpersonal communication in computer-mediated communication: What you do versus who you are in virtual groups. *Human Communication Research*, *35*, 59–85. doi:10.1111/j.1468-2958.2008.01338.x

Whitty, M., & Joinson, A. (2009). *Truth, lies and trust on the internet*. New York: Routledge/Taylor & Francis Group.

Wood, A., & Smith, M. (2005). *Online communication: Linking technology, identity, and culture (2nd ed.)*. Mahwah, NJ: Lawrence Erlbaum Associates Publishers.

Yee, N., Bailenson, J. N., & Ducheneaut, N. (2009). The proteus effect: Implications of transformed digital self-representation on online and offline behavior. *Communication Research*, *36*, 285–312. doi:10.1177/0093650208330254

## KEY TERMS AND DEFINITIONS

**Avatar:** The figure or image developed by a computer user to represent themselves online.

**Consensual Hallucination:** In William Gibson's book, *Neuromancer*, he refers to cyberspace as a consensual hallucination that is "a graphic representation of data abstracted from banks of every computer in the human system." The phrase is often used to describe virtual reality or cyberspace.

**Flow Experience:** First proposed by Mihály Csíkszentmihályi, flow is a mental state characterized by total immersion, focus, and involvement in a task.

**Machinima:** Movies made using nothing but computer-generated animations, tools and cameras.

**Marginal Production Costs:** The change in total production costs caused by increasing production by a single unit.

**MMORPG (Massively Multiplayer Online Role-Playing Game):** Role-playing game in which players interact in an online virtual world.

**Residents:** Virtual characters (avatars) in the *Second Life* game that run businesses, own land, travel, and buy and sell goods and services.

**Second Life:** An online role-playing game centered on commerce.

**Telehealth:** Health-related services delivered via telecommunications.

# Section 2
# E-Business Planning and Performance Evaluation

# Chapter 10
# E-Business Adoption and its Impact on Performance

**Sabah Abdullah Al-Somali**
*Aston University, UK*

**Ben Clegg**
*Aston University, UK*

**Roya Gholami**
*Aston University, UK*

## ABSTRACT

*Organizations today face intense competitive and economic pressures leading to large scale transformation of existing business operations and transactions. In addition, organizations have adopted automated business processes to deal with partners and customers. E-business diffusion is a multi-phase process, moving from initiation through to routinisation and an insight into the adoption processes helps organizations to adopt e-business more effectively. It is imperative that organizations effectively manage the e-business environment, and all associated changes to accommodate the changing relationships with customers and business partners and more importantly, to improve performance. This chapter discusses the process of e-business implementation, usage and diffusion (routinisation stage) on business performance.*

## INTRODUCTION

The Internet provides an excellent opportunity to increase sales while maintaining lower overheads. Indeed, firms that pass up this tremendous opportunity will possibly not survive in the 21st century competitive environment (Saunders, 2000).

E-business is commerce conducted online; it is the result of combining digital communication networks, typically the Internet with existing information technology (IT) systems and infrastructures. E-business is an innovation that has enabled modern day organizations to undertake transactions, share information, collaborate across geographical boundaries and across computing platforms and networks. E-business has helped organizations benefit from improved competitiveness, efficiencies, increased market share, and business expansion (Singh, 2003). Research on organizational adoption of IT and e-business, continues to be popular

DOI: 10.4018/978-1-61520-611-7.ch010

and a sizable body of literature (Cooper & Zmud, 1990; Moore & Benbasat, 1991; Ramamurthy *et al*., 1999; Frambach & Schillewaert, 2002; Zhu *et al*., 2003; Lin & Lin, 2008; Zhao *et al*., 2008) continues to grow.

E-business can be considered as a cluster of interrelated technologies and innovations working in concert with each another (Van Slyke, 1998). Subsequently, e-business implementation is often seen as a multi-phase process, moving from an organization's first awareness of e-business technologies to potentially, acquisition and widespread deployment (Meyer & Goes, 1988; Zhu *et al*., 2006). Correspondingly, organizational adoption of e-business is judged by the degree of implementation of activities such as the use of online advertising, e-mail for inter-organizational communication, electronic supply chain management (e-SCM), website presence, online ordering and payments (Hong & Zhu, 2006; Levenburg,2005). E-business technologies help companies to develop the appropriate functionalities to capitalize on the Internet's potential; such as using open standards, public networks, and global connectivity (Zhu & Kraemer, 2005). However, despite the increasing pervasiveness of studies on e-business (Wu *et al*., 2003; Zhu *et al*., 2003; Lin & Lin, 2008) very few have attempted to holistically explore the process of e-business and Internet technologies adoption (e.g. Dholakia & Kshetri, 2004; Zhu *et al*., 2006).

This chapter therefore considers innovation diffusion and e-business implementation literature (e.g. Zhu *et al*., 2006; Fichman, 2000; Meyer & Goes, 1988) focusing on three stages, namely from a firm's initial evaluation of e-business at the pre-adoption stage (initiation), to its formal adoption decision being made by the appropriate decision maker(s), and finally to its full scale deployment and installation at the routinisation stage (post-adoption). It is in this last stage that e-business becomes a routine feature of the firm and it is fully utilized by its members, clients and customers.

The aim of this chapter is to provide an understanding of the process of e-business implementation and the impact of e-business on business performance in terms of revenue generation, cost reduction and operational efficiency. This chapter will be of value to organizations considering e-business and those at the early stages of e-business adoption, since it delineates the route travelled by other similar firms.

Having introduced the topic of e-business assimilation and its associated benefits, our chapter is comprised of four parts, namely a section that explores the possible benefits and challenges of e-business adoption; followed by a section that provides a coherent and comprehensive picture of the processes of e-business implementation in organizations; then a review of the literature related to the impact of e-business use on firm performance will be outlined; finally, the last section concludes with a discussion of the main implications and forwards suggestion for further research

## WHAT ARE THE POSSIBLE BENEFITS AND CHALLENGES OF E-BUSINESS?

An organization will only choose to adopt an innovation such as e-business if it perceives that doing so will provide comparatively greater benefits than existing methods. Many practitioners and researchers identified the potential benefits or opportunities of e-business as one of the most critical adoption factors (Saunders, 2000; Beatty *et al*., 2001; du Plessis & Boon, 2004; McIvor & Humphreys, 2004). Moreover, almost all studies acknowledge that the Internet provides an opportunity that business cannot afford to pass (Saunders, 2000).

Benefits of e-business adoption can be categorized into two groups, namely direct and indirect benefits. The direct benefits involve operational savings related to the internal efficiency of the organization such as reduced transaction costs, improved cash flow and 24 hour trading as well as information exchange and management. On the other hand, indirect benefits refer to the impact of e-business on business relationships and processes. Indirect benefits, for example, include better customer service, increases ability to compete and improved relationships with suppliers and trading partners. More importantly, e-business broadens an organization's customer base due to the possibility of operating globally through electronic means (Beatty *et al*., 2001; Dholakia & Kshetri, 2004; du Plessis & Boon, 2004; McIvor & Humphreys, 2004).

Conversely, the open nature of the Internet brings many challenges and concerns that inhibit firms from conducting business online. Challenges, for example, may include lack of awareness of e-business technologies, uncertainty about the benefits of e-business, lack of transparency and concerns that firms' products are not well suited for the Internet. Moreover, some authors consider privacy and security issues such as hacking, viruses, data intercepting, and misuse of credit cards as the biggest concern in doing business online (Auger & Gallaugher, 1997; Nath *et al*., 1998; Saunders, 2000; Zhu *et al*., 2006). These challenges in turn seem to pose unique demands on regulatory support different from other Internet technologies such as EDI (Zhu *et al*., 2006).

Government support and the existence of legal frameworks coupled with technologies that provide secure communications on the Internet such as secure socket layers (SSL) are critical factors in fostering e-business and have an important role to overcome e-business challenges. Indeed, government strategies should focus on knowledge building, regulation setting, conducting informational campaigns to increase awareness and provide financial subsidies. Generally, government policies and regulations are important factors that encourage firms to adopt and leverage the benefits associated with e-business technologies

## E-BUSINESS ADOPTION, DIFFUSION AND ASSIMILATION PROCESSES

Research on innovation adoption and diffusion continues to attract significant interest (Daft, 1978; Swanson, 1994; Gallivan, 2001; Frambach & Schillewaert, 2002; Damanpour& Wischnevsky, 2006; Damanpour & Schneider, 2008). The adoption of an innovation has been defined as the use of an internally generated or purchased device, system, policy, program, process, product, or service that is new to the organization (Daft, 1982). On the other hand, innovation diffusion refers to the process by which innovations spread to individuals within an organization or organizations over time (Rogers, 1995). Assimilation refers to an organization's first awareness of e-business technologies to, potentially, acquisition and widespread deployment (Meyer & Goes, 1988; Zhu *et al*., 2006).

E-business literature suggests that organizations pass through several stages on their way to full implementation or assimilation (Zaltman *et al*., 1973; Rogers, 1995; Van de Van *et al*., 2000; Gallivan, 2001; Damanpour & Schneider, 2006). For instance these stages have been proposed as: evaluation, initiation, implementation and routinisation (Hage & Aiken, 1970); initiation and implementation (Zaltman *et al*., 1973); initiation, adoption, adaptation, acceptance, routinisation and infusion (Cooper & Zmud, 1990); awareness, selection, adoption, implementation and routinisation (Klein & Sorra, 1996) and initiation, adoption and routinisation (Zhu *et al*., 2006).

Zaltman *et al*., (1973) presented the first widely accepted diffusion model specifically designed to guide inquiry at the organizational level. More recently, Rogers (1995) updated the earlier work of these authors, taking into account the progress of organizational diffusion research subsequent to the early 1970s. A brief summary of innovation adoption and diffusion process identified in the academic literature is presented in Table 1.

*Table 1. Summary of the process of innovation adoption and diffusion in organizations*

| | | |
|---|---|---|
| Hage & Aiken (1970)<br>1. Evaluation<br>↓<br>2. Initiation<br>↓<br>3. Implementation<br>↓<br>4. Routinisation | Zaltman *et al*., (1973)<br>**I. Initiation stage**<br>1. Knowledge and Awareness sub-stage<br>↓<br>2. Formation of attitudes towards the innovation sub-stage<br>↓<br>3. Decision sub-stage<br>**II. Implementation stage**<br>1.Trial Implementation sub-stage<br>↓<br>2.Sustained implementation sub-stage | Daft (1978)<br>1. Initiation of Idea<br>↓<br>2. Proposal<br>↓<br>3. Adoption (decision)<br>↓<br>4. Implementation |
| Zmud (1982)<br>1. Initiation<br>↓<br>2. Adoption (Decision)<br>↓<br>3. Implementation | Kwon & Zmud (1987) & Cooper & Zmud (1990)<br>1. Initiation<br>↓<br>2. Adoption<br>↓<br>3. Adaptation<br>↓<br>4. Acceptance<br>↓<br>5. Routinisation<br>↓<br>6. Infusion | Klein & Sorra (1996)<br>1. Awareness<br>↓<br>2. Selection<br>↓<br>3. Adoption<br>↓<br>4. Implementation<br>↓<br>5. Routinisation |
| Rogers(1995)<br>**I. Initiation stage**<br>1. Agenda-Setting<br>↓<br>2. Matching<br>**II. Implementation stage**<br>1. Redefining /Restructuring<br>↓<br>2. clarifying<br>↓<br>3. Routinisation | Dholakia & Kshetri (2004)<br>1. Pre-adoption<br>↓<br>2. Adoption<br>↓<br>3. Routinisation | Zhu *et al*., (2006)<br>1. Initiation<br>↓<br>2. Adoption<br>↓<br>3. Routinisation |

Zhu *et al*., (2006) note that the process of e-business assimilation in organizations can be broadly viewed as a multi-phase process consisting of three stages; the initiation of e-business or pre-adoption, adoption, and routinisation or post-adoption and this requires business activities to continue on an ongoing basis to accommodate and enhance changing relationships with customers and business partners (Norris *et al*., 2000). Indeed, if e-business implementation is not taken seriously, it can have very negative consequences for organizations (Barua *et al*., 2001).

*Initiation* is the first stage of e-business diffusion in which the adopting organization starts to gather the required information and evaluates the possible benefits of e-business such as expanding market share and having access to international and/or regional customer and supplier information. Moreover, in this stage, firms prepare for enterprise-wide e-business adoption efforts.

Generally, the next stage is *adoption*. It is here that firms consider the decision to commit resources to the acquisition of e-business technologies, and evaluate proposed ideas from technical, financial and strategic perspectives. More importantly, top management may decide to adopt the innovation and allocate resources (Rogers, 1995; Chau & Tam, 1997). Zaltman *et al*., (1973) note that the attitudes organizational members have towards an innovation are important, and if top managers (committees and/or boards) are motivated to innovate and/or have favorable attitudes toward the innovation, there is likely to be a positive attitude to implement e-business, and resources will be allocated for its acquisition and alteration (Meyer & Goes, 1988). Conversely, if there are less favorable attitudes toward e-business, there is a greater likelihood that it will not be implemented (Zaltman *et al*., 1973).

After an IT innovation is adopted, it then needs to be accepted, adapted, routinised, and institutionalized (Zhu *et al*., 2006). In their study of the implementation of material requirements planning (MRP), Cooper & Zmud (1990) report that, while 73% of surveyed organizations were adopting MRP, only 27% of them had progressed in their adoption and integrated MRP into their capacity planning, which indicated a significant assimilation gap and a relatively low level of utilization.

Correspondingly, Liker *et al*., (1992) report that although computer aided design (CAD) technologies had achieved extensive market penetration in the 1980s, even as late as 1992 widespread deployment of CAD was rare; which implies that widespread acquisition of an innovation is not necessarily followed by widespread use by the acquiring organization (Fichman & Kemerer, 1999). Hence, adoption and routinisation are seen as two distinct stages (Zhu *et al*., 2006); in the routinisation stage, the technology is no longer perceived as something out of the ordinary; but instead, is 'taken for granted', and pervasively integrated into the organization (Tolbert & Zucker, 1996).

Further literature has correlated high degrees of e-business usage and routinisation with increased levels of performance in terms of increased sales, improved customer services, reduced inventory and procurement costs, improved coordination with suppliers, and increased employee productivity (Wu *et al*., 2003; Zhu *et al*., 2004; Levenburg, 2005; Zhu & Kraemer, 2005; Sanders, 2007). The following section discusses the relationship between post-adoption stages (routinisation) in e-business diffusion and business performance.

## IMPACT OF E-BUSINESS ADOPTION ON PERFORMANCE

Definitions of good business performance include: continuing to stay in business (Reid, 1991), achieving the desirable level of sales and financial returns (Zhu *et al*., 2004), introduction of new product and service lines, increasing the quality of product and service offerings (Venkatraman & Ramanujam, 1986); and increasing the levels of customer satisfaction, coordination and collaboration (Paul & McDaniel; 2004; Zhu *et al*., 2004; Chang & Wang, 2008). Empirical studies have reported that the successful implementation of e-business is seen to improve organizational performance. Table 2 provides an overview of several empirical studies investigating the impact of e-business usage and routinisation on financial performance. These findings all suggest that research on innovation adoption must ideally consider both adoption antecedents and performance outcomes in a single context; however, the studies differ in terms of performance measures.

According to Zhu *et al*., (2004), the extent of e-business usage is found to help increase sales, improve customer services, reduce inventory and procurement costs, improve coordination with suppliers, increase employee productivity and make internal processes more efficient. Moreover, Clayton & Goodridge (2004) point out that firms that use e-business for conducting their business processes and activities are found to have higher average labor productivity than firms without such links, and the most productive firms have multiple linkages that include suppliers or customers. In addition, a study by Levenburg (2005) has indicated that the use of e-business tools such as electronic supply chain management (e-SCM)

*Table 2. The impact of e-business usage and routinisation on firm's performance*

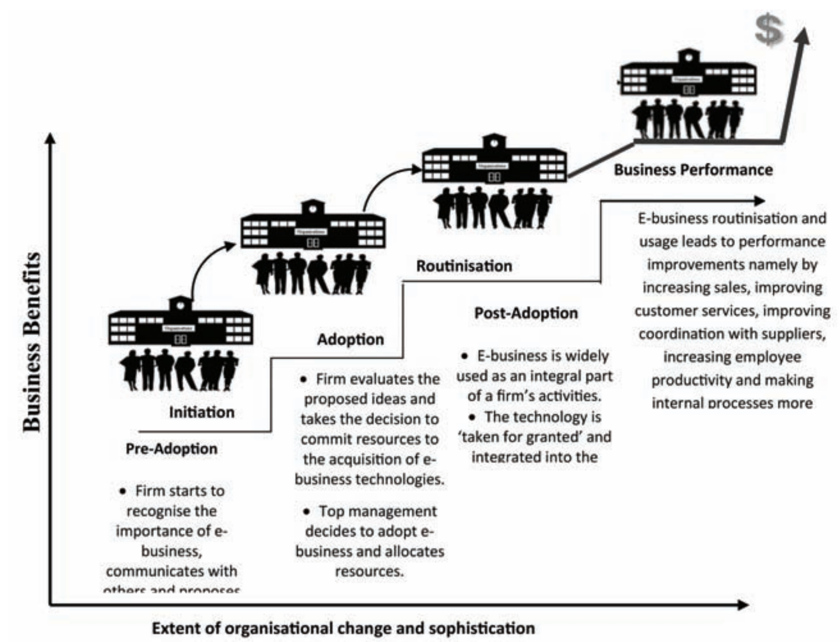
| Source | Performance measures | Major findings |
|---|---|---|
| Wu *et al*., 2003 | Performance measures were (1) efficiency, (2) sales performance, (3) customer satisfaction, and (4) relationship development | E-business use has a significant influence on performance. |
| Zhu *et al*., 2004 | Performance was conceptualized by three dimensions (1) impact on commerce (increasing sales, improving customer services, and widening sales channels); (2) impact on internal efficiency (increasing employee productivity and internal processes efficiency), and (3) impact on *coordination* (reducing transaction costs with business partners, and improving coordination with business partners or suppliers). | As firms move into deeper stages of e-business transformation, the key determinant of e-business value shifts from monetary spending to higher dimensions of organizational capabilities. Moreover, large firms as opposed to smaller firms, are less likely to realize the impact of e-business on their performance |
| Clayton & Goodridge,2004 | Performance was examined using labor productivity using 'Gross Value Added at basic prices' (GVA). | E-business usage is found to improve efficiency, productivity and hence profitability. Moreover, firms that integrate e-business through the enterprise, tend to be more productive than firms that do not adopt e-business. |
| Levenburg, 2005 | Performance was examined using four financial measures (1) sales performance, (2) direct costs to create product or service, (3) shipping cost, and (4) net profit. | The use of e-business tools such as electronic supply chain management (e-SCM) impacts firm's performance and it offers many opportunities to small and medium businesses such as profit increase. |
| Zhu & Kraemer, 2005 | Performance was measured by an integrative measure of the level of Internet-enhanced business performance using three dimensions (1) impact on sales, (2) impact on procurement and (3) impact on internal operations—along the value chain | Higher degrees of e-business usage will be associated with improved business performance. Moreover, only when firms are actually using e-business to conduct value chain activities can e-business have an impact on performance. |
| Sanders, 2007 | Performance composed of multiple measures namely (1) cost, (2) quality, (3) delivery, and (4) new product introduction time | Firms' use of e-business technologies has a direct and positive impact on their performance. |

offers many opportunities to small and medium businesses namely, increased sales and profits, reduced direct costs to create products and/or services, reduced shipping costs, and increased net profits. Similarly, research by Zhu *et al*., (2006a) posits that e-business usage leads to performance improvements in internal and external operations. This argument is consistent with empirical findings of Wu *et al*., (2003) who report that e-business use had a significant influence on performance (i.e., increased efficiency, sales performance, customer satisfaction, and better relationship development). In a more recent study, Sanders, (2007) proposes a model of the relationship between organizational use of e-business technologies, organizational collaboration, and performance, using empirical data. Collectively, we can conclude that e-business routinisation and usage is strongly related to organizational performance. Figure 1 presents a generic overview of the stages involved with e-business adoption and assimilation and their business benefits.

## CONCLUSION AND IMPLICATIONS FOR FUTURE RESEARCH

Firms adopt e-business initiatives to help manage their internal business processes as well as their interfaces with the environment (Wu *et al*., 2003). However, the open nature of the Internet brings many challenges such as hacking, viruses, data intercepting, and misuse of credit cards. These substantial risks notwithstanding, the Internet provides an opportunity that business cannot afford to avoid. Indeed, businesses are finding the web to be a relatively cheap form of advertising and they can use their websites for better customer service

*Figure 1. Benefits of e-business implementation and diffusion in organizations*




and to improved relationships with suppliers and trading partners.

Based on innovation diffusion and e-business implementation literature, e-business adoption and assimilation include three stages, namely: *(a) initiation* – showing interest in e-business applications, *(b) adoption* - a phase that represents a decision being made by the appropriate organization decision maker(s) providing resources for the change; and *(c) routinisation* – it is known that e-business can be used as an integral part of a firm's activities and can be used to sustain recognizable behavior and operational patterns within the organization (Pierce & Delbecq, 1977). This is consistent with the work of Thompson (1965), Meyer & Goes (1988), Fichman (2000) & Zhu *et al*. (2006) in which innovation implementation is recognized as a multi-phased process, and not an event occurring at a single point in time.

Subsequently, it is believed that higher degrees of e-business usage at the post-adoption stage will be strongly associated with improved performance and by only examining the initial adoption phase managers might be measuring the wrong performance characteristics. Thus, by just managing initial adoption, this might not reveal the fully realized benefits of new IT investment, because IT often creates business value in the subsequent stages and needs time to become embedded within the organization (Zhu & Kraemer, 2005).

The recent highs and lows of e-business have renewed the urgency for understanding the relationship between e-business and firm performance. Generally speaking, to capture more understanding about this practice, future research should identify how technological, environmental and organizational characteristics affect e-business adoption and assimilation process. For instance, such efforts should look at the effect of factors such as organizational structure (i.e., formularization, centralization) at different phases of the e-business adoption process and its impact upon the ultimate realization of business benefits.

Diffusion research in different disciplines points to the relevance of supply side factors in explaining the process of adoption and diffusion of technological innovations (Frambach, 1993). Moreover, Frambach (1993) asserts that a supplier's marketing activity can influence the probability that a technology will be adopted by an organization. Ultimately, further research should also investigate how technology suppliers' marketing strategies affect organizations' perceptions of e-business technologies at different phases of the e-business implementation process.

In conclusion the impact of new technology depends on the extent to which it is used in key value-chain activities and indeed, it is through ingrained use that the new technology can improve business performance (Cooper & Zmud, 1990; Zhu *et al*., 2006a). Moreover, it is imperative that organizations effectively manage the e-business environment to attain the efficiencies generated by e-business infrastructures and activities by paying close attention to maintaining the e-business environment (Singh, 2003).

Future research in this area should focus on longitudinal studies examining implementation and impacts on performance, or compare e-business adoption in industrialized countries to developing and newly industrialized countries. In many ways, e-business is still new -there is much yet to happen and much yet to be learned (Zhu *et al*., 2004).

## REFERENCES

Auger, P., & Gallaugher, J. M. (1997). Factors affecting the Adoption of an Internet-Based Sales Presence for Small Business. *The Information Society*, *13*(1), 55–74. doi:10.1080/019722497129287

Barua, A., Konana, P., Whinston, A., & Yin, F. (2001 January/February). Measures for e-business value assessment. *IT Pr.*, 35-39.

Beatty, R. C., Shim, J. P., & Jones, M. C. (2001). Factors influencing corporate web site adoption: a time-based assessment. *Information & Management*, *38*, 337–354. doi:10.1016/S0378-7206(00)00064-1

Chang, H. H., & Wang, I. C. (2008). The relationship between network structure and international channel performance: a moderating effect of E-business activity. *The Service Industries Journal*, *28*(2), 255–274. doi:10.1080/02642060701843595

Chau, P. Y. K., & Tam, K. Y. (1997). Factors affecting the adoption of open systems: an exploratory study. *MIS Quarterly*, *21*(1), 1–21. doi:10.2307/249740

Clayton, T., & Goodridge, P. (2004). E-business and labour productivity in manufacturing and services. *Economic Trends*, 609, 47–53. Retrieved December 29, 2008, from http://www.statistics.gov.uk/CCI/article.asp?ID=945

Cooper, R. B., & Zmud, R. W. (1990). Information technology implementation research: a technological diffusion approach. *Management Science*, *36*(2), 123–139. doi:10.1287/mnsc.36.2.123

Daft, R. L. (1978). A dual–core Model of Organizational innovation. *Academy of Management Journal*, *21*(2), 193–210. doi:10.2307/255754

Daft, R. L. (1982). Bureaucratic Versus Non bureaucratic Structure and the Process of innovation and Change. In S. R. Bacharach (Ed.), *Research in the Sociology of organizations* (pp. 122-166). Greenwich, CT: JAI Press.

Damanpour, F., & Schneider, M. (2008). Characteristics of Innovation and Innovation Adoption in Public Organizations: Assessing the Role of Managers. *Journal of Public Administration Research and Theory Advance Access*. Retrieved January 19, 2009, From http://jpart.oxfordjournals.org/cgi/content/full/mun021v1

Damanpour, F., & Wischnevsky, J. D. (2006). Research on innovation in organizations: Distinguishing innovation-generating from innovation-adopting organizations. *Journal of Engineering and Technology Management*, *23*(4), 269–291. doi:10.1016/j.jengtecman.2006.08.002

Del Aguila-Obra, A. R., Bruque-Camara, S., & Padilla-Meléndez, A. (2002). Internet usage and competitive advantage: the impact of the Internet on an old economy sector. *Internet Research*, *12*(5), 391–401. doi:10.1108/10662240210447146

Dholakia, R. R., & Kshetri, N. (2004). Factors Impacting the Adoption of the Internet among SMEs. *Small Business Economics*, *23*, 311–322. doi:10.1023/B:SBEJ.0000032036.90353.1f

du Plessis, M., & Boon, J. A. (2004). Knowledge Management in eBusiness and Customer Relationship Management: South African Case Study Findings. *International Journal of Information Management*, *24*, 73–86. doi:10.1016/j.ijinfomgt.2003.10.002

Fichman, R. G. (2000). The diffusion and assimilation of information technology innovations. In R. W. Zmud (Ed.), *Framing the Domains of IT Management: Projecting the Future through the Past* (pp.105–127). Cleveland, OH: Pinnaflex Publishing.

Fichman, R. G., & Kemerer, C. (1999). The illusory diffusion of innovation: An examination of assimilation gaps. *Information Systems Research*, *10*(3), 255–275. doi:10.1287/isre.10.3.255

Frambach, R. (1993). An integrated model of organizational adoption and diffusion of innovations. *European Journal of Marketing*, *27*(5), 22–41. doi:10.1108/03090569310039705

Frambach, R. T., & Schillewaert, N. (2002). Organizational innovation adoption: a multi-level framework of determinants and opportunities for future research. *Journal of Business Research*, *55*(2), 163–176. doi:10.1016/S0148-2963(00)00152-1

Gallivan, M. J. (2001). Organizational adoption and assimilation of complex technological innovations. *The Data Base for Advances in Information Systems*, *32*(3), 51.

Hage, J., & Aiken, M. (1970). *Social change in complex organizations*. New York: Random House.

Hong, W., & Zhu, K. (2006). Migrating to internet-based e-commerce: Factors affecting e-commerce adoption and migration at the firm level. *Information & Management*, *43*(2), 204–221. doi:10.1016/j.im.2005.06.003

Klein, K. J., & Sorra, J. S. (1996). The challenge of innovation implementation. *Academy of Management Review*, *21*, 1055–1080. doi:10.2307/259164

Levenburg, N. M. (2005). Does Size Matter? Small Firms' Use of E-Business Tools in the Supply Chain. *Electronic Markets*, *15*(2), 94–105. doi:10.1080/10196780500083746

Liker, J. K., Fleischer, M., & Arnsdorf, D. (1992). Fulfilling the promises of CAD. *Sloan Management Review*, *33*(3), 74–86.

Lin, H., & Lin, S. (2008). Determinants of e-business diffusion: A test of the technology diffusion perspective. *Technovation*, *28*, 135–145. doi:10.1016/j.technovation.2007.10.003

McIvor, R., & Humphreys, P. (2004). The Implications of Electronic B2B Intermediaries for the Buyer-Supplier Interface. *International Journal of Operations & Production Management*, *24*(3), 241–269. doi:10.1108/01443570410519024

Meyer, A. D., & Goes, J. B. (1988). Organizational assimilation of innovations: a multilevel contextual analysis. *Academy of Management Journal*, *31*, 897–923. doi:10.2307/256344

Moore, G., & Benbasat, I. (1991). Development of an instrument to measure the perceptions of adopting an information technology innovation. *Information Systems Research*, *2*(3), 192–221. doi:10.1287/isre.2.3.192

Nath, R., Akmanligil, M., Hjelm, K., Sakaguchi, T., & Schultz, M. (1998). Electronic commerce *and the* internet*:* issues, problems, and perspectives. *International Journal of Information Management*, *18*(2), 91–101. doi:10.1016/S0268-4012(97)00051-0

Paul, D. L., & McDaniel, R. R. (2004). A field study of the effect of interpersonal trust on virtual collaborative relationship performance. *MIS Quarterly*, *28*(2), 183–227.

Pierce, J. L., & Delbecq, A. L. (1977). Organization Structure, Individual Attitudes and Innovation. *Academy of Management Review*, *2*(1), 26–37. doi:10.2307/257602

Ramamurthy, K., Premkumar, G., & Crum, M. (1999). Organizational and Inter-organizational Determinants of EDI Diffusion and Organizational Performance: A Causal Model. *Journal of Organizational Computing and Electronic Commerce*, *9*(4), 253–285. doi:10.1207/S153277440904_2

Reid, G. C. (1991). Staying in business. *International Journal of Industrial Organization*, *9*, 545–556. doi:10.1016/0167-7187(91)90064-R

Rogers, E. M. (1995). *Diffusion of Innovations* (4th Ed.). New York: The Free Press.

Sanders, N. R. (2007). An empirical study of the impact of e-business technologies on organizational collaboration and performance. *Journal of Operations Management*, *25*, 1332–1347. doi:10.1016/j.jom.2007.01.008

Saunders, G. (2000). Commercial Use of the Internet: Some Pros and Cons. *The Journal of Applied Business Research*, *16*(1), 1–7.

Singh, M. (2003). *Innovation and Change Management.* In *E-Business Innovation and Change Management.* Hershey, PA, USA: Idea Group Inc.

Swanson, E. B. (1994). Information Systems Innovations among Organizations. *Management Science*, *40*(9), 1069–1092. doi:10.1287/mnsc.40.9.1069

Thompson, V. A. (1965). Bureaucracy and innovation. *Administrative Science Quarterly*, *10*, 1–20. doi:10.2307/2391646

Tolbert, P., & Zucker, L. (1996). The Institutionalization of Institutional theory. In S. Clegg, C. Hardy & W. Nord (Eds.), *Handbook of Organization Studies* (pp. 175-190). Thousand Oaks, CA: Sage Publications.

Van Beveren, J., & Thomson, H. (2002). The use of electronic commerce by SMEs in Victoria, Australia. *Journal of Small Business Management*, *40*(3), 250–253. doi:10.1111/1540-627X.00054

Van Slyke, C. (1998). *Technology cluster innovations: impacts of adding a technology to an existing cluster.* Unpublished doctoral dissertation, University of Central Florida, USA.

Venkatraman, N., & Ramanujam, V. (1986). Measurement of Business Performance in Strategy Research: A Comparison of Approaches. *Academy of Management Review*, *11*(4), 801–814. doi:10.2307/258398

Wu, F., Mahajan, V., & Balasubramanian, S. (2003). An Analysis of E-Business Adoption and Its Impact on Business Performance. *Journal of the Academy of Marketing Science*, *31*(4), 425–447. doi:10.1177/0092070303255379

Zaltman, G., Duncan, R., & Holbek, J. (1973). *Innovations and Organizations*. New York: Wiley.

Zhao, J., Huang, W. V., & Zhu, Z. (2008). An Empirical Study of E-Business Implementation Process in China. *IEEE Transactions on Engineering Management*, *55*(1), 44–73. doi:10.1109/TEM.2007.912930

Zhu, K., Dong, S., Xu, S. X., & Kraemer, K. L. (2006a). Innovation diffusion in global contexts: determinants of post-adoption digital transformation of European companies. *European Journal of Information Systems*, *15*(6), 601–616. doi:10.1057/palgrave.ejis.3000650

Zhu, K., Kraemer, K., & Xu, S. (2003). Electronic business adoption by European firms: a cross-country assessment of the facilitators and inhibitors. *European Journal of Information Systems*, *12*(4), 251–268. doi:10.1057/palgrave.ejis.3000475

Zhu, K., & Kraemer, K. L. (2005). Post-adoption variations in usage and value of e-business by organizations: Cross-country evidence from the retail industry. *Information Systems Research*, *16*(1), 61–84. doi:10.1287/isre.1050.0045

Zhu, K., Kraemer, K. L., & Xu, S. (2006). The Process of Innovation Assimilation by Firms in Different Countries: A Technology Diffusion Perspective on E-Business. *Management Science*, *52*(2), 1557–1576. doi:10.1287/mnsc.1050.0487

Zhu, K., Kraemer, K. L., Xu, S., & Dedrick, J. L. (2004). Information technology payoff in e-business environments: An international perspective on value creation of e-business in the financial services industry. *Journal of Management Information Systems*, *21*(1), 17–54.

Zmud, R. W. (1982). Diffusion of modern software practices: influence of centralization and formalization. *Management Science*, *28*, 1421–1431. doi:10.1287/mnsc.28.12.1421

## KEY TERMS AND DEFINITIONS

**Diffusion:** refers to the process by which innovations spread to individuals within an organization or organizations within a population over time through various channels (Rogers, 1995; Fichman & Kemerer, 1999)

**E-Business Adoption:** is the process during which a firm becomes able to make full use of e-business technologies as the best course of action available, while rejection is the decision to not to adopt (Rogers, 1995)

**E-Business Assimilation:** is a multi-phase process which refers to an organization's first awareness of e-business technologies to, potentially, acquisition and widespread deployment (Meyer & Goes, 1988; Zhu *et al*., 2006).

**E-Business Impact:** refers to the actual benefits adopters receive from utilising e-business (Wu *et al*., 2003; Zhu *et al*., 2004; Clayton & Goodridge, 2004; Levenburg, 2005; Zhu & Kraemer, 2005; Sanders, 2007).

**Electronic Business or E-Business:** refers to the use of Internet technologies (e.g. e-mail, World Wide Web) combined with information technologies to support companies' business activities and functions such as purchasing from suppliers and selling products and services to customers (Zhu *et al*., 2006).

**Implementation:** concerns the extent to which development, feedback, and adjustment activities are performed so that it becomes embedded in business operations (Thompson, 1965).

**Innovation:** is 'an idea, practice or object that is perceived as new by individuals or other units of adoption' (Rogers, 1995. pg.11).

**Routinisation:** is defined as the stage in which e-commerce is widely used as an integral part in a firm's activities (Zhu *et al*, 2006).

# Chapter 11
# B2B Website Benefits Realization in Australian SMEs

**Chad Lin**
*Curtin University of Technology, Australia*

**Yu-An Huang**
*National Chi Nan University, Taiwan*

**Rosemary Stockdale**
*Massey University, New Zealand*

## INTRODUCTION

One aspect of small and medium-sized enterprises (SMEs) electronic commerce activity that is acknowledged but rarely examined is their use of websites as they are a critical element of their business growth and competitiveness (Loiacono et al., 2002). Their successful design and use can alter the effectiveness of an SME's venture into electronic commerce. However, SMEs are still lagging behind larger organizations in the adoption and evaluation of their electronic commerce activities despite the benefits it offers (Lin et al., 2007) and in overcoming the potential barriers that hamper their evaluation practices (Standing and Lin, 2007). Understanding the factors used by the SMEs' potential customers to evaluate their website effectiveness can serve as a basis for creating and improving websites (Simmons et al., 2007).

Moreover, only a handful of studies so far have examined specifically at the issue of (business-to-business) B2B website effectiveness (Berthon et al., 2003). Most of these published academic studies are somewhat limited by their use of B2C websites, student/faculty samples, and small sample sizes (Chakraborty et al., 2002). Very few studies have empirically demonstrated what organizational drivers lead to the effectiveness of a B2B website (Chakraborty et al., 2002). Therefore, the main aim of this research is to examine the relationships between B2B website adoption readiness (*WSAR*), B2B website adoption barriers (*WSAB*), IT investment evaluation (*ITIE*), and B2B benefits (*Benefits*) in Australian SMEs. A key contribution of the study

DOI: 10.4018/978-1-61520-611-7.ch011

is the identification of the factors which would influence the realization of B2B website benefits for Australian SMEs.

## BACKGROUND

Statistics show that 36% of small and 82% of medium-sized businesses in Australia have established a website (ABS, 2003). Two thirds of SMEs believe that their website enhances their business effectiveness, by increasing visibility and accessibility, improving communications and increasing sales (ABS, 2003). This accords with view by Loiacono et al. (2002) that effective communication of a B2B website plays a key role in successfully conveying its messages and influencing stakeholders' behavior and satisfaction. The implementation of B2B websites is seen as an important stage in e-commerce development and a crucial part of a firm's use of the Internet for communicating, entertaining and interaction with stakeholders.

However, the effectiveness of B2B websites and organizational drivers which influence it are rarely addressed (Manuel, 2004). For example, the findings reveal that Italian SMEs, fearing being imitated by their competitors, possess lower level of B2B e-commerce adoption readiness. However, their Asian counterparts exhibit little fear of information leakages and tend to be more prepared in their exploitation of e-commerce via their B2B websites. There are numerous online sources offering, often conflicting, advice and help on setting up a website while business organizations and government sources continue to encourage SMEs to launch websites. The proliferation of sites has increased the imperative for businesses to have some knowledge of what they intend their site to achieve.

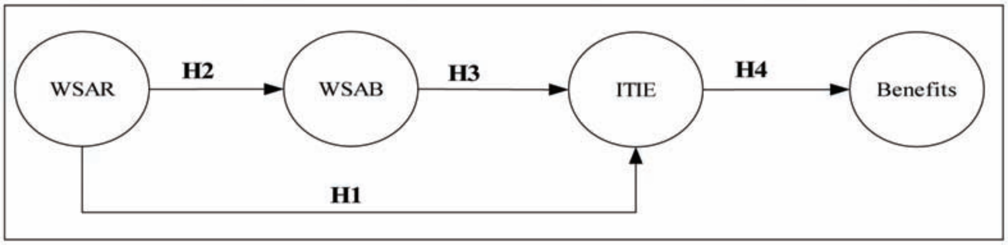
## THEORETICAL BACKGROUND

According to the organizational view, organizations wishing to increase their outputs need to have a close linkage between their IT infrastructures (B2B website adoption readiness) and supporting business architecture (IT investment evaluation) (Parker, 1996). It recognizes that both IT and business domains (i.e. IT infrastructures and supporting business architecture) should be managed and positioned in terms of their respective IT and business focuses. Organizations wishing to increase their outputs need to have a closer strategic alignment between their exiting organizational drivers (Parker, 1996). Not surprisingly, organizations with a high strategic alignment between organizational drivers have been found to exhibit better performance (Chan et al., 1997). In other words, in order for organizations to derive significant benefits from their B2B website investments, senior executives have to ensure that a clear linkage exists between the level of B2B website adoption readiness and IT investment evaluation (Parker, 1996).

### Limit-to-Value Model in B2B Website Benefits Realization

The limit-to-value model highlights how B2B website adoption barriers within a SME can impact on the realization of B2B benefits. The Chircu and Kauffman's limit-to-value model (2000) was adapted to describe the barriers and benefits and associated with B2B website adoption. The model attempts to identify and a number of industry-independent sources of benefits. In order to determine the potential B2B benefits for a specific industry or a specific organization (SME), the contribution of all the benefits need to be measured during the B2B website evaluation process. Industry adoption barriers also need to be carefully determined and assessed. Potential benefit to a SME is the maximum benefit that can be obtained within the overall environment.

*Figure 1. A research model of B2B website benefits*




However, problems are likely to occur during B2B website adoption and therefore, the realized benefit will be less than 100%. Hence, this process is fraught with industry adoption barriers that can determine the amount of potential B2B benefits that can be successfully transformed into realized B2B benefits. SMEs need to overcome as many adoption barriers as possible in order to obtain maximum B2B benefits from the adoption of their websites.

## A Research Model of B2B Website Benefits

It is also arguable that B2B website adoption readiness can assist organizations in employing IT investment evaluation and in reducing the B2B website adoption barriers. This in turn will enhance their B2B website effectiveness by realizing B2B benefits. The adoption of IT investment evaluation enables organizations to undertake planning and evaluation activities (Standing and Lin, 2007) which will force themselves to make some serious efforts to formulate strategies in order to maximize their B2B website benefits.

Therefore, we extend our argument to posit that higher levels of strategic alignment between B2B website adoption readiness and the adoption of IT investment evaluation can lead to lower level of B2B website adoption barriers and higher level of B2B website benefits (Figure 1).

## Research Hypotheses

The B2B website adoption readiness refers to an organization's capability to utilize its existing organizational infrastructure to obtain business value from its B2B (Soliman and Janz, 2004). The adoption of investment evaluation is crucial for organizations to measure the contribution of their IT investments to business performance (Lin et al., 2007). Therefore, organizations need to ensure that their level of B2B website adoption readiness is favorable to the adoption of IT investment evaluation in order to maximize the likelihood of successful adoption of IT investment evaluation. Thus, the following hypothesis is derived:

**H1:** The level of B2B website adoption readiness is positively related to the level of IT investment evaluation.

According to Chircu and Kauffman (2000), the level of barriers within the organization can have a significant impact on the amount of potential B2B benefit that can be successfully transformed into realized B2B benefit. Organizations need to overcome or minimize as many barriers as possible in order to obtain maximum B2B benefits (Chircu and Kauffman, 2000). One good way of lowering the level of B2B adoption barriers is to strengthen its B2B adoption readiness (Lin et al., 2008). Therefore, we argue that the level of B2B website adoption readiness has a significant negative relationship with the level of B2B website adoption barriers. Thus, the hypothesis is derived:

**H2:** The level of B2B website adoption readiness is negatively related to the level of B2B website adoption barriers.

Recent literature has suggested the there is some relationship between the level of barriers and the level of IT investment evaluation (Chircu and Kauffman, 2000). Organizations which have lower level of barriers are generally more capable of adopting an IT investment evaluation methodology (Standing and Lin, 2007). In other words, an organization's ability to overcome, for example, organizational barriers has a significant impact on the level of IT evaluation methods or processes adopted by the organization. Hence, when barriers are high there is a tendency for organizations to evaluate less. We argue that the level of barriers related to the B2B website adoption is negatively related to the level of IT investment evaluation:

**H3:** The level of B2B website adoption barriers is negatively related to the level of IT investment evaluation.

IT investment evaluation assist in assessing projects that offer the greatest benefits for the investment and ensures expected benefits are identified and realized after a decision to invest has been taken (Ward and Daniel, 2006). For example, it can help to underscore best practices which organizations can apply to future IT investment evaluation processes and this will have some impact on organizations' B2B benefits (Lin et al., 2008). Hence, the following hypothesis is derived:

**H4:** The level of IT investment evaluation is positively related to the level of B2B benefits.

## RESEARCH METHODOLOGY

### Data Collection

Prior to mailing out the main survey, 20 Australian SMEs owners/CEOs running B2B websites were surveyed and interviewed in relation to the questionnaire. Subsequent analysis of the results gave support for the use of the questionnaire as designed. For the main survey, 1000 Australian SMEs trading in a B2B e-commerce environment were randomly selected from the Dun and Bradstreet Business Who is Who Database. A total of 201 valid questionnaires were collected.

Chi-squared Goodness of Fit test, on industry type, showed that the sample respondents were not significantly different to the target population. Thus, the sample is representative of the target population. In addition, the potential problems inherent in a survey make the analysis of non-respondents a crucial exercise in order to avoid non-response bias. One of the key assumptions in such an approach is that later respondents to a survey are more similar to nonrespondents than are earlier respondents (Armstrong and Overton, 1977). A chi-square analysis was performed to compare late returns with earlier responses in order to check for non-response bias (Armstrong and Overton, 1977). No significant differences were detected between the two samples on total number of employees.

### Measurement

The survey was conducted to examine the relationships between the B2B website adoption readiness, B2B website adoption barriers, IT investment evaluation, and B2B benefits. Respondents were asked to indicate their agreement on a seven-point Likert scale (1 for strongly disagree and 7 for strongly agree) with statements concerning the four main constructs. The reliability analysis (alpha) was conducted on these five main constructs. Cronbach's alphas and measurement for

*Table 1. Correlation matrix for constructs*

| | Mean | C1 | C2 | C3 | C4 | Alpha[a] | CR[b] |
|---|---|---|---|---|---|---|---|
| C1 WSAR | 4.38 | *.74*[c] | | | | .91 | .89 |
| C2 WSAB | 3.26 | -.341*** | *.75* | | | .88 | .90 |
| C3 ITIE | 4.44 | .258*** | -.620*** | *.74* | | .87 | .89 |
| C4 Benefits | 4.40 | .313*** | -.499*** | .414*** | *.85* | .93 | .94 |

*p< .05; **p< .01; ***p< .001
[a]Internal Consistency Reliability Cronbach's coefficient alpha.
[b]Composite Reliability (Fornell and Larcker, 1981).
[c] The diagonal (in italics) shows the average variance extracted (Fornell and Larcker, 1981) for each construct.

all constructs are provided in Table 1 with all above 0.70 indicating an acceptable reliability of the measures (Nunnally, 1978). Table 1 presents the descriptive statistics and covariance for the variables used in this study.

A reliable and valid scale for measuring the factors that lead to effective B2B websites is needed. Based on the review of the relevant literature, the operational definitions of constructs that influence SMEs' B2B website effectiveness was developed and described as followed:

The B2B WebSite Adoption Readiness *(WSAR)* scale was derived from Soliman and Janz (2004). The B2B website adoption readiness refers to an organization's capability to utilize its existing organizational infrastructure to obtain business value from its B2B (Soliman and Janz, 2004). The scale measured the degree of fit between the adoption of B2B e-commerce and the values, beliefs, and business needs of firms (Soliman and Janz, 2004). The scale has three items and the alpha value for this scale is 0.91

The B2B WebSite Adoption Barriers (*WSAB*) scale was derived from Standing and Lin (2007). Barriers related to B2B website adoption measured the resources in terms of financial, technical and managerial expertise to manage and run a B2B website. The scale has four items and the alpha value for this scale is 0.88.

The *IT Investment Evaluation (ITIE)* scale was derived from Lin and Pervan (2003). The scale measured the use of IT investment evaluation and benefits realization processes of Australian SMEs investing in B2B websites. The scale has three items and alpha values for this scales is 0.87. The scale measured the use of IT investment evaluation methodology, the processes taken to identify, review, evaluate, and realize the benefits during the website adoption, and the inclusion of intangible benefits in the evaluation process (Lin and Pervan, 2003).

The *B2B Benefits* (*Benefits*) scale was derived from scales used by Tsao et al. (2004). The scale has three items and the alpha value for this scale is 0.93. The scale measured the costs, relationships with suppliers and efficiency associated with running a B2B website, . In the absence of objective data on B2B benefits, the perceptions of owners or senior executives were used.

## RESEARCH FINDINGS

All measures were then analyzed for reliability and validity in accordance with the guidelines set out by Jöreskog and Sörbom (1993). Confirmatory factor analysis (CFA) was used to construct a measurement model composed of the four constructs using maximum likelihood in LISREL 8.72. Overall, the resulting fit indexes indicated that the measurement model fitted the data well: chi-square ($\chi 2$) = 105.183 (89 degrees of freedom (*d. f*)), $p = 0.116$, comparative fit index (CFI) = 0.996, root mean square error of approximation (RMSEA) = 0.030, goodness-of-fit index (GFI) = 0.937, and adjusted goodness-of-fit index (AGFI) = 0.904. The value of (Chi-square/degree of freedom) is less than 2 and the GFI and AGFI values are all equal to or greater than the acceptable value of 0.900 (Hair et al., 1998). In addition, RMSEA value is less than the acceptable value of 0.050 (Hair et al., 1998). The above figures imply good model fit.

Furthermore, we assessed convergent validity by examining composite reliability (CR) and average variance extracted (AVE) from the measures (Hair et al., 1998). Our CR values of the five antecedent constructs were between 0.89 and 0.94 and all are above the suggested minimum of 0.700 (Hair et al., 1998). Their AVE values were between 0.74 and 0.85 and these values provided further evidence of convergent validity (Fornell and Larcker, 1981) (see Table 1).

The results indicated that B2B website adoption readiness had a significant and negative impact on the level of B2B website adoption barriers ($\beta$= -0.406*******) while the level of B2B website adoption barriers had also a negative relationship with the level of IT investment evaluation adoption ($\beta$= -0.572*******). Therefore, both **H2** and **H3** were supported. However, there was no significant relationship between B2B website adoption readiness and IT investment evaluation adoption ($\beta$= 0.025). As a result, **H1** was not supported. In addition, the level of IT investment evaluation adoption was positively related to the realization of B2B benefits ($\beta$= 1.217*******), but had no significant impact on the degree of satisfaction with B2B website adoption ($\beta$=0.03). Therefore, **H4** was supported. In summary, **H2** (Readiness→Barriers), **H3** (Barriers→Evaluation) and **H4** (Evaluation→Benefits) were supported while **H1** (Readiness→Evaluation) was not supported.

## CONCLUSION AND IMPLICATIONS

The empirical results have supported the model of B2B website benefits developed. That is, the three constructs directly or indirectly influenced the realization of B2B benefits and the degree of satisfaction with B2B website adoption was positively affected by the SMEs' ability to realize the benefits. In particular, we have provided evidence that the level of B2B website adoption readiness and the level of adoption barriers had also played a key role in enhancing these SMEs' ability to undertake IT investment evaluation. This also implies that organizations interested in investing in B2B websites should start with a thorough analysis of their businesses in terms of their B2B website adoption readiness and barriers. In this way, they will build realistic organizational capabilities in which to better equip themselves with adopting appropriate IT investment evaluation.

The results have also provided a number of interesting implications. SMEs owners are often faced with resource allocation questions and more often than not their decisions are guided by intuition, especially in the area of IT evaluation. Our results offer them some assistance in deciding on how to allocate resources. Based on the results of this study, SMEs owners for B2B websites will be well advised to improve their IT evaluation practices as it has a direct impact on the level of IT benefits realized, which in turn can affect the degree of satisfaction with B2B website adoption.

This study also makes a contribution to the relevant IT evaluation literature by showing that the realization of B2B website benefits as one of the most important determinants for Australian SMEs to set up their own websites. In addition, this study draws attention to the fallacy of the adoption of IT investment evaluation alone will lead to successful outcomes for IT investment in B2B websites. Organizations including SMEs that continue to spend significant financial resources on IT are often baffled by the return on their IT investment. Results from this study have suggested that SMEs should not only focus on their level of B2B website adoption readiness and barriers, but also should be more concerned with the adoption IT investment evaluation, since this is where benefits resulting from B2B websites can be directly monitored, managed, tracked, and realized.

## FUTURE RESEARCH DIRECTIONS

It is envisaged that SMEs' websites will play a vital role in attracting potential customers and in influencing purchasing decision as more and more businesses are beginning to conduct more and more of their business via their websites. However, unless SMEs can see the benefits of using their websites, they are unlikely to continue investing and evaluating in their websites. It is becoming critical for the SMEs to understand customer requirements, to continuously assess the effectiveness of their websites, and to enhance their web accordingly. In addition, to fully utilize the benefits of the websites, the design will need to be more business oriented than technical focused. Moreover, the websites will need to serve to the needs and business goals of the SMEs. Producing high quality functionality and information for a wide range of services and products may still be beyond the resources of many SMEs in the future. It may be more appropriate, for example, to simply provide links to the manufacturer's websites. However, SMEs are starting to leverage on business to business electronic commerce through their websites in gaining competitive advantage with the trend towards increased functionality supported by improved future Internet technology. The challenge for the SMEs is to find the incentives and motivation to pour in more resources into updating and maintaining their websites, evaluating the impact of their websites, and then refining their services on a regular basis. Finally, further research could take a longitudinal approach as the organizational drivers and the approach to managing B2B websites evaluation are likely to change over time.

## REFERENCES

ABS. (2003). *Business Use of Information Technology.* Canberra, Australia: Australian Bureau of Statistics.

Armstrong, J. S., & Overton, T. (1977, August 14). Estimating Nonresponse Bias in Mail Surveys. *JMR, Journal of Marketing Research*, 396–402. doi:10.2307/3150783

Berthon, P., Ewing, M., Pitt, L. F., & Naude, P. (2003). Understanding B2Band the web: The acceleration of Coordination and Motivation. *Industrial Marketing Management*, *32*(7), 553–561. doi:10.1016/S0019-8501(02)00279-1

Chakraborty, G., Lala, V., & Warren, D. (2002). An empirical investigation of antecedents of B2B Websites' effectiveness. *Journal of Interactive Marketing*, *16*(4), 51–72. doi:10.1002/dir.10044

Chan, Y. E., Huff, S. L., Barclay, D. W., & Copeland, D. G. (1997). Business Strategy Orientation, Information Systems Orientation and Strategic Alignment. *Information Systems Research*, *8*(2), 125–150. doi:10.1287/isre.8.2.125

Chircu, A. M., & Kauffman, R. J. (2000). Limits to Value in Electronic Commerce-Related IT Investments. *Journal of Management Information Systems*, *17*(2), 59–80.

Churchill, G. A. (1979). A Paradigm for Developing Better Measures of Marketing Constructs. *JMR, Journal of Marketing Research*, *16*, 64–73. doi:10.2307/3150876

Fioretti, G. (2004). Will Industrial Districts Exploit B2B? A Local Experience and a General Assessment. *NETNOMICS: Economic Research and Electronic Networking*, *6*, 221–242. doi:10.1007/s11066-005-0443-9

Fornell, C., & Larcker, D. F. (1981). Evaluating Structural Equation Models with Unobservable Variables and Measurement Error . *JMR, Journal of Marketing Research*, *18*(1), 39–50. doi:10.2307/3151312

Hair, J. F., Anderson, R. E., Tatham, R. L., & Black, W. C. (1998). *Multivariate Data Analysis* (5th ed.). Englewood Cliffs, NJ: Prentice Hall.

Jöreskog, K. G., & Sörbom, D. (1993). *LISREL 8: A Guide to the Program and Applications.* Chicago: SPSS.

Lin, C., Huang, Y., & Burn, J. (2007). Realising B2B e-Commerce Benefits: The Link with IT Maturity, Evaluation Practices, and B2B e-Commerce Adoption Readiness. *European Journal of Information Systems*, *16*(6), 806–819. doi:10.1057/palgrave.ejis.3000724

Lin, C., & Pervan, G. (2003). The Practice of IS/IT Benefits Management in Large Australian Organizations. *Information & Management*, *41*(1), 13–24. doi:10.1016/S0378-7206(03)00002-8

Lin, C., Pervan, G., Lin, H.-C., & Tsao, H. (2008). An Investigation into Business-to-Business Electronic Commerce Organizations. *Journal of Research and Practices in Information Technology*, *40*(1), 3–18.

Loiacono, E., Watson, R., & Goodhue, D. (2002). *WebQual™: A Measure of Web Site Quality.* Retrieved March 25, 2004, from http://www.terry.uga.edu/cisl/includes/pdf/webqual.pdf

Manuel, N. (2004). Wizzy websites can make SMEs look like world-beaters. *Financial Times (North American Edition)*, 18.

Nunnally, J. C. (1978). *Psychometric Theory*. New York: McGraw-Hill.

Parker, M. M. (1996). *Strategic Transformation and Information Technology: Paradigms for Performing while Transforming*. Upper Saddle River, NJ: Prentice-Hall, Inc.

Simmons, G. J., Durkin, M. G., McGowan, P., & Armstrong, G. A. (2007). Determinants of Internet Adoption by SME Agri-food Companies. *Journal of Small Business and Enterprise Development*, *14*(4), 620–640. doi:10.1108/14626000710832730

Soliman, K. S., & Janz, B. D. (2004). An Exploratory Study to Identify the Critical Success Factors Affecting the Decision to Establish Internet-based Interorganizational Information Systems. *Information & Management*, *41*(6), 697–706. doi:10.1016/j.im.2003.06.001

Standing, C., & Lin, C. (2007). Organizational Evaluation of the Benefits, Barriers and Satisfaction with Business-To-Business Electronic Commerce. *International Journal of Electronic Commerce*, *11*(3), 107–153. doi:10.2753/JEC1086-4415110304

Tsao, H., Lin, K. H., & Lin, C. (2004). An Investigation of Critical Success Factors in the Adoption of B2BEC by Taiwanese Companies. *The Journal of American Academy of Business, Cambridge*, *5*(1/2), 198–202.

Ward, J., & Daniel, E. (2006). *Benefits Management: Delivering Value from IS & IT Investments*. Chichester, UK: John Wiley & Sons Ltd.

## KEY TERMS AND DEFINITIONS

**B2BEC:** Business-to-business electronic commerce.

**Electronic Commerce:** It is a business model that is conducted over the Internet in which clients are able to participate in all phases of a purchase decision between two businesses transmitting funds, goods, services or between a business and a customer.

**IT Investment Evaluation:** This is the weighing up process to rationally assess the value of any in-house IT assets and acquisition of software or hardware which are expected to improve business value of an organization's information systems.

**Methodology:** An organized, documented set of guidelines and procedures for one or more phases of the systems development life cycle, such as analysis or design.

**SMEs:** Small to median enterprises. The European Commission has defined SMEs as organizations which employ less than 250 people.

**Website Evaluation:** This is the weighing up process to rationally assess the effectiveness and benefits of websites which are expected to improve organizations' business value.

**Website:** A place on the World Wide Web where an organization's homepage is located. It is a collection of web pages, that is, HTML/XHTML documents accessible via HTTP on the Internet.

# Chapter 12
# Lifelong Learning in the Knowledge Economy:
## An Empirical Analysis of E-Learning Adoption at Firm-Level

**Maria Rosalia Vicente**
*University of Oviedo, Spain*

**Ana Jesus Lopez**
*University of Oviedo, Spain*

## INTRODUCTION

In a global knowledge-based economy, the performance of business organizations depends on ensuring that all categories of employees possess current and up-to-date knowledge and skills. Therefore, businesses must analyze their training needs in greater depth and update workers' skills much more rapidly than in the past, while attempting to reduce training costs to remain competitive in this changing environment (Roy & Raymond, 2008). This requires organizations to educate and train anyone, anytime, and from anywhere with the lowest possible costs (Ong et al., 2004). Thus, many enterprises have turned to e-Learning as a best practice to provide adequate training to their employees.

The aim of this paper is to examine e-learning adoption among a sample of European firms (an area for which empirical evidence is quite scarce), and investigate the factors driving its introduction.

## BACKGROUND: FACTORS DRIVING ICT DIFFUSION AT FIRM-LEVEL

The last few years have seen a growing interest in explaining the diffusion of information and communication technologies (ICT) at firm-level. The vast economic literature that has been developed in this field highlights that a firm will only choose to adopt ICT if it perceives that doing so will provide greater benefits than existing technologies (Hollenstein, 2004; Karshenas & Stoneman, 1995).

DOI: 10.4018/978-1-61520-611-7.ch012

Therefore, a firm will only choose to adopt e-learning if it believes that doing so will provide greater benefits than traditional training methods, in which there is no use of ICT. Overall e-learning breaks the limitations of time and space. For corporations, finding training facilities and then allocating large chunks of time for staff to attend sessions away from their workplace is often not a productive or cost-effective way to conduct training. The use of e-learning eliminates or, at least, reduces facility costs as well as the travel costs of workers to the training centre (Britt, 2004; European Commission, 2005; Harun, 2002; OECD, 2002; Servage, 2005). Moreover, it allows training needs being met at a more appropriate time for both the organization and its employees, and not having to replace employees during work hours. There are also benefits for workers, in particular the convenience and the opportunity to learn at their pace.

Nonetheless, it is important to take into account that there might be obstacles to the use of the new technology. Firms experiencing economic or financial difficulties are less likely to invest in new technologies (Bocquet et al., 2007).

Another major determinant of ICT adoption is the firm's absorptive capacity. The endowment with human and knowledge capital is the main factor involved in this capacity. Thus, firms with a high level of human capital exhibit a higher propensity to use information technology and its applications (Black & Lynch, 2001; Bresnahan et al., 2002; Brynjolfsson & Hitt, 2000). In this context, it is important to consider a possible double causality between the use of e-learning and human capital: firms with a high level of human capital are more likely to adopt e-learning, and at the same time the use of e-learning leads to better skilled labor force.

Research and development (R&D) activities, as an element of firm's absorptive capacity, are also important for technology adoption. Cohen & Levinthal (1989) showed that firms' innovative activity facilitates the successful use of external knowledge in general and of new technologies in particular.

Firm size is another of the most commonly studied determinants of technology adoption. Starting with the classical contribution of Schumpeter (1912), various other authors have seen a positive relation between size and the adoption of a new technology since larger firms are in a better position to appropriate the returns from adoption and have greater funds available to invest in the new technology. Moreover, many technologies, like the Internet and its applications, are scale-enhancing and, therefore, larger firms adopt them sooner because they capture economies of scale more quickly (Fabiani et al., 2005; Hall, 2003).

Likewise, competitive pressure has long been recognized in the economic literature as a driver of technology diffusion. Firms in a competitive environment are more likely to adopt those innovations and technologies that can enhance their decision making, strengthen their performance, and quickly improve their employees' skills, than those operating in a more sheltered environment (Porter, 1990).

Finally, research has also shown that the industry in which the firm operates has an important influence on ICT adoption. In contrast to Solow's famous remarks "you can see computers everywhere but in productivity statistics" (Solow, 1987), ICT are in fact heavily concentrated in the service sector. e-Learning, as an application of these technologies, is very likely to be used more intensively by service firms. Nevertheless, it is important to bear in mind that ICT are general purpose technologies (Bresnahan & Trajtenberg, 1995), which implies that all sectors might be able to benefit from their use and the use of their applications.

## METHODOLOGY AND DATA

### Methodology

In order to analyze the determinants of the decision to adopt e-learning at firm-level, we use a simple linear random utility model (Greene, 2007; Hosmer & Lemeshow, 1989). A firm (i) will adopt e-learning if the utility associated with using this application ($U_{i1}$) is higher than the utility of not using it ($U_{i0}$). We assume that these utilities are linear functions of decision-makers attributes, X, and an additive error term, ε. Hence they can be expressed as:

$$U_{i0} = X_i\beta_0 + \varepsilon_{i0} \qquad (1)$$

$$U_{i1} = X_i\beta_1 + \varepsilon_{i1} \qquad (2)$$

Let's define a dichotomous variable, Y, so that $Y_i$=1 if the ith firm adopts e-learning, and $Y_i$=0 if it does not. Then, the probability of adoption can be expressed as:

$$P(Y_i=1) = P(U_{i1} > U_{i0})=F[X_i(\beta_1- \beta_0)] \qquad (3)$$

where F is the cumulative distribution function of the error term. Assuming that this function is a logistic, the model can be estimated by means of a logistic regression.

Therefore it can accordingly be written as:

$$P\left(Y_i = 1\right) = \frac{e^{X_i\beta}}{1+e^{X_i\beta}} \qquad (4)$$

### Data

The data used in this study comes from the 2006 e-Business Survey (European Commission & The Sectoral e-Business Watch, 2006), and covers the 27 Member States of the European Union with a sample of almost 6,700 establishments, coming from manufacturing, construction, and services[1]. Moreover, some macroeconomic data was derived from Eurostat (2007). Table 1 includes a description of the variables used in the analysis.

## RESULTS

Table 2 shows the estimated coefficients of six logit models: Models 1-2 include the full set explanatory variables at firm level, and country dummies which coefficients are not shown in the table due to space considerations. Models 3-6 include some macroeconomic variables to take account of cross-country variation instead of using dummies. We find that almost all of the explanatory variables are significant at the 1% level.

As it is to be expected, the proxy for the perceived importance of ICT adoption is significant and positive. Therefore, those firms which expect a high impact of ICT on business functions have a higher propensity to adopt e-learning.

On the contrary, financial constraints, derived from a decrease in last year's turnover, reveal as a significant obstacle to e-learning adoption. The coefficient is significant and negative. If we reckon the odds ratio[3], which is a measure of strength of association between variables usually reported in logit regressions, we find that firms facing financial constraints are about 0.8 times as likely to adopt e-learning than those without financial difficulties.

Results also show that the various dimensions of absorptive capacity stimulate the adoption of e-learning. The variable indicating the proportion of workers with a college or university degree is significant with a positive sign. The same happens with the variables related to innovation: they are both significant and with a positive sign.

The proxies for firm size prove highly significant and show the expected positive signs. Thus, larger firms have a larger propensity to adopt e-learning. In particular, we find that small firms (between 10 and 49 employees) are about 1.2 times as likely to adopt e-learning as micro-firms (less

*Table 1. Description of variables*

| Variable | Description |
|---|---|
| E-LEARNING | Dummy=1 if the firm has used e-learning applications that is, for instance, learning materials for employees available on an Intranet or on the Internet during the past 12 months (zero otherwise) |
| IMPACT | Scores from a factor analysis on the expected impact of ICT on seven business functions as assessed by firms on a four-point Likert scale (from 1: no impact to 4: high impact) [2] |
| FINAN_CONSTR | Dummy=1 if the turnover of the company has decreased in the last year (zero otherwise) |
| EDUC | Percentage of employees with a college or university degree |
| INN_PT | Dummy=1 if the firm has launched any new or substantially improved products or services during the past 12 months (zero otherwise) |
| INN_PC | Dummy=1 if the firm has introduced any new or significantly improved internal processes during the past 12 months (zero otherwise) |
| SIZE (10-49) | Dummy=1 if the firm has 10-49 employees (zero otherwise) |
| SIZE (50-249) | Dummy=1 if the firm has 50-249 employees (zero otherwise) |
| SIZE (250 and more) | Dummy=1 if the firm has 250 or more employees (zero otherwise) |
| COMPET | Dummy=1 if the firm believes that ICT have increased the competition in the sector (zero otherwise) |
| BROADBAND | Dummy=1 if the firm has a high-speed Internet connection (zero otherwise) |
| CONST | Dummy=1 if the firm belongs to the construction industry (zero otherwise) |
| SERV | Dummy=1 if the firm belongs to the service industry (zero otherwise) |
| GDP | Gross Domestic Product per capita as an index (European Union-27=100) |
| EDUCATION | Education expenditure as a percentage of Gross Domestic Product |
| OPENNESS | Imports and exports of goods as a percentage of Gross Domestic Product |
| PRICE | Price of national calls (€/10 minute call) |

Note: Country dummies are not included in the table for space considerations.

than 10 workers); while, medium (between 50 and 249 workers) and large firms (250 and more employees) are respectively 1.4 and 2.2 times more likely than micro-firms.

Likewise, the competitive environment tends to stimulate online training. The coefficient of the variable related to an increase in competition is positive and significant. Thus, those firms which believe that ICT has increased competition are more likely to take-up e-learning than those which do not.

We also find that firms belonging to service industries are more likely to adopt e-learning than those belonging to manufacturing. In fact, service firms are 1.2 times more likely than manufacturing firms. The industry dummy related to construction firms is found to be positive as well, but it is not statistically significant.

Moreover, there is significant evidence of the positive correlation between e-learning adoption and the use of broadband.

As previously mentioned, Models 3-6 include some macroeconomic variables in order to take account of cross-country differences. We have not included the variable related to broadband in these models since it might be highly correlated with the macroeconomic factors and, therefore, this could cause problems of multicollinearity. This same problem is the reason that leads us to include each macroeconomic variable in a separate model, instead of running a full model with the four macro variables.

Results show that all macroeconomic factors are significant at the 1% level. Nonetheless, there are some unexpected results. Thus, both income per capita and education level have a negative

*Table 2. Logit estimates for e-learning adoption (coefficients)*

| Variables | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| IMPACT | 0.345*** | 0.339*** | 0.310*** | 0.311*** | 0.334*** | 0.314*** |
| FINAN_CONSTR | -0.231** | -0.219** | -0.252*** | -0.264*** | -0.245** | -0.276*** |
| EDUC | 0.007*** | 0.007*** | 0.007*** | 0.007*** | 0.007*** | 0.007*** |
| INN PT | 0.266*** | 0.259*** | 0.235*** | 0.244*** | 0.235*** | 0.264*** |
| INN PRC | 0.474*** | 0.468*** | 0.442*** | 0.435*** | 0.435*** | 0.412*** |
| SIZE (10-49) | 0.187*** | 0.172** | 0.210*** | 0.205*** | 0.209*** | 0.226*** |
| SIZE (50-249) | 0.372*** | 0.345*** | 0.348*** | 0.341*** | 0.347*** | 0.378*** |
| SIZE (250 and more) | 0.852*** | 0.818*** | 0.818*** | 0.824*** | 0.801*** | 0.925*** |
| COMPET | 0.374*** | 0.366*** | 0.413*** | 0.413*** | 0.408*** | 0.417*** |
| BROADBAND | | 0.277*** | | | | |
| CONST | 0.032 | 0.039 | 0.128 | 0.134* | 0.095 | 0.102 |
| SERV | 0.186*** | 0.177*** | 0.221*** | 0.228*** | 0.199*** | 0.230*** |
| GDP | | | -0.002*** | | | |
| EDUCATION | | | | -0.093*** | | |
| OPENNESS | | | | | 0.006*** | |
| PRICE | | | | | | -0.310*** |
| Constant | -2.496*** | -2.677*** | -2.237*** | -1.970*** | -2.666*** | -2.282*** |
| | | | | | | |
| **$R^2$ Cox-Snell** | 0.104 | 0.106 | 0.082 | 0.083 | 0.083 | 0.083 |
| **$R^2$ Nagelkerke** | 0.165 | 0.167 | 0.130 | 0.131 | 0.131 | 0.134 |
| | | | | | | |
| **Hosmer-Lemeshow** | | | | | | |
| Statistic | 7.931 | 11.379 | 8.440 | 8.315 | 12.705 | 11.051 |
| P-value | 0.440 | 0.181 | 0.392 | 0.403 | 0.122 | 0.199 |
| **Classification rate (%)** | 80.4 | 80.3 | 80.2 | 80.4 | 80.4 | 81.2 |

Note: ***, **, * significant at the 1%, 5%, and 10% level, respectively. Although models 1-2 are run including countries dummies, results are not reported in the table for space considerations.

effect on e-learning adoption, in contrast to previous evidence which has shown that ICT adoption was higher in those countries with higher income levels and higher educational attainment (Vicente & López, 2006). To get further insights into this result, we have considered other online applications (for instance, e-commerce) as dependent variables and regressed them over the same set of explanatory variables[4]. In all cases we find that income and education exert a significant and positive impact. Therefore, it seems that the negative influence of these two variables is a special case of e-learning adoption.

Finally, the openness of the economy favors the adoption e-learning among firms, while prices have a significant negative effect.

Overall the goodness of fit is not high. $R^2$ values are around 0.1. Nevertheless, these low figures seem to be quite usual in this kind of analysis. The fit of the models is significant with the Hosmer and Lemeshow goodness-of-fit test, which checks that there is no difference between the observed and predicted values by the model, implying that the model's estimates fit the data quite well. Moreover, the overall rates of correct classification using the fitted models are quite high, with figures of 80%.

## FUTURE RESEARCH DIRECTIONS

Our analysis has focused on investigating the factors for the adoption of e-learning among a sample of European firms, coming from manufacturing, construction, and service industries.

The question that gauged the use of e-learning in our survey was simply a yes/no question that assessed the use of learning materials available on either an Intranet or on the Internet. The survey did not provide any information on the kind of materials that were being used (multimedia files, online books …). Therefore, future research on this area should provide insights on the type of materials that are being used for corporate training. Likewise, it would be interesting to know in which areas of workforce training e-learning is being used and whether it has any differential impact across these areas.

Besides, future research should be aimed at studying whether the provision of online training is having any significant impact on business performance. Therefore, a dynamic approach is required, incorporating longitudinal data to properly assess the impacts.

Finally, the observed negative effects of income per capita and education on e-learning adoption require further investigation, since they suggest that the path of diffusion of this e-practice is completely different from the one followed by other Internet applications such e-commerce and e-banking, among others. This issue needs to be clarified and checked by means of new databases. If national income were to be negatively associated with online training, it would suggest that there could be some catch-up effect of firms in developing countries with those in developed nations.

## CONCLUSION

With the rapid changes imposed by the global knowledge economy, firms face the constant challenge to rapidly train and retrain people in new technologies, products, and services. In this context, the flexibility of e-learning has made it emerged as one of the fastest organizational uses of the Internet.

Our empirical results show that the perceived impact of ICT and competitive pressures are important drivers of e-learning adoption by firms. Also we find that human capital has a positive effect on the rate of diffusion of this application. Such result might be related to the fact that the use of e-learning requires from workers to have some computer knowledge and digital skills to use it effectively. Furthermore, results confirm that, as happens with other technologies and applications, larger firms are more likely to use online training.

Our findings have some implications for both managers and public policies that support ICT adoption in general and the diffusion of e-learning in particular. Thus, a pre-requisite for the efficient and effective use of e-learning is to provide workers with the necessary digital skills. In addition, it is essential to develop an e-learning culture. Thus, the only way for both managers and employees to be truly motivated to use this kind of training is because they believe and understand the benefits it can provide for both the individual and the organization's development in a global changing environment. This implies a greater promotion of e-learning's value through the dissemination of its potential and advantages to firms, and especially to small enterprises.

## REFERENCES

Black, S., & Lynch, L. (2001). How to Compete: The Impact of Workplace Practices and Information Technology on Productivity. *The Review of Economics and Statistics*, *83*(3), 434–445. doi:10.1162/00346530152480081

Bocquet, R., Brossard, O., & Sabatier, M. (2007). Complementarities in organizational design and the diffusion of information technologies: An empirical analysis. *Research Policy*, *36*, 367–386. doi:10.1016/j.respol.2006.12.005

Bresnahan, T., & Trajtenberg, M. (1995). General purpose technologies: Engines of growth? *Journal of Econometrics*, *65*, 83–108. doi:10.1016/0304-4076(94)01598-T

Bresnahan, T. F., Brynjolfsson, E., & Hitt, M. L. (2002). Information technology, workplace organization, and the demand of skilled labor: firm-level evidence. *The Quarterly Journal of Economics*, *117*, 339–376. doi:10.1162/003355302753399526

Britt, P. (2004). E-Learning on the rise: Companies move classroom content online. *EContent*, *27*(11), 36–40.

Brynjolfsson, E., & Hitt, M. L. (2000). Beyond computation: information technology, organization transformation and business performance. *The Journal of Economic Perspectives*, *14*, 23–48.

Cohen, W. M., & Levinthal, D. A. (1989). Innovation and Learning: The two Faces of R&D. *The Economic Journal*, *99*(4), 569–596. doi:10.2307/2233763

European Commission. (2005). *E-learning in continuing vocational training, particularly at the workplace, with emphasis on Small and Medium Enterprises*. Brussels: European Commission.

European Commission & The Sectoral e-Business Watch. (2006). *2006 e-Business Survey*. Retrieved August 14, 2007, from http://www.ebusiness-watch.org

Eurostat. (2007). *European Structural Indicators*. Retrieved November 30, 2008, from http://www.ec.europa.eu/eurostat

Fabiani, S., Schivardi, F., & Trento, S. (2005). ICT adoption in Italian manufacturing: firm-level evidence. *Industrial and Corporate Change*, *14*(2), 225–249. doi:10.1093/icc/dth050

Greene, W. H. (2007). *Econometric Analysis* (6th Ed). New York: Prentice Hall.

Hall, B. H. (2003). Adoption of new technology. In D.C. Jones (Ed.), *The New Economy Handbook* (pp. 229-249). San Diego, CA: Academic Press.

Harun, M. H. (2002). Integrating e-Learning into the workplace. *The Internet and Higher Education*, *4*, 301–310. doi:10.1016/S1096-7516(01)00073-2

Hollenstein, B. H. (2004). The decision to adopt information and communication technologies (ICT), firm-level evidence for Switzerland. In OECD (Ed.), *The economic impact of ICT* (pp. 37-60). Paris: OECD.

Hosmer, D. W., & Lemeshow, S. (1989). *Applied logistic regression*. New York: Wiley.

Karshenas, M., & Stoneman, P. (1995). Technological diffusion. In P. Stoneman (Ed.), *Handbook of the Economics of Innovation and Technological Change* (pp. 263-297). Oxford, UK: Blackwell.

OECD. (2002). *La formation des dirigeants des PME*. Paris: OECD.

Ong, C. S., Lai, J. Y., & Wang, Y. S. (2004). Factors affecting engineers' acceptance of asynchronous e-learning systems in high-tech companies. *Information & Management*, *41*(6), 795–804. doi:10.1016/j.im.2003.08.012

Porter, M. (1990). *The Competitive Advantage of Nations*. New York: Free Press.

Roy, A., & Raymond, L. (2008). Meeting the training needs of SMEs: Is e-Learning a solution? *The Electronic Journal of e-Learning, 6*(2), 89-98. Retrieved January 30, 2009, from http://www.ejel.org

Schumpeter, J. A. (1912). *Theorie der wirtschaftlichen Entwicklung. English Ed. 1934. The Theory of Economic Development*. Cambridge, MA: Harvard University Press.

Servage, L. (2005). Strategizing for workplace e-Learning: Some critical considerations. *Journal of Workplace Learning*, *17*(5/6), 304–317. doi:10.1108/13665620510606733

Solow, R. M. (1987, July 12). We'd better watch out. *New York Times Book Review,* 36.

Vicente, M. R., & López, A. J. (2006b). Patterns of ICT diffusion across the European Union. *Economics Letters*, *93*, 45–51. doi:10.1016/j.econlet.2006.03.039

## ADDITIONAL READING

Baldwin-Evans, K. (2004). Employees and e-learning: What do the end-users think? *Industrial and Commercial Training*, *36*(7), 269–274. doi:10.1108/00197850410563894

Barron, J. (2006). Top ten secrets of effective e-learning. *Industrial and Commercial Training*, *38*(7), 360–364. doi:10.1108/00197850610704552

Bell, B. S., Kanar, A. M., & Kozlowski, W. J. (2008). Current issues and future directions in simulation-based training in North America. *International Journal of Human Resource Management*, *19*(8), 1416–1434. doi:10.1080/09585190802200173

Cegarra, J. G., & Sabater, R. (2005). E-learning: organizational requirements for successful feedback learning. *Journal of Workplace Learning*, *17*(5/6), 276–290. doi:10.1108/13665620510606715

Dublin, L. (2004). The nine myths of e-learning implementation: ensuring the real return on your e-learning investment. *Industrial and Commercial Training*, *36*(7), 291–294. doi:10.1108/00197850410563939

European Commission. (2007). *E-skills for the 21st century: fostering competitiveness, growth and jobs*. Brussels: European Commission.

Gravill, J., & Compeau, D. (2008). Self-regulated learning strategies and software training. *Information & Management*, *45*(5), 288–296. doi:10.1016/j.im.2008.03.001

Hamburg, I., & Hall, T. (2008). Informal learning and the use of Web 2.0. within SME training strategies. *eLearning Papers, 11.*

Hamid, A. A. (2001). e-Learning: Is it the e or the learning that matters? *The Internet and Higher Education*, *4*(3-4), 311–316. doi:10.1016/S1096-7516(01)00072-0

Jensen, S. (2006). Are European businesses getting the live e-learning message? *Industrial and Commercial Training*, *38*(1), 46–48. doi:10.1108/00197850610646043

Kolding, M., & Kroa, V. (2007). *E-Skills-The key to employment and inclusion in Europe*. London: IDC.

Larsen, K., & Vicente-Lancrin, S. (2006). The impact of ICT on tertiary education: Advances and promises. In B. Kahin, & D. Foray (Ed.), *Advancing Knowledge and the Knowledge Economy* (pp. 151-168). Cambridge, MA: The MIT Press.

Lea, P. (2003). Understanding the culture of e-learning. *Industrial and Commercial Training*, *35*(5), 217–219. doi:10.1108/00197850310487377

Lucchetti, R., & Sterlacchini, A. (2004). The adoption of ICT among SMEs: evidence from an Italian survey. *Small Business Economics*, *23*, 151–168. doi:10.1023/B:SBEJ.0000027667.55821.53

Matlay, H., & Westhead, P. (2005). Virtual Teams and the Rise of e-Entrepreneurship in Europe. *International Small Business Journal*, *23*(3), 279–302. doi:10.1177/0266242605052074

McDonald, J. (2006). *Blended learning and online tutoring: a good practice guide*. Aldershot, UK: Gower Publishing

Nikandrou, I., Apospori, E., Panayotopoulou, L., Stavrou, E. T., & Papalexandris, N. (2008). Training and firm performance in Europe: the impact of national and organizational characteristics. *International Journal of Human Resource Management*, *19*(11), 2057–2078. doi:10.1080/09585190802404304

Nisar, T. M. (2002). Organisational determinants of e-learning. *Industrial and Commercial Training*, *34*(7), 256–262. doi:10.1108/00197850210447246

Park, J. H., & Wentling, T. (2007). Factors associated with transfer of training in workplace e-learning. *Journal of Workplace Learning*, *19*(5), 311–329. doi:10.1108/13665620710757860

Sanderson, P. E. (2002). E-Learning: strategies for delivering knowledge in the digital age. *The Internet and Higher Education*, *5*(2), 185–188. doi:10.1016/S1096-7516(02)00082-9

Vicente, M. R., López, A. J., & Pérez, R. (2008). Teaching and Learning in a Shared Virtual Campus: Two Experiences in the G9 Network. In J.E. Larkley, & V.B. Maynhard (Ed.), *Innovation in Education* (pp. 189-206). New York: Nova Publishers.

Vries, P., & Brall, S. (2008). Microtraining as a support mechanism for informal learning. *eLearning Papers*, 11.

Wan, Z., Wang, Y., & Haggerty, N. (2008). Why people benefit from e-learning differently: The effects of psychological processes on e-learning outcomes. *Information & Management*, *45*(8), 513–521. doi:10.1016/j.im.2008.08.003

Welle-Strand, A., & Thune, T. (2003). E-learning policies, practices and challenges in two Norwegian organizations. *Evaluation and Program Planning*, *26*(2), 185–192. doi:10.1016/S0149-7189(03)00006-5

Wurzburg, G. (2005, June). *Sustainable Investment in Lifelong Learning: the Pivotal Role of ICT*. Paper presented at EDEN 2005 Annual Conference on Lifelong E-Learning, Helsinki.

## KEY TERMS AND DEFINITIONS

**Absorptive Capacity:** The ability to evaluate, assimilate, and apply new knowledge.

**Corporate Training:** The training provided by the firm to its employees with the aim to improve their performance in the job they currently hold.

**Digital Skills or E-Skills:** The learned capacity to use information and communication technologies, and to search for information online in an efficient and effective way.

**E-Learning:** The use of information and communication technologies to support learning, knowledge, and the acquisition of skills.

**ICT:** Information and communication technologies.

**Lifelong Learning:** This term is used to refer to the fact that in the knowledge economy learning must take place throughout life in order to be able to adapt to the changing environment.

**Technology Adoption:** The choice to acquire and use a new innovation or invention.

## ENDNOTES

1 More details on survey methodology can be retrieved from http://www.ebusiness-watch.org.

2 Results are available upon request.

3 The odds ratio is reckoned for each variable as exp(β), where β is the estimated coefficient.

4 Results are available upon request.

# Chapter 13
# Measuring the Quality of E-Business Services

**Mark Springer**
*Western Washington University, USA*

**Craig K. Tyran**
*Western Washington University, USA*

**Steven Ross**
*Western Washington University, USA*

## ABSTRACT

*Electronic service quality, or e-service quality, refers to the quality experienced by the user of a service delivered via the Internet. Over the past several years, researchers have developed different models of e-service quality with the objective of identifying those aspects that are most important for customer satisfaction and loyalty. The current authors develop a framework to compare and contrast these models. While there is some agreement between existing models regarding the key dimensions of e-service quality, these models focus almost exclusively on retail e-commerce Web sites. Additional research is needed not only to resolve the differences between existing quality models for e-commerce Web sites, but also to develop e-service quality assessment tools for the entire range of e-business services.*

## INTRODUCTION

With the advent of the e-business era, more and more organizations rely on the Internet to support communication and transactions with constituents. Examples range from electronic retailers such as Amazon to health care providers to government agencies. For many organizations, a Web site is a primary way in which the organization's customers or constituents interact with the organization. Given the important role of such websites, it is critical for organizations to provide high quality electronic services and delivery via a website. High quality electronic services can promote customer satisfaction and loyalty, while poor services may result in dissatisfied and lost customers (Parasuraman, Zeithaml, & Malhotra, 2005).

In recent years, researchers have begun to actively explore the factors associated with electronic service quality and the assessment of electronic service quality. This research has been conducted to provide guidance to website system developers

DOI: 10.4018/978-1-61520-611-7.ch013

and marketers who work with e-businesses that rely on websites for customer interactions. This article provides a review of the existing research concerning electronic service quality. The authors summarize recent developments in the measurement of e-service quality and suggest directions for future research.

## BACKGROUND

Much of the work regarding electronic service quality is directly or indirectly grounded in earlier research regarding traditional, or non-electronic, service quality. As summarized by Parasuraman, Zeithaml, and Berry (1985), service quality differs significantly from physical goods quality due to the intangible, heterogeneous, and inseparable nature of services This led Parasuraman et al. (1985) to conclude that service quality was more difficult for consumers to evaluate than goods quality; that consumer quality assessment depends on a comparison of prior expectations with perceived service performance; and that the process of service delivery as well as the outcome of the service were both vital in the customer's evaluation of quality.

Parasuraman, Zeithaml, and Berry (1988) subsequently developed SERVQUAL, a service quality model and assessment tool designed to incorporate these differences. SERVQUAL assessed service quality along five dimensions via a forty-four question customer survey. A key element of the original SERVQUAL was the "gap model" of service quality, defining service quality as the difference between a customer's expectations of service and her actual service experience. The forty-four questions of the survey consisted of twenty-two paired questions; the first question in the pair asks the customer to rate her expectation of some aspect of the service, and the second question asks the customer to assess her actual experience with that aspect. The five service quality dimensions the authors derived were service tangibles (e.g., the appearance of the service facility), reliability (e.g. consistency of the service), responsiveness (e.g. promptness of reply to customer needs), assurance (e.g. trustworthiness of the servers), and empathy (e.g., apparent personal concern for the customers).

After its introduction, SERVQUAL was applied to a wide range of traditional services including retail businesses (Teas, 1993), support services (Pitt, Watson, & Kavan, 1995), and health care applications (Babakus & Mangold, 1992). Several authors, however, questioned the utility of the gap model in assessing service quality (e.g., Asubonteng, McCleary & Swan, 1996; Babakus & Boller, 1992). As an alternative, Cronin and Taylor (1992) introduced SERVPERF, which directly measured the service quality perceived by the customer in lieu of assessing the gap between expectation and experience. The survey items used in the SERVPERF model are largely based on the survey items in SERVQUAL, suggesting some consensus regarding the critical aspects of traditional service quality.

Both SERVQUAL and SERVPERF remain well-used measures of traditional service quality (Carrillat, Jaramillo, & Mulki, 2007). Virtually all models and assessment tools for e-service quality have adopted the direct measurement approach of SERVPERF rather than the gap theory approach of SERVQUAL.

## THE ASSESSMENT OF E-SERVICE QUALITY

Several instruments have been developed to assess e-service quality. To provide a way to compare and contrast the different instruments, we present a framework that organizes the research findings based on the key dimensions of e-service quality that have been examined. Using the framework, we summarize the common research issues that

*Figure 1. Framework of e-service quality dimensions proposed by alternative models (number of items in scale in parentheses)*

| | E-Service Quality Models and Model-Specific Dimensions | | | | | |
|---|---|---|---|---|---|---|
| Framework E-Service Quality Dimension | SITEQUAL | eTailQ | WebQual | E-S-QUAL | E-RecS-QUAL | Boshoff E-S-QUAL |
| Aesthetics | Aesthetic Design (3) | | Usability (8) | | | |
| Ease of Use-Navigation | Ease of use (2) | Web site design (5) | | Efficiency (6) | | Efficiency (6) |
| Ease of Use-Content | | | Information Quality (7) | | | |
| Ease of Use-Speed | Processing speed (2) | | | Efficiency (2) | | Speed (3) |
| Site Availability | | | | System Availability (4) | | System Availability (3) |
| Security | Security (2) | Security/ Privacy (3) | Service Interaction (7) | Privacy (3) | | Privacy (3) |
| Physical fulfillment | | Fulfillment/ reliability (3) | | Fulfillment (7) | | Fulfillment (3) |
| Reliability | | | | | | Reliability (3) |
| Customer service | | Customer service (3) | | | Responsiveness (5) | |
| Compensation | | | | | Compensation (3) | |
| Contacts | | | | | Contacts (3) | |

have been addressed concerning e-service quality assessment. We also identify assessment areas that require additional exploration.

## The Dimensions of E-Service Quality

In this review, we consider six e-service quality models: SITEQUAL (Yoo & Donthu, 2001), eTailQ (Wolfinbarger and Gilly, 2003), WebQual (Barnes and Vidgen, 2002), E-S-QUAL (Parasuraman, et al. (2005), E-RecS-QUAL (Parasuraman, et al. (2005), and Boshoff's six-factor E-S-QUAL (Boshoff, 2007). Each of these models employs a set of Likert-scale survey questions asking users to rate different aspects of e-service quality. Based on the user responses collected in one or more samples, the authors of each model then ascertain the key dimensions of e-service quality. Each dimension is typically reflected by two or more questions in the corresponding survey. Most of the e-service quality models were developed using formal statistical techniques such as exploratory and/or confirmatory factor analysis to identify the different e-service quality factors. Because not all of the authors used factor analysis, we use the more general term of "dimension" when referring to each of the different components of e-service quality.

A framework listing the dimensions proposed by the different models is found in Figure 1. The left-hand column of Figure 1 lists dimensions identified by one or more researchers. For each dimension that appears to be defined in a common way across different models, the name for the framework dimension is chosen from a name used by at least one of the models (e.g., the security dimension). For most cases, however, there is little agreement regarding the way that a dimension is assessed by the different models. In these instances, we assign a new name that attempts to reflect what consensus does exist for that dimension (e.g., ease of use-content).

The dimensions in the left-hand column are defined as follows. "Aesthetics" is the attractiveness of the Web site through which the e-service is delivered. "Ease of use-navigation" is the ease of navigating the Web site to accomplish the desired task. "Ease of use-content" is the quality of information that is provided on the Web site. "Ease of use-speed" refers to the time required for the Web site to process the user's input and return a response. "Site availability" is the availability of the Web site for customer use. "Site security" is the security and safety of the user's data and transactions with the Web site. "Physical fulfillment" is the speed with which a physical product ordered on the Web site is delivered to the customer. "Reliability" is the trustworthiness of the Web site in delivering the physical product that was displayed on-line. "Customer service" is the timeliness of the Web site in responding to customer concerns and issues. "Compensation" is the value of the compensation offered to customers who have a service problem that needs to be resolved. Finally, "contacts" is the quality of the Web site's posted contact information.

Each column to the right of the left hand column shows the model-specific dimensions identified by each researcher and, in parentheses, the number of survey items used to assess the dimension. To accurately assign model-specific dimensions to framework dimensions, we examined the survey items from each model. If the model-specific dimension identified by a particular researcher appears to encompass two or more of the framework dimensions, the model-specific dimension straddles the appropriate framework dimensions. Provided below is a summary of each model.

## SITEQUAL

The first published effort to develop a comprehensive model and assessment tool for e-service quality was SITEQUAL, which was created specifically to assess the perceived quality of retail e-commerce Web sites (Yoo & Donthu, 2001). The authors began their analysis by having a sample of undergraduate college students rate three Web sites using a survey with fifty-four questions. Based on the usable surveys of the participants, nine of the original survey items were used to form the four-dimensional SITEQUAL scale. As shown in Figure 1, the four dimensions found by the researchers were ease of use; aesthetic design; processing speed; and site security. The authors used confirmatory factor analysis to successfully validate the new scale. While the authors suggested using the average of all nine items as a composite measure of overall site quality, they also investigated which of the four dimensions were most correlated with the shopper's overall perception of site quality. Although all correlations were significantly positive, ease of use and aesthetic design were more strongly correlated with overall site quality than processing speed and security.

## eTailQ

Wolfinbarger and Gilly (2003) developed eTailQ, an assessment tool also directed towards assessing e-commerce Web sites. Using SERVQUAL's twenty-two survey items and an additional 275 potential survey items as a starting point, the authors undertook a series of progressively refining analyses to obtain an instrument containing fourteen survey items representing four e-commerce quality dimensions: Web site design, security/privacy, fulfillment/reliability, and customer service. The authors found that the site design and fulfillment/reliability dimensions were of roughly equal importance in impacting a user's perception of overall Web site quality, while customer service was of lesser importance and the security/privacy dimension was important only for frequent shoppers.

As shown in Figure 1, eTailQ's dimensions do not precisely match up with those of SITEQUAL. While the security dimensions for SITEQUAL and eTailQ appear similarly defined, SITEQUAL's "ease of use" dimension focused on navigation, while eTailQ's "Web site design" dimension was comprised of survey items relating to the navigational, content availability, and processing speed. Furthermore, ETailQ includes a broader definition of e-service quality for e-commerce providers. First, they introduced the dimension of physical fulfillment; since many e-commerce customers are purchasing a physical product, eTailQ assesses the business' performance in getting the ordered product to the customer in a timely manner. Second, the customer service dimension assesses the company's performance in responding to customer needs and inquiries regarding the site.

## WebQual

Barnes and Vidgen (2002; 2003) used SERVQUAL as a basis for developing the WebQual instrument to assess the quality of e-business sites. WebQual 4.0 grouped twenty-two seven-point scale items into three broad categories: usability, information quality, and service interaction. They also included a twenty-third item which asked users to rank the overall quality of the Web site. Unlike the developers of eTailQ and SITEQUAL, the authors did not validate their items or categories with confirmatory factor analysis. Rather, they have continually made adjustments to the model based on its repeated use in quality workshops. As can be seen in Figure 1, most of the three WebQual 4.0 dimensions do not match up precisely with those of SITEQUAL or eTailQ. Similar to eTailQ, however, WebQual is interested in assessing customer service and physical fulfillment as part of the "service interaction" dimension.

## E-S-QUAL and E-RecS-QUAL

Parasuraman, et al. (2005) developed the E-S-QUAL scale to measure the service quality of e-commerce Web sites. Beginning with a list of 121 survey items representing eleven potential dimensions, progressive analyses resulted in a validated four-dimensional scale consisting of twenty-two items. Three of the E-S-QUAL dimensions are comparable to the dimensions of two or more of the earlier e-service models: efficiency focused on navigational ease of use, while privacy and fulfillment are defined in a similar way as the corresponding dimensions in eTailQ. E-S-QUAL, did, however, incorporate speed in two of the survey items comprising the eight-item efficiency dimension, and also introduced the new dimension of system availability. This latter dimension was concerned with whether the Web site was available for use when needed, and also the rapidity with which it could be accessed. As with the authors of SITEQUAL and eTailQ, Parasuraman et al. (2005) validated their model using confirmatory factor analysis. They also found that efficiency and fulfillment were the most important dimensions affecting user perceptions of Web site quality. System availability and privacy were of distinctly less importance in affecting customer attitudes.

Parasuraman et al. (2005) introduced the E-RecS-QUAL instrument in the same paper. This scale was designed to measure the quality of recovery services and focused on three e-service quality dimensions important to customers who had "nonroutine encounters," i.e. service problems, with the e-business. The responsiveness dimension of E-RecS-QUAL was similar to the customer service dimension emphasized by eTailQ; the authors also introduced the compensation and contacts dimensions to measure the extent to which the business compensated the customer for the problem, and the ease with which the customer could contact the appropriate company personnel to resolve the problem.

## Boshoff's Six-Factor E-S-QUAL

Boshoff (2007) applied the E-S-QUAL instrument to a sample of 1,409 people who had purchased products on the Web. Using exploratory factor analysis, he found evidence of six rather than four dimensions associated with the twenty-two items of the E-S-QUAL instrument. One new dimension was speed, which was comprised of two items from E-S-QUAL's efficiency dimension as well as one item allocated to E-S-QUAL's system availability dimension. A second new dimension emerged from the original fulfillment factor, which was split into a reliability (honesty/truthfulness) dimension and a delivery dimension. Of the six dimensions identified by Boshoff, reliability and efficiency were found to be the most important dimensions impacting user perceptions of quality.

## Summary

Examining Figure 1, one is struck by the agreement between the different proposed measures on a few key aspects of e-service quality. If we consider E-S-QUAL and E-RecS-QUAL together as a single model, there are five distinct models represented in Figure 1. All five consider the ease of navigation and security to be key dimensions of e-service quality. Web site speed, reliability, and physical fulfillment are incorporated in some manner by four of the five models. In contrast, site aesthetics, site content, and site availability are assessed by only two of the five models. The relative absence of customer service, compensation, and contacts in most of the models is a likely result of the models focusing on routine, rather than non-routine, e-service experiences. Finally, some measures incorporate more aggregated dimensions than other measures, as some authors have used a single dimension to describe what another author recognizes as two or more distinct dimensions.

## Beyond E-Commerce to E-Business

E-commerce is frequently defined as using the Internet as a distribution channel for retail goods, while E-business is generally understood to encompass the entire range of business activity conducted over the Internet. Most of the research on e-service quality has focused on the quality of e-commerce Web sites. Yoo & Donthu (2001) explicitly stated that "Internet sites without shopping features may develop a different definition of quality and are not included in the SITEQUAL domain" (p.32). Similarly, the authors of eTailQ, as its name suggests, were concerned with establishing a valid instrument for "measuring online etail [electronic retail] quality" (Wolfinbarger & Gilly, 2003, p. 183). Parasuraman et al. (2005) proposed E-S-QUAL as a scale which measured "the extent to which a Web site facilitates efficient and effective shopping, purchasing, and delivery" (p. 217). Indeed, the inclusion of dimensions for fulfillment and reliability indicate a focus on a rather narrow definition of e-commerce, namely retail Web sites that were geared towards the delivery of physical goods.

Barnes and Vidgen (2003) explicitly proposed modified versions of WebQual which could be applied to non-e-commerce Web sites (2002; 2003). WebQual 1.0 was in fact developed to assess informational Web sites. WebQual 2.0 was then developed to focus exclusively on e-commerce Web sites. This latter focus continued through WebQual 4.0, but the authors proposed a simple strategy for modifying WebQual 4.0 to make it suitable for a "knowledge exchange" Web site: drop the three transaction-related items. While Barnes and Vidgen did not validate their different instruments as rigorously as the others, their attempts to develop quality measures for non-e-commerce sites are notable.

To extend the research on quality assessment beyond e-commerce, researchers must adopt a perspective that encompasses e-services beyond e-retail transactions. There may be a variety of ways that e-business may provide electronic services, therefore a simple dichotomy between e-commerce and more general e-business Web sites may not be sufficient. Instead, a perspective that recognizes the full spectrum of e-business services would be useful.

## The Belanger et al. (2006) Taxonomy

The importance of the distinctions across the e-business spectrum was recognized by Belanger et al. (2006), who developed a Web site taxonomy based on the goals of eleven different types of

*Figure 2. Web site taxonomy (based on Belanger et al., 2006)*

| *General Web Site Focus* | *Belanger et al. Web Site Goal* | *Definition* |
|---|---|---|
| Transaction processing | E-commerce | Allow online transactions with others (suppliers, partner, customer, government) |
| | Interactive service management | Allow individuals or organizations to service accounts online |
| | Online application | Allow individuals or organizations access to applications on Web-based platforms |
| Decision support | Informed decision-biased | Give product information with goal of influencing user decisions |
| | Informed decision-unbiased | Help users make an informed decision but without bias toward a particular decision |
| Information acquisition | Life enrichment | Increase general awareness of a topic, but not necessarily a product |
| | Online learning | Offer forums for educational purposes |
| | Knowledge enhancement | Inform visitors on current events or specific topics quickly |
| | Information specific search | Provide ability to search and find relevant information on particular topics |
| Online community | Online community | Gather and share information on certain topics and act as forums for people with similar interests |
| Entertainment and gaming | Entertainment | Offer entertainment |

Web sites. This taxonomy, along with the original definitions provided by Belanger et al. (2006), is reproduced in Figure 2, second and third columns. The left most column combines these into six more general categories.

As can be seen in Figure 2, e-commerce is only one of eleven distinct Web site types identified by Belanger et al. (2006). In general, e-commerce is a specific type of transaction processing Web site. The other types of transaction processing sites – interactive service management sites and online application sites – would not necessarily have similar goals and quality dimensions as an e-commerce site. Differences would be increasingly likely for e-business applications with a focus other than transaction processing: decision support, knowledge acquisition, online community, and entertainment Web sites.

## FUTURE RESEARCH DIRECTIONS

To date, most of the research on e-services quality assessment concerns e-commerce Web sites. The lack of quality assessment tools for more general e-business Web sites highlights an important area for future research. Investigators will need to determine which factors will be important to explore. In reviewing the eleven dimensions identified by one or more of the e-service quality models listed in Figure 1, it is clear that some would likely not be relevant for a non-e-commerce Web site. Physical fulfillment, for example, is unlikely to be an important quality dimension for Web sites that do not deliver a physical product, such as a decision support Web site. Conversely, some dimensions that appear less important for e-commerce Web sites may be quite important for other e-businesses: the aesthetics of a Web site have not been found to be nearly as important as navigational ease of use for e-commerce service quality, but for an entertainment Web site one might expect both to be of equal importance. In short, there is a large body of work required to develop successful e-service quality models and assessment tools for Web sites other than retail e-commerce.

In addition to extending the e-service quality research to other type of e-business Web sites, it will also be useful for researchers to continue to refine the models that are developed. For instance, while there exists notable agreement on some of the key dimensions across the e-service quality models for e-commerce, Boshoff's work (2007) suggests that the e-commerce quality models reviewed here could benefit from replication studies to examine the key quality dimensions for retail e-commerce. In the traditional service industry, SERVQUAL and SERVPERF have been applied to multiple samples from different businesses, providing important insights to traditional service quality. Similar work in the field of e-commerce service quality would be in the spirit of Boshoff's paper (2007), i.e. administering an existing survey instrument and using exploratory and confirmatory factor analysis to confirm or modify the quality dimensions in the corresponding model.

## CONCLUSION

Several models have been proposed to assess the quality of e-commerce Web sites. These models are each based upon survey instruments that ask users to evaluate their perception of Web site quality across several distinct dimensions. For the five models considered here, a total of eleven distinct dimensions were identified by one or more researchers. While no two models agree completely regarding the number and definition of dimensions, some key dimensions – such as navigational ease of use and physical fulfillment – have been identified as being of particular importance by multiple models. All of these models, however, are concerned almost exclusively with assessing the quality of e-commerce Web sites. Given the wide range of e-business Web sites in existence, a need exists for the development of e-service quality models targeted towards Web sites focused on decision support, entertainment, knowledge acquisition, and online community.

## REFERENCES

Asubonteng, P., McCleary, K. J., & Swan, J. E. (1996). SERVQUAL revisited: A critical review of service quality. *Journal of Services Marketing*, *10*(6), 62–81. doi:10.1108/08876049610148602

Babakus, E., & Boller, G. W. (1992). An empirical assessment of the SERVQUAL scale. *Journal of Business Research*, *24*(3), 253–268. doi:10.1016/0148-2963(92)90022-4

Babakus, E., & Mangold, G. W. (1992). Adapting the SERVQUAL scale to hospital services: An empirical investigation. *Health Services Research*, *26*(6), 767–786.

Barnes, S. J., & Vidgen, R. (2001). An evaluation of cyber-bookshops using the WebQual method. *International Journal of Electronic Commerce*, *6*(1), 11–30.

Barnes, S. J., & Vidgen, R. (2003). Measuring web site quality improvements: A case study of the forum on strategic management knowledge exchange. *Industrial Management & Data Systems*, *103*(5), 297–309. doi:10.1108/02635570310477352

Belanger, F., Fan, W., Schaupp, L. C., Krishen, A., Everhart, J., Poteet, D., & Nakamoto, K. (2006). Web site success metrics: Addressing the duality of goals. *Communications of the ACM*, *49*(12), 114–116. doi:10.1145/1183236.1183256

Boshoff, C. (2007). A psychometric assessment of E-S-Qual: A scale to measure electronic service quality. *Journal of Electronic Commerce Research*, *8*(1), 101–114.

Carrillat, F. A., Jaramillo, F., & Mulki, J. P. (2007). The validity of the SERVQUAL and SERVPERF scales: A meta-analytic view of 17 years of research across five continents. *International Journal of Service Industry Management*, *18*(5), 474–490. doi:10.1108/09564230710826250

Cronin, J. J. Jr, & Taylor, A. S. (1992). Measuring service quality: A reexamination and an Extension. *Journal of Marketing*, *56*(3), 55–67. doi:10.2307/1252296

Parasuraman, A., Zeithaml, V. A., & Berry, L. L. (1985). A conceptual model of service quality and its implications for future research. *Journal of Marketing*, *49*(4), 41–50. doi:10.2307/1251430

Parasuraman, A., Zeithaml, V. A., & Berry, L. L. (1988). SERVQUAL: A multiple-item scale for measuring consumer perception of service quality. *Journal of Retailing*, *64*(1), 12–40.

Parasuraman, A., Zeithaml, V. A., & Malhotra, A. (2005). E-S-Qual: A multiple-item scale for assessing electronic service quality. *Journal of Service Research*, *7*(3), 213–233. doi:10.1177/1094670504271156

Pitt, L. F., Watson, R. T., & Kavan, C. B. (1995). Service quality: A measure of information systems effectiveness. *MIS Quarterly*, *19*(2), 173–187. doi:10.2307/249687

Teas, K. R. (1993). Expectations, performance evaluation, and consumers' perceptions of quality. *Journal of Marketing*, *57*(4), 18–34. doi:10.2307/1252216

Wolfinbarger, M., & Gilly, M. (2003). eTailQ: Dimensionalizing, measuring, and predicting retail quality. *Journal of Retailing*, *79*, 183–193. doi:10.1016/S0022-4359(03)00034-4

Yoo, B., & Donthu, N. (2001). Developing a scale to measure perceived quality of an internet shopping site (SITEQUAL). *Quarterly Journal of Electronic Commerce*, *2*(1), 31–46.

## ADDITIONAL READING

Aladwani, A. M., & Palvia, P. C. (2002). Developing and validating an instrument for measuring user-perceived web quality. *Information & Management*, *39*, 467–476. doi:10.1016/S0378-7206(01)00113-6

Broderick, A. J., & Bachirapornpuk, S. (2002). Service quality in Internet banking: The importance of customer role. *Marketing Intelligence & Planning*, *20*(6), 327–335. doi:10.1108/02634500210445383

Caruana, A., & Ewing, M. T. (2006). The psychometric properties of eTail quality. *International Marketing Review*, *23*(4), 353–370. doi:10.1108/02651330610678958

Collier, J. E., & Bienstock, C. C. (2006). Measuring service quality in e-retailing . *Journal of Service Research*, *8*(3), 260–275. doi:10.1177/1094670505278867

Cronin, J. J. Jr, & Taylor, A. S. (1994). SERVPERF versus SERVQUAL: Reconciling performance-based and perceptions-minus-expectations measurement of service quality. *Journal of Marketing*, *58*(1), 125–131. doi:10.2307/1252256

Eriksson, L., Firman, M., & Norman, A. (2007). Electronic service quality: Public transport information on the Internet. *Journal of Public Transportation*, *10*(3), 35–46.

Fassnacht, M., & Koese, I. (2006). Quality of electronic services: Conceptualizing and testing a hierarchical model. *Journal of Service Research*, *9*(1), 19–37. doi:10.1177/1094670506289531

Heim, G. R., & Field, J. M. (2007). Process drivers of e-service quality: Analysis of data from an online rating site. *Journal of Operations Management*, *25*, 962–984. doi:10.1016/j.jom.2006.10.002

Kettinger, W. J., & Lee, C. C. (1994). Perceived service quality and user satisfaction with the information services function. *Decision Sciences*, *25*(5/6), 737–766. doi:10.1111/j.1540-5915.1994.tb01868.x

Kim, M., Kim, J., & Lennon, S. (2006). Online service attributes available on apparel retail web sites: An E-S-QUAL approach. *Managing Service Quality*, *16*(1), 51–77. doi:10.1108/09604520610639964

Parasuraman, A., Zeithaml, V. A., & Berry, L. L. (1994). Reassessment of expectation as a comparison standard in measuring service quality: Implications for further research. *Journal of Marketing*, *58*(1), 111–124. doi:10.2307/1252255

Rowley, J., & Slack, F. (2007). Information kiosks: A taxonomy. *The Journal of Documentation*, *63*(6), 879–897. doi:10.1108/00220410710836402

Van Iwaarden, J., Van der Wiele, T., & Ball, L. (2004). Perceptions about the quality of web sites: a survey amongst students at Northeastern University and Erasmus University. *Information & Management*, *41*, 947–959. doi:10.1016/j.im.2003.10.002

Zeithaml, V. A. (2002). Service excellence in electronic channels. *Managing Service Quality*, *12*(3), 135–138. doi:10.1108/09604520210429187

Zeithaml, V. A., Parasuraman, A., & Malhotra, A. (2002). Service quality delivery through web sites: A critical review of extant knowledge. *Journal of the Academy of Marketing Science*, *30*(4), 362–375. doi:10.1177/009207002236911

## KEY TERMS AND DEFINITIONS

**E-RecS-QUAL:** An eleven item survey instrument used to assess the quality of recovery services (e.g., product returns) associated with e-commerce. The instrument includes three dimensions: responsiveness, compensation, and contacts.

**E-S-QUAL:** A twenty two item survey instrument used to assess electronic service quality. The instrument includes four dimensions: efficiency, system availability, privacy, and fulfillment.

**eTailQ:** A fourteen item survey instrument used to assess the quality of retail electronic commerce. The instrument includes four dimensions: web site design, security/privacy, fulfillment/reliability, and customer service.

**Service Quality:** The level of service provided by a person, organization, or a computer-based source. If the service is provided by a computer-based source (e.g., Web site), the service quality is referred to as an electronic service quality.

**SERVPERF:** A twenty two item survey instrument used to assess non-electronic service quality base on perceptions of actual service quality. The instrument includes five dimensions: reliability, assurance, tangibles, empathy, and responsiveness.

**SERVQUAL:** A survey instrument with twenty two pairs of items used to assess non-electronic service quality based on gap scores between perceptions of actual and expected service quality. The instrument includes five dimensions: reliability, assurance, tangibles, empathy, and responsiveness.

**SITEQUAL:** A nine item survey instrument used to assess e-commerce web site quality. The instrument includes four dimensions: aesthetic design, ease of use, processing speed, and security.

**WebQual:** A twenty two item survey instrument used to assess e-commerce web site quality. The instrument includes three dimensions: usability, information quality, and service interaction.

Chapter 14

# Measuring B2C Quality of Electronic Service: Towards a Common Consensus

**Mahmoud Amer**
*Carl von Ossietzky University of Oldenburg, Germany*

**Jorge Marx Gómez**
*Carl von Ossietzky University of Oldenburg, Germany*

## INTRODUCTION

In our efforts to study the dimensions affecting the electronic service quality (eSQ) measurement in the Business to Business (B2B) domain, we were faced with a problem of the lack of consensus on the Business to Consumer (B2C) eSQ measurement dimensions, which makes it difficult for researchers in this field to generalize their findings on the B2B domain.

Due to this lack of consensus on the subject, we have decided to propose a B2C electronic Service Quality "eSQ" model of consensus summarizing the past research efforts in this domain. In order to test - in future research- if the model proposed here for B2C eSQ can be extended to the B2B domain or not. This study tries to explain some of the current scales used in measuring electronic service quality in the Business to Consumer "B2C" domain, propose a model of consensus for the eSQ B2C based on an extensive literature review of the collective work done by the researches in this field.

DOI: 10.4018/978-1-61520-611-7.ch014

## BACKGROUND

The eService topic is currently one of the most discussed segments in the eCommerce domain. Maybe due to the increasing competition between many of the service providers in the virtual world. This article discusses the topic of electronic service quality and how to measure it, and summarizes the huge work done by some researchers in the B2C domain. Moreover, it tries to discuss some of the models used in that domain, and propose metrics that would help us to form a consensus on the eSQ for B2C.

## Electronic Service Quality Definitions

In order to measure the electronic service quality, it should be defined first. The origin of the eSQ can be traced back to the service quality. Collier & Carol (2006) define e-service quality as "customer's perceptions of the outcome of the service along with recovery perceptions if a problem should occur".

Zeithaml (2002) defines the electronic service quality as "the extent to which a web site facilitates efficient and effective shopping, purchasing and delivery", which had significant impact on the companies in the service sector. In this sector, the definition usually focuses on meeting customer's needs and requirements, and tries to explain how the service delivered can meet the company's expectations (Lewis & Booms, 1983).

# LITERATURE REVIEW

Electronic services are no longer regarded as trendy internet applications; rather, customers have become more and more demanding. Also, they are less tolerant to poor services performance, and it is the delivery of high services quality that makes customers come back and buy again (Fassnacht & Koese, 2006).

Many studies were conducted to put some metrics to measure e-commerce services quality. One of the most popular studies is the study of (Parasurman, Zeithmal, & Malhotra, 2005). This study set out to conceptualize, construct, refine, and test a multiple item scale (E-S-QUAL) for measuring the service quality delivered by websites. The E-S-QUAL was refined, and a subscale of E-S-QUAL called E-ReS-QUAL containing items focusing on handling service problems and inquiries was introduced.

Collier & Carol (2006) suggested that customers evaluate the process of placing an order by evaluating the design, information accuracy, privacy, functionality, and ease of the use of a website. (Trabold, Heim, & Field, 2006) found several interesting differences across the different e-retailing sectors, and mainly focused on analyzing the impacts on the overall e-service quality dimensions of online retailers, along with several other sectors in the B2C environment. These dimensions have resulted in finding differences in service quality among different market sectors.

The study by Fassnacht & Koese (2006) resulted in a conceptualization with three dimensions, and nine sub dimensions that offer an understanding of Quality of Electronic Services (QoES). The three dimensions are environment quality, delivery quality, and outcome quality. The sub dimensions are: graphic quality, clarity of layout, attractiveness of selection, information quality, ease of use, technical quality, functional benefit, and emotional benefit. Jun, Yang, & DaeSoo (2004) revealed some important findings about online service quality. The study identified six key online retailing service quality dimensions as perceived by online customers: reliable prompt responses, access, ease of use, attractiveness, security, and credibility.

In order to deliver and maintain the service quality, an organization must first identify what constitutes quality to those whom it serves (Grönroos, 1984; Grönroos, 1984) classified service quality into two categories: Technical quality, which is primarily focused on what consumers actually received from the service; and Functional quality, focused on the process of service delivery (Fassnacht & Koese, 2006).

## SERVQUAL, E-S-QUAL AND WEBQUAL MEASUREMENT SCALES

1. SERVQUAL:

Zeithaml (2002) and Parasurman, Zeithmal, & Malhotra (2005) did a study on measuring online service quality, this study was a continuation of their efforts in measuring service quality in the physical markets (i.e. "Brick & Mortar companies"). This effort led to the development of the E-S-QUAL scale based on the 7 dimensions (Zeithaml, 2000; Zeithaml, 2002; Parasurman, Zeithmal, & Malhotra, 2005). Zeithaml (2002) studied the differences between the two measurement scales SERVQUAL and E-S-QUAL. Zeithaml (2002) indicated that some dimensions from the SERVQUAL scales can be re-implemented and used to measure electronic service quality, but also indicated that other dimensions needs to be added to this scale to reflect the technological aspects of the electronic service quality measurement.

2. E-S-QUAL:

The E-S-QUAL scale consists of 11 dimensions in measuring the electronic service quality; this scale was later revised by Parasurman, Zeithmal, & Malhotra (2005) and was reduced to 7 dimensions. These dimensions are categorized into two groups, the Core dimensions and the Recovery dimensions. The Core dimensions are: efficiency, system availability, fulfillment, and privacy. And were named E-S-QUAL. and the other dimensions like: responsiveness, compensation, and contact, were called ERecSQUAL (Parasurman, Zeithmal, & Malhotra, 2005).

3. WebQual

WebQual instrument is based on what is known as Quality Function Deployment or (QFD) for short, it is a "Structured and disciplined process that provides a means to identify and carry the voice of the customer through each stage of product and or service development and implementation" (Slabey, 1990).

As in all the other instruments, this method takes the customer point of view of the website, by capturing the quality requirements through phrases and words that are easily understood by the customer. And then, the customer is asked to rate the website based on a range of qualities on a 5 points scale. After that, the customer is asked to give a weight for each quality dimension by rating each of the qualities for importance using also a 5 points scale. By using this "weighted" manipulation, we get a better understanding of the customer's perspective regarding the importance of these qualities as perceived by him/her.

The three models which were discussed above are not the only models available for measuring eSQ, but they are the major tools used in this domain. Other models which also have a wide impact on the research are mentioned in Figure 1. These models cannot be discussed here due to the impracticality of discussing them now in this article. But each of these models is classified by its dimensions in the mentioned table.

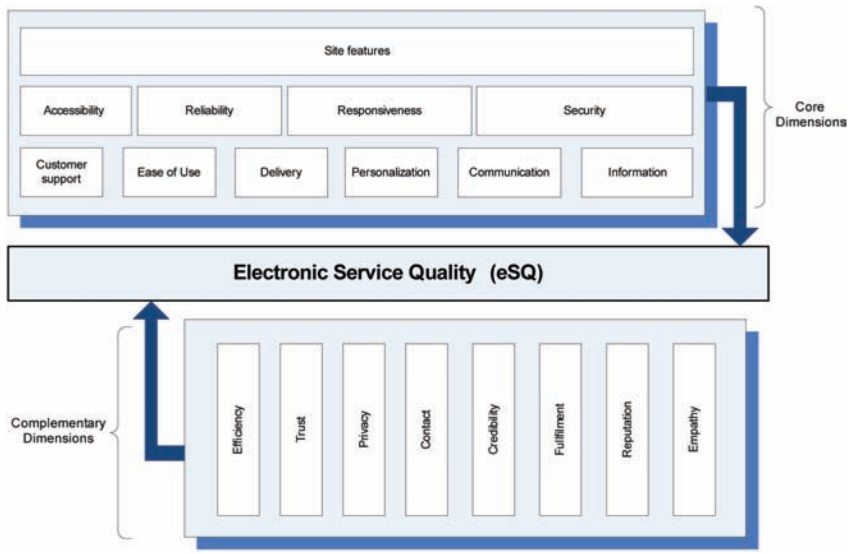
## RESEARCHING E-SERVICE QUALITY

Figure 1 shows the major studies researched in the online B2C domain, along with its correspondent dimensions proposed for measuring the electronic services. The table consists of 31 models proposed by the leading researchers in this domain, and a summary of the interlaced dimensions. It shows the most common dimensions like site features, security, responsiveness, reliability, accessibility, communications, personalization, delivery, ease of use, and customer support. These are what to become the core dimensions in the Figure 2. It should be noted here that we have adopted the idea of grouping the dimension together based of their descriptions rather than their names (Rowley,

*Figure 1. Literature classification of the eSQ dimensions*

| Author(s) | Site Features | Security | Responsiveness | Reliability | Accessibility | Information | Communication | Personalization | Delivery | Ease of Use |
|---|---|---|---|---|---|---|---|---|---|---|
| Kim et al. (2006) | • | • | • | • | • | • | | • | | |
| Yang and Fang (2004) | • | • | • | • | • | | | | | |
| Yang and Jun (2002) | • | • | • | • | • | | | • | | |
| Zeithaml et al. (2000) | • | • | • | • | • | | | • | | |
| Zeithaml et al. (2000) | • | • | • | • | • | | | • | | |
| Yang et al. (2004) | • | • | • | • | | | | | | • |
| Lee and Lin (2005) | • | • | • | • | | | | | | |
| Yang et al. (2003) | • | • | • | | • | | | | | • |
| Loiacono et al. (2002) | • | • | • | | | • | • | | | |
| Jayawardhena (2004) | • | • | | | • | | | | | |
| Field et al., (2004) | • | • | | • | | | | | | |
| Waite (2006) | • | • | | | | | | | | |
| Yoo and Donthu (2001) | • | • | | | | | | | | • |
| Yang et al. (2001) | • | • | | | | • | | | | |
| Jun and Cai (2001) | • | • | | | | • | | | | • |
| BizRate.com (www.bizrate.com) | • | • | | | | • | | | • | |
| Wolfinbarger and Gilly (2002) | • | • | | • | | | | | | |
| Madu and Madu (2002) | • | • | | | | | • | • | | |
| Janda et al. (2002) | • | • | | | • | • | | | • | |
| Santos (2003) | • | • | | • | | • | • | | | • |
| Gounaris et al. (2005) | • | | • | | | • | | | | |
| Yen (2005) | • | | | | | | | | | |
| Dabholkar (1996) | • | | | • | | | | | • | • |
| Kaynama and Black (2000) | • | | • | | • | • | | • | | |
| Fassnacht and Koese (2006) | • | | | • | | • | | | | • |
| Cox and Dale (2001) | • | | | | • | | • | | | |
| Kim and Stoel (2004) | • | | • | | | • | | | | |
| Long and McMellon (2004) | | • | • | • | | | • | | • | |
| Zeithaml et al. (2002) | | • | • | • | | | • | | • | |
| Parasuraman et al. (2005) | | • | • | | • | | • | | • | |
| Surjadaja et al. (2003) | | • | • | | • | • | • | • | • | |
| *Total number of researches citing a dimension* | 27 | 24 | 16 | 14 | 12 | 12 | 8 | 7 | 7 | 7 |

*Figure 2. eSQ measurement model "B2C Domain"*




2006). Because Rowley (2006) indicates that some dimensions (such as reliability and responsiveness) are described with the same term in most studies. Others are described with different terms in different studies. Site aesthetics, ease of use, ease of navigation, appearance, design, intuitiveness, visual appeal, ease of ordering, web site performance, structure, flow, and interaction and sensation (Rowley, 2006, p. 384).

Having grouped the similar dimensions of electronic service quality together, and excluding the deviations, it shows the common dimension that appeared to be vital for measuring eSQ in most of the literature. These dimensions are shown in Figure 2 as part of the core dimensions. It would be rational to identify and group the core dimensions of B2C eSQ together, as it will provide us with a common ground to see deviations between the core B2C eSQ dimensions in different sectors, these core dimensions are considered as vital services provided to customers, irrespective of the company's type of business (i.e. cross services found in all companies even if they are in different market segments).

Figure 1 indicates that the dimension "site features" appeared 27 times in the various studies, "security" appeared 24 times, "responsiveness" 16 times, "reliability" 14 times, "accessibility" 12 times, "information" 12 times, "communication" 8 times, "personalization" 7 times, "delivery" 7 times, "ease of use" 7 times, "customer support" 5 times, while there was some disagreements in the studies on the dimensions 20 times.

Each of these dimensions is given a weight based on its importance, by which we mean the most discussed and agreed upon dimensions in the past research (i.e. have the most consensus) . And it is reflected in the Figure 2 by the size of the dimension's shape. The bigger it is, the more weight or importance it represent. And this will be reflected in the measuring tool used to study the company's service quality through an empirical study. In this way, the more dominant dimensions have more contribution in reflecting the right level of service quality perceived by the customer.

As we can see from this table, there is some consensus on the dimensions that are needed to measure B2C eSQ, but these dimensions on their own are not enough to measure eSQ, so the complementary dimensions are added to complete the analysis. These complementary dimensions are not all mandatory to be used for measuring the eSQ. some of them are of less weight compared to the core services. But they are adapted and used in different market segments. For example: companies providing online after sale services to end customers of physical products (i.e. “Click & Mortar Companies”) have different complementary dimensions than companies providing consultation services, or some accountancy book keeping. In this way, customers in one market segment will represent different quality preferences, than customers in other market segments. In summary, each company have all of the core dimensions and some of the complementary dimensions, so the model is tailored and adapted depending on the company’s services and type of work (Market Segment).

In this consensus, we can use this model as a basis for future research in researching a concrete framework toward measuring business to consumer electronic service quality.

## LIMITATIONS AND FUTURE RESEARCH

This article studies the past research and literature in the eSQ B2C domain, and proposes a consensus on the measurement dimensions needed in this area. As we tried to measure the eSQ for the B2B markets, we were faced with the challenge of finding scales suitable for the B2C domain first. So this model of the eSQ B2C was proposed to summarize a consensus of an agreed upon dimensions by different researchers and practitioners in this field. Our future research work will be to classify the complementary dimensions based on their market segment and to see whether these dimensions can be extended to the B2B domain or not. The proposed model in this article shall be the basis for other research work that we are currently doing in the B2B domain, in our efforts to identify differences and incompatibilities between the B2C and B2B electronic markets.

## REFERENCES


Barnes, S., & R. T, V. (2001, January 4-6). Assessing the Quality of Auction Web Sites. In *Proceedings of the Hawaii International Conference on Systems Sciences,* Maui, Hawaii.

Collier, J., & Carol, B. (2006). Measuring Quality in E-Retailing. *Journal of Service Research*, *8*(3), 260–275. doi:10.1177/1094670505278867

Cox, J., & Dale, B. (2001). Service quality and e-commerce: an exploratory analysis. *Managing Service Quality*, *11*(2), 121–131. doi:10.1108/09604520110387257

Dabholkar, P.(n.d.). Consumer evaluations of new technology-based self-service options: an investigation of alternative modes of service quality. *International Journal of Research in Marketing*, *13*(1), 29–51. doi:10.1016/0167-8116(95)00027-5

Fassnacht, M., & Koese, I. (2006). Quality of Electronic Services. *Journal of Service Research*, *9*(1), 19–37. doi:10.1177/1094670506289531

Field, J., Heim, G., & Sinha, K. (2004). Managing quality in the e-service system: development and application of a process model. *Production and Operations*, *13*(4), 291–306.

Gounaris, S., Dimitriadis, S., & Stathakopoulos, V. (2005). Antecedents of perceived quality in the context of Internet retail stores. *Journal of Marketing Management*, *21*(7), 669–700. doi:10.1362/026725705774538390

Grönroos, C. (1984). A service quality model and its marketing implications. *European Journal of Marketing*, *18*(4), 37–44. doi:10.1108/EUM0000000004784

Janda, S., Trocchia, P., & Gwinner, K. (2002). Consumer perceptions of Internet retail service quality. *International Journal of Service Industry Management*, *13*(5), 412–431. doi:10.1108/09564230210447913

Jayawardhena, C. (2004). Measurement of service quality in Internet banking: the development of an instrument. *Journal of Marketing Management*, *20*, 185–207. doi:10.1362/026725704773041177

Jun, M., & Cai, S. (2001). The key determinants of Internet banking service quality: a content analysis. *International Journal of Bank Marketing*, *19*(7), 276–291. doi:10.1108/02652320110409825

Jun, M., & Yang, Z., & DaeSoo, K. (2004). Customers Perceptions of online retailing service quality and their satisfaction. *International Journal of Quality & Reliability Management*, *21*(8), 817–840. doi:10.1108/02656710410551728

Kaynama, S., & Black, C. (2000). A proposal to assess the service quality of online travel agencies: an exploratory study. *Journal of Professional Services Marketing*, *21*(1), 63–88. doi:10.1300/J090v21n01_05

Kim, M., Kim, J.-H., & Lennon, S. (2006). Online service attributes available on apparel retail web sites: an E-S-QUAL approach. *Managing Service Quality*, *16*(1), 51–77. doi:10.1108/09604520610639964

Lee, G.-G., & Lin, H.-F. (2005). Customer perceptions of e-service quality in online shopping. *International Journal of Retail & Distribution Management*, *33*(2), 161–176. doi:10.1108/09590550510581485

Lewis, R. C., & Booms, B. H. (1983). The Marketing Aspects of SQ. In Berry L.L, Shostack, G.L., Upah, G.D. (Eds.). *Emerging Perspectives on Services Marketing* (pp. 99-104). Chicago, IL: American Marketing Association.

Lociacono, E., Watson, R., & Hoodhue, D. (2002). WEBQUAL: measure of web site quality. *2002 Marketing Educators Conference: Marketing Theory and Applications, 13*, 432-437.

Long, M., & McMellon, C. (2004). Exploring the determinants of retail service quality on the Internet. *Journal of Services Marketing*, *18*(1), 78–90. doi:10.1108/08876040410520726

Madu, C., & Madu, A. (2002). Dimensions of e-quality. *International Journal of Quality & Reliability Management*, *19*(3), 246–259. doi:10.1108/02656710210415668

Parasuraman, A., & Zeithaml, V., & Berry. (1985). A conceptual model of service quality and its implications for future research. *Journal of Marketing*, 41–50. doi:10.2307/1251430

Parasurman, A., Zeithmal, V., & Malhotra, A. (2005). E-S-QUAL: a multiple item scale for assessing Electronic Service Quality. *Journal of Service Research*, *7*(3), 213–233. doi:10.1177/1094670504271156

Rowley, J. (2006). An analysis of the e-service literature: towards a research agenda. *Journal of Internet Research*, *16*(3), 339–359. doi:10.1108/10662240610673736

Santos, J. (2003). E-service quality – a model of virtual service dimensions. *Managing Service Quality*, *13*(3), 233–247. doi:10.1108/09604520310476490

Slabey, R. (1990). QFD: A Basic Primer. In *Transactions from the Second Symposium on Quality Function Deployment,* Novi, Michigan.

Surjadaja, H., Ghosh, S., & Antony, F. (2003). Determining and assessing the determinants of e-service operations. *Managing Service Quality*, *13*(1), 39–44. doi:10.1108/09604520310456708

Trabold, L., Heim, G., & Field, J. (2006). Comparing e-services performance across industry sector: Drivers of Overall satisfaction in online retailing. *International Journal of Retail Distribution Management*, *34*(4/5), 240–257. doi:10.1108/09590550610660215

Waite, K. (2006). Task scenario effects on bank web site expectations. *Internet Research*, *16*(1), 7–22. doi:10.1108/10662240610642514

Wolfinbarger, M., & Gilly, M. (2002). *comQ: dimensionalizing, measuring and predicting quality of the e-tailing experience.* Cambridge, MA: Marketing Science Institute.

Yang, Z., & Fang, X. (2004). Online service quality dimensions and their relationships with satisfaction: a content analysis of customer reviews of securities brokerage services. *International Journal of Service Industry Management*, *15*(3), 302–326. doi:10.1108/09564230410540953

Yang, Z., & Jun, M. (2002). Consumer perception of e-service quality: from Internet purchaser and non-purchaser perspectives. *The Journal of Business Strategy*, *19*(1), 19–41.

Yang, Z., Peterson, R., & Cai, S. (2003). Services quality dimensions of Internet retailing: an exploratory analysis. *Journal of Services Marketing*, *17*(7), 685–701. doi:10.1108/08876040310501241

Yang, Z., Peterson, R., & Huang, L. (2001). Taking the pulse of Internet pharmacies. *Marketing Health Services.*

Yen, H. (2005). An attribute-based model of quality satisfaction for Internet self-service technology. *The Service Industries Journal*, *25*(5), 641–659. doi:10.1080/02642060500100833

Yoo, B., & Donthu, N. (2001). Developing a scale to measure perceived quality of an Internet shopping site (SITEQUAL). *Quarterly Journal of Electronic Commerce*, *2*(1), 31–46.

Zeithaml, V. (2000). Service quality, profitability and the economic worth of customers: What we know and what we need to learn. *Journal of the Academy of Marketing Science*, *28*(1), 67–85. doi:10.1177/0092070300281007

Zeithaml, V. (2002). Service excellence in electronic channels. *Managing Service Quality*, *12*(3), 135–139. doi:10.1108/09604520210429187

## KEY TERMS AND DEFINITIONS

**Brick and Mortar Company:** a traditional "street-side" business that deals with its customers face to face in an office or store that the business owns or rents.

**Business-to-Business (B2B):** is a term used to describe transactions between businesses like the one between a supplier and a manufacturer (i.e. both the buyer and the seller are business entity).

**Business-to-Consumers (B2C):** is a term used to describe transactions between businesses and Consumers, retailing in the major form of this model.

**Click and Mortar Company:** a type of business model that includes both online and offline operations, which typically include a website and a physical store. A click-and-mortar company can offer customers the benefits of fast, online transactions or traditional, face to face service.

**Electronic Business:** commonly referred to as "eBusiness" or "e-Business", may be defined as the utilization of information and communication technologies (ICT) in support of all the activities of business.

**Electronic Commerce:** constitutes the exchange of products and services between businesses, groups and individuals online and hence can be seen as one of the essential activities of eBusiness.

**Electronic Service Quality (eSQ):** the extent to which a website supports purchases and delivery of products and services in an efficient and effective manner.

**Online Shopping:** is the process consumers go through to purchase products or services over the Internet.

**SERVQUAL:** is a service quality framework. SERVQUAL was developed in the mid eighties by Zeithaml, Parasuraman & Berry. Was originally measured on 10 aspects of service quality: reliability, responsiveness, competence, access, courtesy, communication, credibility, security, understanding or knowing the customer and tangibles. It measures the gap between customer expectations and experience.

# Chapter 15
# The Business Value of E-Collaboration: A Conceptual Framework

**Lior Fink**
*Ben-Gurion University of the Negev, Israel*

## INTRODUCTION

This article presents a conceptual framework of the business value of e-collaboration. In the past decade, firms have increasingly implemented collaborative technologies to support business activities, and investments in collaborative technologies have taken an increasing share of firms' e-business investments. Presumably, such investments have been motivated by the notion that the implementation of collaborative technologies has business value. While research has repeatedly demonstrated the individual- and group-level impacts of collaborative technologies, it has rarely addressed their impacts at the organizational level and demonstrated their business value. In this article, I draw on three strategic management frameworks – the resource-based view of the firm, the knowledge-based view of the firm, and the dynamic capabilities perspective – to describe how specialized knowledge assets can be integrated through collaborative processes to create and sustain a competitive advantage. I then use this conceptualization as a platform for defining the organizational roles of collaborative technologies and the potential impact of each role on organizational performance. The main objective of this article is to provide a conceptual framework for researchers and practitioners who are interested in investigating and understanding the organizational impacts of collaborative technologies.

## BACKGROUND

### Resource- and Knowledge-Based Views of the Firm

The resource-based view of the firm (Barney, 1991) argues that heterogeneity and immobility of firm resources can provide a basis for superior competitive performance. Firm resources that are strategically valuable and heterogeneously distributed enable firms to outperform the competition. However, such

DOI: 10.4018/978-1-61520-611-7.ch015

a competitive advantage cannot be sustained if competitors can acquire strategically equivalent resources to implement the same valuable strategy. Therefore, for a firm to sustain its competitive advantage, its valuable and rare resources should not be open to imitation or substitution.

The knowledge-based view of the firm (Grant, 1996; Kogut & Zander, 1996; Nonaka, 1991) extends the resource-based view by defining organizational knowledge as a valuable subset of firm resources. The knowledge-based view perceives a firm as a knowledge-creating entity; it argues that the capability to create and utilize knowledge is the most valuable source of the firm's sustainable competitive advantage (Nonaka, Toyama, & Nagata, 2000). Specialized, firm-specific knowledge resources are those that are valuable, scarce, and difficult to imitate, transfer, or substitute. By using such resources, a firm could gain an advantage in its markets that competitors would find difficult to overcome.

Applying Grant's (1996) view of coordination mechanisms, e-collaboration is conceptualized here as a group coordination mechanism. Kock, Davison, Wazlawick, and Ocker (2001) define e-collaboration as "collaboration among individuals engaged in a common task using electronic technologies" (p. 1). This definition encompasses different types of systems, ranging from computer-mediated communication (CMC), through group decision support systems (GDSS), to Web-based collaboration tools (Kock & Nosek, 2005). Nonetheless, researchers agree that e-collaboration tools are vehicles for information and knowledge sharing that transcends traditional limitations of time and space. Therefore, compared with traditional coordination mechanisms, e-collaboration is a group coordination mechanism with wider capabilities because it enables and facilitates the work of *virtual* groups, giving firms extra degrees of freedom in establishing and managing knowledge-sharing mechanisms.

## Dynamic Capabilities Perspective

The dynamic capabilities perspective (Teece, Pisano, & Shuen, 1997) is an extension of the resource-based view to dynamic markets. It has evolved to account for the deficiencies of the resource-based view in explaining how firm resources are developed and renewed in response to shifts in the business environment. The resource-based view identifies a subset of resources as a potential source of competitive advantage. However, this is a static view of the relationship between firm resources and competitive advantage. When change occurs in the business environment, firm resources should evolve to enable new and innovative forms of competitive advantage. By adopting a process approach, the dynamic capabilities perspective argues that dynamic capabilities are the process mechanisms responsible for the continuous development of resources in the face of rapidly evolving strategic needs.

By viewing specialized, firm-specific knowledge resources as a strategic asset and e-collaboration processes as a dynamic capability, I propose that e-collaboration is a potential source of competitive advantage, because of its ability to foster organizational change and innovation. In rapidly changing business environments, knowledge assets that have enabled superior competitiveness can quickly lose their strategic relevance, calling for the fast identification and utilization of novel, possibly tacit and distributed knowledge bases to maintain a favorable market position. In these situations, e-collaboration can provide a unique mechanism for the persistent identification, organization, integration, and utilization of knowledge assets. By creating webs of collaborations among various business segments, firms are able to generate new and synergistic resource combinations (Eisenhardt & Galunic, 2000). The dynamic capability of e-collaboration enables the frequent introduction of organizational innovations, which, in turn, can provide a source of sustained competitive advantage.

## ORGANIZATIONAL ROLES OF E-COLLABORATION

Teece et al. (1997) describe organizational processes as having three roles: coordination/integration (a static concept), learning (a dynamic concept), and reconfiguration (a transformational concept). Building upon this framework, I describe coordination, learning, and innovation as the three organizational roles of e-collaboration.

## COORDINATION

The primary functional role of e-collaboration is to facilitate coordination among individuals, groups, and organizations. Malone and Crowston (1994), who define coordination as "managing dependencies between activities" (p. 90), describe communication and group decision making as two processes that are important in almost all instances of coordination. Collaborative technologies are typically designed to facilitate communication and decision making and therefore enable firms to manage dependencies between activities more efficiently and effectively, whether those dependencies are intra- or inter-organizational. The ability of collaborative technologies to enhance coordination among organizations is frequently discussed in the context of interorganizational systems (e.g., Chi & Holsapple, 2005). Bafoutsou and Mentzas (2002) demonstrate that all categories of electronic tools for communication and collaboration address some of the coordination problems created by recent organizational trends, such as decentralization and outsourcing.

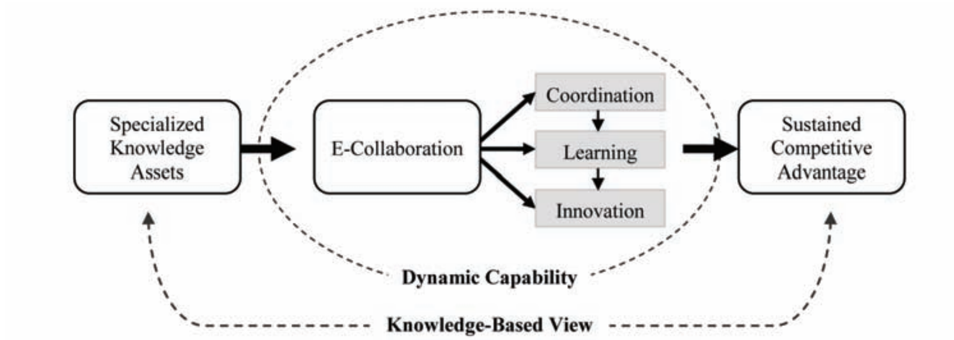
### Learning

E-collaboration may serve as a mechanism for facilitating learning by boosting knowledge creation and sharing processes. Kogut and Zander (1996) view firms as organizations that represent social knowledge of coordination and learning. Collaborative technologies can enable individuals to arrive at new insights by providing an extended field for interaction among members of an organization (Alavi & Leidner, 2001). The use of collaborative technologies improves the three aspects of knowledge management – knowledge creation, knowledge discovery, and knowledge transfer (Paul, 2006). Leidner, Alavi, and Kayworth (2006) describe two fundamental approaches to knowledge management: the process approach and the practice approach. The process approach attempts to codify organizational knowledge through formalized processes. In contrast, the practice approach attempts to build social environments necessary to facilitate the sharing of tacit knowledge. According to Leidner et al., both approaches involve the use of collaborative technologies – either to enhance the quality and speed of knowledge creation and distribution or to facilitate conversations and transfer of tacit knowledge.

### Innovation

Knowledge can provide a firm with a competitive advantage, because it is through this knowledge that the firm is able to introduce innovation in processes, products, and services (Nonaka et al., 2000). Nonaka (1991) describes the "knowledge-creating company" as a company "whose sole business is continuous innovation" (p. 96). Collaborative technologies play a significant role in creating business innovation (Eden & Ackermann, 2001). Wheeler (2002) proposes the net-enabled business innovation cycle (NEBIC) as an applied dynamic capabilities theory for understanding how pervasive digital networks can enable growth through business innovation. The role of collaboration in fostering business innovation is also demonstrated in absorptive capacity research. Cohen and Levinthal (1990) show that a firm's absorptive capacity – its ability to recognize, assimilate, and apply new information based on prior related knowledge – is critical to its innovative capabilities. E-collaboration as a platform for

*Figure 1. How e-collaboration creates a competitive advantage*




interaction and learning creates opportunities for integrating new external knowledge into existing knowledge assets. Figure 1 graphically presents the process through which e-collaboration creates a competitive advantage.

## ORGANIZATIONAL PERFORMANCE IMPACTS OF E-COLLABORATION

In a comprehensive review of the literature on IT and organizational performance, Melville, Kraemer, and Gurbaxani (2004) highlight the existence of two formulations of performance, efficiency and effectiveness. The former, designated efficiency impacts, adopts an internal process perspective using such metrics as cost reduction and productivity enhancement. The latter, designated competitive impacts, focuses on the attainment of organizational objectives in relation to the external environment. I propose that e-collaboration roles are associated with both efficiency and competitive impacts. However, the particular roles differ in their impacts on organizational performance – coordination leads primarily to efficiency impacts, whereas learning and innovation are more strongly associated with competitive impacts.

One of the most fundamental performance impacts attributed to IT is the reduction of coordination costs. Efficiency impacts also result from better coordination with the external business environment. Collaborative supply chain management (SCM) systems, which strengthen coordination among partners in a supply chain, offer inventory, process, and product cost reductions, while lowering the total cost of system ownership (McLaren, Head, & Yuan, 2002). Coordination-based efficiency impacts are apparent at the organizational and interorganizational levels, but also at lower levels. Huang and Newell (2003) empirically demonstrate that the level of coordination positively affects integration efficiency in the context of cross-functional project teams. In conclusion, implementing collaborative technologies for the purpose of enhancing coordination, at different organizational levels, can deliver a wide range of organizational efficiency impacts.

Conversely, organizational learning has the potential to generate both efficiency and competitive impacts, depending on its objectives and level. Electronic links enhance lower and higher levels of learning (Scott, 2000). At the lower level, collaborative technologies are used to integrate explicit knowledge for the purpose of reducing process and product costs, shortening cycle times, improving productivity, enhancing quality, and streamlining business processes. At the higher level, collaborative technologies are used to facilitate strategic planning, strengthening the ability of firms to identify opportunities and threats in the business environment, to understand their strengths and weaknesses, to formulate an organizational vision, and to develop creative solutions to organizational problems. By identifying, integrating, and utilizing organizational sources of tacit knowledge, a firm can outperform the competition and gain a competitive advantage. However, at the higher level, the competitive impacts of learning are not direct but rather mediated through innovation. There is a causal relationship between organizational learning capabilities, process and product innovation, and competitive advantage (Adams & Lamont, 2003). While collaborative technologies may be viewed as commodity resources that are susceptible to imitation, a firm's ability to exploit their potential in facilitating its learning and innovation capabilities is critical in gaining IT-based competitiveness. The strategic importance of learning comes from implying path-dependency and specificity in organizational transformations preventing imitability, which is crucial for competitive advantage (Andreu & Ciborra, 1996). In recent years, it seems that continuous business innovation has repeatedly been identified, more than any other organizational capability, as a potential source of competitive advantage in contemporary business environments (e.g., Sawhney, Wolcott, & Arroniz, 2006).

## A CONTINGENCY PERSPECTIVE OF E-COLLABORATION

In this section, I draw on contingency theory to integrate the conceptualizations developed thus far in this article into a process view of e-collaboration at the organizational level. Contingency theory, one of the most dominant theories in the study of organizational design and performance, is based on the assumption that there is no one best way to organize, and that any one way of organizing is not equally effective under all conditions (Galbraith, 1973). Central to this theory is the proposition that the structure and process of an organization must fit its context, if it is to be effective (Drazin & Van de Ven, 1985). The contingency approach to information systems research suggests that the better the fit between contingency variables and the design and use of IT, the better the IT performance and the organizational performance (Weill & Olson, 1989).

The view developed here focuses on the business environment, specifically on the extent to which it is dynamic, as the primary contingency variable determining the preferred mode of e-collaboration. The business environment has been conceptualized as one of the key constructs for understanding organizational behavior and performance (Prescott, 1986). One of its important characteristics is the rate of change in products, processes, and organizational factors. The rate of change in the business environment has been found to be a moderator of the relationship between IT use and organizational performance (Guimaraes, Cook, & Natarajan, 2002). I propose that firms can implement collaborative technologies in two different modes, operational and strategic. The former is more valuable when a firm's business environment is static, whereas the latter is more valuable when the business environment is dynamic.

### Operational Mode of E-Collaboration

Firms can implement collaborative technologies to improve their efficiency of scale and scope by building upon their ability to facilitate organizational coordination. Such an IT investment is more lucrative for firms that operate in less dynamic business environments and aim at gaining efficiency advantages in their markets. When market conditions are relatively stable, market entry barriers are high, new technologies are developed along an evolutionary path, and business models are established and steady, then a firm may pursue market advantages that are based on superior cost and time-to-market positions. To gain IT-based efficiency advantages, the firm can implement collaborative technologies that emphasize the coordination role of e-collaboration. The use of asynchronous communication tools, such as Wikis, Blogs, and RSS, may enable better exchange of information and explicit knowledge, improved coordination, and, eventually, cost and cycle time reductions. The primary purpose of such tools is to provide an efficient platform for information sharing; valuable information is easily captured, stored, presented, and disseminated. Such an information sharing mechanism facilitates rehearsability (the medium enables the rehearsal or fine tuning of messages prior to sending them) and reprocessability (messages can be reexamined or reprocessed within a communication event) (Dennis & Valacich, 1999). Rehearsability and reprocessability improve information clarity, accuracy, and completeness, which are crucial given the high cost associated with inaccuracies and misunderstandings when coordination and efficiency are the objectives.

## Strategic Mode of E-Collaboration

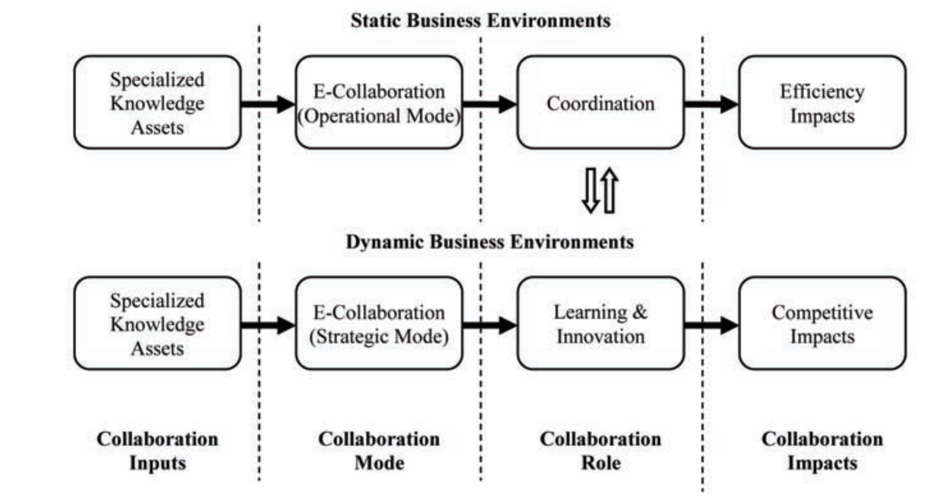
Firms can also use collaborative technologies to gain competitive advantages by capitalizing on their ability to facilitate organizational learning and innovation. Such an IT investment is more lucrative for firms that operate in high-velocity markets and repeatedly seek to exploit opportunities and neutralize threats in their external environments. When market conditions are dynamic, market entry barriers are low, new technologies are developed along a revolutionary path, and business opportunities are proliferating, then a firm has to continuously find new organizational sources of competitiveness. To gain an IT-based competitive advantage, the firm can implement collaborative technologies that emphasize the role of e-collaboration in enabling learning and innovation processes. The use of synchronous collaboration tools, such as instant messaging and Web conferencing, may support the cross-organizational identification and integration of tacit knowledge, enhance learning processes, and generate opportunities for innovation. Such tools are designed to facilitate communication, expression, and collective thinking, significantly beyond those enabled by traditional technologies. The tools improve feedback immediacy (the medium enables rapid bidirectional communication), symbol variety (the variety of ways in which information can be communicated), and parallelism (the number of simultaneous conversations that can exist effectively) (Dennis & Valacich, 1999). In dynamic business environments, the interactiveness and richness of communication channels are crucial to the creative thinking of individuals and to their ability to learn and innovate.

## Transitioning between Modes of E-Collaboration

Another dynamic aspect that the framework should account for is the need to transition from one mode of e-collaboration to another because of a dramatic change in the level of environmental turbulence. A good example is the recent financial crisis that negatively affected the stability of many relatively static markets. Firms having to transition between e-collaboration modes need to transform the organizational role of e-collaboration from coordination to learning and innovation, or vice versa. Because the framework suggests that different roles are associated with different tools, these firms also need to transform their portfolio of collaboration tools. Thus, such a transition represents a combined technical-managerial effort. It requires financial resources to acquire new tools, and managerial resources to implement these tools and motivate employees to use them to enhance valuable organizational capabilities. While the technical effort should precede the managerial effort, the latter is undoubtedly more demanding and uncertain than the former. Firms that are able to meet this challenge are better positioned to create business value from e-collaboration.

Figure 2 graphically summarizes the conceptual framework developed in this article.

Figure 2. A conceptual framework of the business value of e-collaboration




## FUTURE RESEARCH DIRECTIONS

The conceptual framework presented in this article draws on contingency theory to argue that the extent to which the business environment is dynamic is an important determinant of the selection and implementation of collaborative technologies. This contingency approach to e-collaboration can be used in future research to explore the influence of other environmental characteristics on the business value of e-collaboration. Such studies on environmental characteristics can considerably advance the e-collaboration literature because of its emphasis on the moderating effects of media and task characteristics. The conceptual framework depicted in Figure 2, which identifies the modes, roles, and impacts of e-collaboration, may serve as a theoretical starting point for such studies.

Furthermore, the proposed framework can promote empirical research on the business value of e-collaboration. The conceptualizations developed in this article may be used straightforwardly to formulate research hypotheses about relationships among collaboration tools, roles, organizational impacts, and environmental characteristics. For example, empirical research may investigate whether synchronous collaboration tools are associated with collaboration-based learning and innovation, resulting in competitive impacts, and whether those relationships are more significant in dynamic business environments than in static environments.

## CONCLUSION

While there is an increasingly growing body of research that explores the organizational implementation of collaborative technologies, a significant part of that research typically focuses on the context of the individual or the group. As a result, studies that use an organizational lens to explore e-collaboration are lacking. In this article, I propose a conceptual framework of the business value of e-collaboration. A view of e-collaboration as having three organizational roles – coordination, learning, and innovation – associated with either efficiency impacts (operational mode) or competitive impacts (strategic mode) offers valuable practical guidelines and, at the same time, advances theory development. The next conceptual step should be to link this organizational view to previous, more established views of e-collaboration, which focus on processes that individuals or groups undergo.

## REFERENCES

Adams, G. L., & Lamont, B. T. (2003). Knowledge management systems and developing sustainable competitive advantage. *Journal of Knowledge Management*, *7*(2), 142–154. doi:10.1108/13673270310477342

Alavi, M., & Leidner, D. E. (2001). Knowledge management and knowledge management systems: Conceptual foundations and research issues. *MIS Quarterly*, *25*(1), 107–136. doi:10.2307/3250961

Andreu, R., & Ciborra, C. (1996). Organizational learning and core capabilities development: The role of IT. *The Journal of Strategic Information Systems*, *5*(2), 111–127. doi:10.1016/S0963-8687(96)80039-4

Bafoutsou, G., & Mentzas, G. (2002). Review and functional classification of collaborative systems. *International Journal of Information Management*, *22*(4), 281–305. doi:10.1016/S0268-4012(02)00013-0

Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, *17*(1), 99–120. doi:10.1177/014920639101700108

Chi, L., & Holsapple, C. W. (2005). Understanding computer-mediated interorganizational collaboration: A model and framework. *Journal of Knowledge Management*, *9*(1), 53–75. doi:10.1108/13673270510582965

Cohen, W. M., & Levinthal, D. A. (1990). Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly*, *35*(1), 128–152. doi:10.2307/2393553

Dennis, A. R., & Valacich, J. S. (1999). Rethinking media richness: Towards a theory of media synchronicity. In R. H. Sprague (Ed.), *32nd Hawaii International Conference on System Sciences* (pp. 1-10). Los Alamitos, CA: IEEE Computer Society Press.

Drazin, R., & Van de Ven, A. H. (1985). Alternative forms of fit in contingency theory. *Administrative Science Quarterly*, *30*(4), 514–539. doi:10.2307/2392695

Eden, C., & Ackermann, F. (2001). Group decision and negotiation in strategy making. *Group Decision and Negotiation*, *10*(2), 119–140. doi:10.1023/A:1008710816126

Eisenhardt, K. M., & Galunic, D. C. (2000). Coevolving: At last, a way to make synergies work. *Harvard Business Review*, *78*(1), 91–101.

Galbraith, J. (1973). *Designing complex organizations*. Reading, MA: Addison-Wesley.

Grant, R. M. (1996). Toward a knowledge-based theory of the firm. *Strategic Management Journal*, *17*, 109–122. doi:10.1002/(SICI)1097-0266(199602)17:2<109::AID-SMJ796>3.0.CO;2-P

Guimaraes, T., Cook, D., & Natarajan, N. (2002). Exploring the importance of business clockspeed as a moderator for determinants of supplier network performance. *Decision Sciences*, *33*(4), 629–644. doi:10.1111/j.1540-5915.2002.tb01659.x

Huang, J. C., & Newell, S. (2003). Knowledge integration processes and dynamics within the context of cross-functional projects. *International Journal of Project Management*, *21*(3), 167–176. doi:10.1016/S0263-7863(02)00091-1

Kock, N., Davison, R., Wazlawick, R., & Ocker, R. (2001). E-collaboration: A look at past research and future challenges. *Journal of Systems and Information Technology*, *5*(1), 1–9.

Kock, N., & Nosek, J. (2005). Expanding the boundaries of e-collaboration. *IEEE Transactions on Professional Communication*, *48*(1), 1–9. doi:10.1109/TPC.2004.843272

Kogut, B., & Zander, U. (1996). What do firms do? Coordination, identity, and learning. *Organization Science*, *7*(5), 502–518. doi:10.1287/orsc.7.5.502

Leidner, D., Alavi, M., & Kayworth, T. (2006). The role of culture in knowledge management: A case study of two global firms. *International Journal of e-Collaboration*, *2*(1), 17–40.

Malone, T. W., & Crowston, K. (1994). The interdisciplinary study of coordination. *ACM Computing Surveys*, *26*(1), 87–119. doi:10.1145/174666.174668

McLaren, T., Head, M., & Yuan, Y. (2002). Supply chain collaboration alternatives: Understanding the expected costs and benefits. *Internet Research*, *12*(4), 348–364. doi:10.1108/10662240210438416

Melville, N., Kraemer, K., & Gurbaxani, V. (2004). Information technology and organizational performance: An integrative model of IT business value. *MIS Quarterly*, *28*(2), 283–322.

Nonaka, I. (1991). The knowledge-creating company. *Harvard Business Review*, *69*(6), 96–104.

Nonaka, I., Toyama, R., & Nagata, A. (2000). A firm as a knowledge-creating entity: A new perspective on the theory of the firm. *Industrial and Corporate Change*, *9*(1), 1–20. doi:10.1093/icc/9.1.1

Paul, D. L. (2006). Collaborative activities in virtual settings: A knowledge management perspective of telemedicine. *Journal of Management Information Systems*, *22*(4), 143–176. doi:10.2753/MIS0742-1222220406

Prescott, J. E. (1986). Environments as moderators of the relationship between strategy and performance. *Academy of Management Journal*, *29*(2), 329–346. doi:10.2307/256191

Sawhney, M., Wolcott, R. C., & Arroniz, I. (2006). The 12 different ways for companies to innovate. *MIT Sloan Management Review*, *47*(3), 75–81.

Scott, J. E. (2000). Facilitating interorganizational learning with information technology. *Journal of Management Information Systems*, *17*(2), 81–113.

Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, *18*(7), 509–533. doi:10.1002/(SICI)1097-0266(199708)18:7<509::AID-SMJ882>3.0.CO;2-Z

Weill, P., & Olson, M. H. (1989). An assessment of the contingency theory of management information systems. *Journal of Management Information Systems*, *6*(1), 59–85.

Wheeler, B. C. (2002). NEBIC: A dynamic capabilities theory for assessing net-enablement. *Information Systems Research*, *13*(2), 125–146. doi:10.1287/isre.13.2.125.89

## ADDITIONAL READING

Barua, A., Konana, P., Whinston, A. B., & Yin, F. (2004). An empirical investigation of net-enabled business value. *MIS Quarterly*, *28*(4), 585–620.

Bharadwaj, A. S. (2000). A resource-based perspective on information technology capability and firm performance: An empirical investigation. *MIS Quarterly*, *24*(1), 169–196. doi:10.2307/3250983

Bhatt, G. D., & Grover, V. (2005). Types of information technology capabilities and their role in competitive advantage: An empirical study. *Journal of Management Information Systems*, *22*(2), 253–277.

Brews, P. J., & Tucci, C. L. (2004). Exploring the structural effects of internetworking. *Strategic Management Journal*, *25*(5), 429–451. doi:10.1002/smj.386

Daft, R. L., & Lengel, R. H. (1986). Organizational information requirements, media richness and structural design. *Management Science*, *32*(5), 554–571. doi:10.1287/mnsc.32.5.554

Dedrick, J., Gurbaxani, V., & Kraemer, K. L. (2003). Information technology and economic performance: A critical review of the empirical evidence. *ACM Computing Surveys*, *35*(1), 1–28. doi:10.1145/641865.641866

El Sawy, O. A., & Pavlou, P. A. (2008). IT-enabled business capabilities for turbulent environments. *MIS Quarterly Executive*, *7*(3), 139–150.

Fink, L., & Neumann, S. (2009). Exploring the perceived business value of the flexibility enabled by information technology infrastructure. *Information & Management*, *46*(2), 90–99. doi:10.1016/j.im.2008.11.007

Ginsberg, A., & Venkatraman, N. (1985). Contingency perspectives of organizational strategy: A critical review of the empirical research. *Academy of Management Review*, *10*(3), 421–434. doi:10.2307/258125

Goh, A. L. S. (2005). Harnessing knowledge for innovation: An integrated management framework. *Journal of Knowledge Management*, *9*(4), 6–18. doi:10.1108/13673270510610297

Kearns, G. S., & Lederer, A. L. (2003). A resource-based view of strategic IT alignment: How knowledge sharing creates competitive advantage. *Decision Sciences*, *34*(1), 1–29. doi:10.1111/1540-5915.02289

Kock, N. (Ed.). (2007). *Encyclopedia of e-collaboration*. Hershey, PA: Information Science Reference.

Kohli, R., & Grover, V. (2008). Business value of IT: An essay on expanding research directions to keep up with the times. *Journal of the Association for Information Systems*, *9*(1), 23–39.

Li, M., & Ye, L. R. (1999). Information technology and firm performance: Linking with environmental, strategic and managerial contexts. *Information & Management*, *35*(1), 43–51. doi:10.1016/S0378-7206(98)00075-5

Malhotra, Y. (2000). Knowledge management and new organization forms: A framework for business model innovation. *Information Resources Management Journal*, *13*(1), 5–14.

Nonaka, I., & Takeuchi, H. (1995). *The knowledge-creating company: How Japanese companies create the dynamics of innovation*. New York, NY: Oxford University Press.

Oh, W., & Pinsonneault, A. (2007). On the assessment of the strategic value of information technologies: Conceptual and analytical approaches. *MIS Quarterly*, *31*(2), 239–265.

Peteraf, M. A. (1993). The cornerstones of competitive advantage: A resource-based view. *Strategic Management Journal*, *14*(3), 179–191. doi:10.1002/smj.4250140303

Porter, M. E. (2001). Strategy and the Internet. *Harvard Business Review*, *79*(3), 63–78.

Powell, W. W., Koput, K. W., & Smith-Doerr, L. (1996). Interorganizational collaboration and the locus of innovation: Networks of learning in biotechnology. *Administrative Science Quarterly*, *41*(1), 116–145. doi:10.2307/2393988

Ravichandran, T., & Lertwongsatien, C. (2005). Effect of information systems resources and capabilities on firm performance: A resource-based perspective. *Journal of Management Information Systems*, *21*(4), 237–276.

Sambamurthy, V., Bharadwaj, A., & Grover, V. (2003). Shaping agility through digital options: Reconceptualizing the role of information technology in contemporary firms. *MIS Quarterly*, *27*(2), 237–263.

Santhanam, R., & Hartono, E. (2003). Issues in linking information technology capability to firm performance. *MIS Quarterly*, *27*(1), 125–153.

Soh, C., & Markus, M. L. (1995). How IT creates business value: A process theory synthesis. In J. I. DeGross, G. Ariav, C. Beath, R. Hoyer & C. Kemerer (Eds.), *16th International Conference on Information Systems* (pp. 29-41). Atlanta, GA: Association for Information Systems.

Teece, D. J. (2007). Explicating dynamic capabilities: The nature and microfoundations of (sustainable) enterprise performance. *Strategic Management Journal*, *28*(13), 1319–1350. doi:10.1002/smj.640

Teo, T. S. H., & Pian, Y. (2003). A contingency perspective on Internet adoption and competitive advantage. *European Journal of Information Systems*, *12*(2), 78–92. doi:10.1057/palgrave.ejis.3000448

Tippins, M. J., & Sohi, R. S. (2003). IT competency and firm performance: Is organizational learning a missing link? *Strategic Management Journal*, *24*(8), 745–761. doi:10.1002/smj.337

Wade, M., & Hulland, J. (2004). The resource-based view and information systems research: Review, extension, and suggestions for future research. *MIS Quarterly*, *28*(1), 107–142.

Zahra, S. A., & George, G. (2002). The net-enabled business innovation cycle and the evolution of dynamic capabilities. *Information Systems Research*, *13*(2), 147–150. doi:10.1287/isre.13.2.147.90

Zigurs, I., & Buckland, B. K. (1998). A theory of task/technology fit and group support systems effectiveness. *MIS Quarterly*, *22*(3), 313–334. doi:10.2307/249668

## KEY TERMS AND DEFINITIONS

**Business Value:** The contribution of a firm resource to business performance.

**Competitive Advantage:** The ability of a firm to systematically achieve above-normal performance.

**Contingency Theory:** A theoretical view that considers the fit between a firm's structure and process and its context as critical to organizational effectiveness.

**Dynamic Capability:** A theoretical view that attributes competitive advantage to a firm's ability to reconfigure and redeploy its resource base to address rapidly changing environments.

**E-Collaboration:** Cooperation among individuals using electronic technologies.

**Organizational Learning:** The ability within an organization to improve performance based on experience.

**Resource-Based View:** A theoretical view that attributes competitive advantage to a subset of firm resources.

# Chapter 16

# A Model of the Antecedents and Consequences of E-Procurement

**M. José Garrido**
*Universidad de Valladolid, Spain*

**Ana Gutiérrez**
*Universidad de Valladolid, Spain*

**Rebeca San José**
*Universidad de Valladolid, Spain*

## ABSTRACT

*The Internet is used by firm purchasers as a source of information in procurement. We propose a model of the determinants and consequences of Internet use in this process. We analyzed whether different Internet tools are used throughout all purchasing phases and whether the characteristics of the buying situation determined the use of the Internet in that process. We also proposed to analyze how Internet use in this process impacts companies from two different points of view: organizational and economical. Organizational consequences refer to the buying center structure in terms of size, participation, number of hierarchical levels, and functional areas. Economical consequences refer to purchase results in terms of efficacy and efficiency. Implications for business-to-business marketers and researchers are discussed.*

## INTRODUCTION

Since the discovery of the Internet as a new communication medium, it has become part of many firms' strategy. The Internet has been largely used in management; it works as an advertising medium for firms to include their campaigns, as a distribution channel, and as a source of information. Application of Internet usage to the development of diverse firm strategies is a practice that has come to be called *e-commerce*.

Basically, the Internet added-value resides in its ability to contribute to cost reduction associated with communication and transaction (Boyd & Spekman, 2001; De Boer et al., 2002). The Internet allows access to a great amount of information

DOI: 10.4018/978-1-61520-611-7.ch016

with lower costs of time and money than those derived from other tools, both inside and outside the organization (Avlonitis & Karayanni, 2000; Boyle & Alwitt, 1999; Min & Galle, 1999; Tang et al., 2001).

The present research is framed within industrial marketing or business-to-business (B2B). Specifically, we focused on the role the Internet plays in firm procurement. Most of the literature regarding the use of Internet in the process of industrial purchase covers an analysis of the consequences. Determinants of Internet adoption in industrial purchase have rarely been given attention by researchers in the literature (Garrido et al., 2006).

Taking this into account, we propose a theoretical model about the buying process's determinants and consequences in order to put Internet technology systems into practice in the buying process. On the one hand, regarding determinants of e-procurement process, in this model, we intend to approach the factors that determine the use of the Internet as a source of information in procurement. Referring to the traditional literature on the process of industrial purchasing and other more recent studies related to the characteristics of the Internet as a communication medium, we propose a contingency model accounting for the use of the Internet in the process of industrial purchases. In this model, both the stage in the buying process and the type of buying situations (characterized by novelty, complexity, perceived risk, time pressure, and personal stake) act as determinants of Internet use in purchasing.

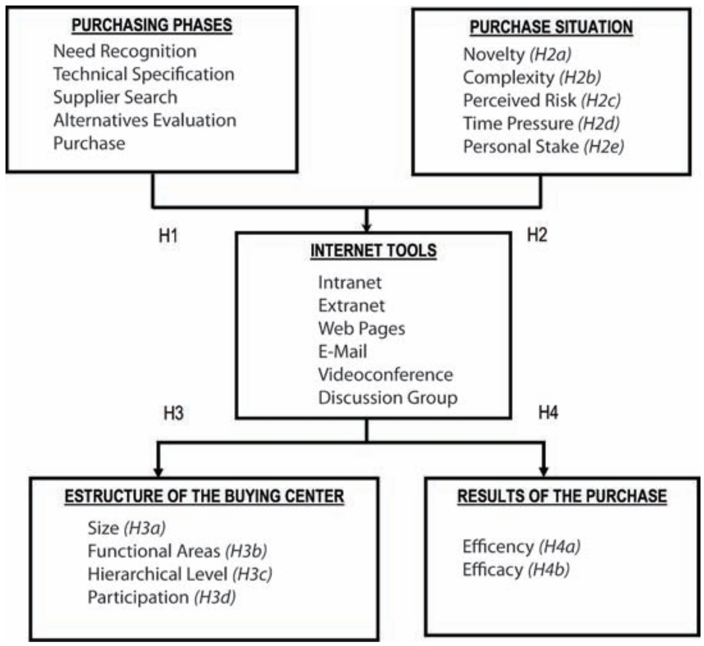
On the other hand, the intent of identifying the consequences of Internet use in the process of industrial purchase has been carried out in different ways. We are interested in two: the consequences of Internet use on the organizational structure of the buying center, and a study of the effect of Internet use on the results of the purchase. Based on the theoretical model proposed by Osmonbekov et al. (2002), the organizational consequences of Internet use in the purchasing process considered in this work concern the structure of the buying center. The structural aspects of the buying center analyzed here include size, functional areas, hierarchical levels, and participation. Part of the interest of our work is that some of our hypotheses relating to the consequences of Internet use intensity on the buying center structure contradict the approaches used in the pioneering research of Osmonbekov et al. Several procurement outcomes are analyzed, as well. The economical consequences of e-procurement refer to efficiency and effectiveness of the purchasing process, according the classification of economic consequences of e-procurement proposed by Kalakota and Robinson (1999).

This study provides several substantial contributions in e-procurement. This research is different from previous works because it is the first effort to offer a complete context of Internet use in the buying process. In this study, we extend theory and previous research because until now, no researchers had analyzed both the stage in the buying process and the type of buying situation as determinants of Internet use in the purchasing, nor have previous researchers recollected in a combined form the economical and organizational consequences of Internet use. These factors allow us to establish a series of interesting managerial recommendations in the last part of this article.

## A MODEL OF INTERNET USE IN INDUSTRIAL PURCHASING

The model proposed of determinants and consequences of e-procurement in firms appears in Figure 1. It is a contingency model based on the premise that Internet use is not a uniform process throughout all of a firm's purchases, but rather it can vary depending on each situation. In particular, we propose that, considering the flow of information allowed for each Internet tool, each tool's use is conditioned by two aspects: the phase in the purchasing process, and the characteristics of

Figure 1. A model of Internet use in industrial purchasing




each buying situation. Further, Internet use in the purchasing process causes two types of effects: (a) on the organizational structure of the buying center (*organizational effect*), and (b) on the outcomes of the purchase (*economical effect*).

The model has been structured in the following way:

## Internet Tools Used in Procurement

From the consultation of suppliers' Web sites to the creation of firms' networks through the Internet, the use of different Internet tools occurs throughout the process of industrial purchase. In this study, we refer to the following: World Wide Web, Intranet, extranet, discussion groups, electronic mail (e-mail), and videoconference.

The characteristics of the information flow associated with Internet tools vary, depending on the peculiarities each tool presents (Garrido et al., 2006). Due precisely to this fact, the use of each Internet application as a source of information in the industrial purchasing process is subject to certain conditions.

## Determinants of Business E-Procurement

In the proposed model, the use of different Internet tools is conditioned by two aspects: the phase in the purchasing process, and the characteristics of each buying situation.

## The Purchasing Phase

The industrial purchasing process can be split into a certain number of phases as follows: recognition of a need, technical specifications, search for suppliers, evaluation of alternatives, and formalization of the purchase (Garrido, 2001). Our interest focused on establishing the differences in the use of diverse Internet tools throughout the stages of the buying process.

The intranet is a firm's internal tool; consequently, the conjecture is that it may be applied to the stages of the process that are primarily more internally oriented, such as need recognition or technical specifications. Inside the intranet, videoconference and e-mails complement each other as personal communication media, thus enriching the flow of information.

The search for suppliers and the formalization of the purchase are stages that require contact with other organizations, which is why in that purchasing phases the extranet of suppliers with whom the firm is interconnected can be the main sources of information. In the purchasing formalization phase, e-mails permit a quick and personal contact with the selected supplier.

In the alternatives evaluation phase, individuals from both inside and outside the organization can intervene, the suppliers being included among the latter. Therefore, in this phase, internal and external tools are likely to be combined. Specifically, videoconference and e-mails allow for personal contact with suppliers when additional information is necessary before making a final decision.

**H1.** The purchasing phase determines the use of Internet tools that will be used as a source of information.

## The Buying Situation

Different purchasing situations hold unique strategic e-business implications for purchasing requirements (Hunter et al., 2004). Next, we specify the effect of each characteristic of the buying situation in several hypotheses.

In the offline context, we have found only one work addressing the determinants of procurement. Garrido (2001) focused on the following characteristics of the buying situation: novelty, complexity, perceived risk, time pressure, and personal stake

*Novelty.* In this study, novelty is understood as the industrialist's lack of experience in making decisions at a certain buying situation (McQuiston, 1989). Researchers have theorized that in industrial purchasing, when members of an organization face high uncertainty in a purchase decision, the buying center individuals tend to reduce it by seeking information (Anderson, 1982; Sheth, 1973). Therefore, the lack of experience in a certain buying situation will cause an increase of Internet use (Osmonbekov et al., 2002; Garrido et al., 2006).

**H2a.** The novelty of the purchase for the organization positively determines Internet use.

*Complexity.* One of the features of the Internet, as compared to other media, is the ability to find a large amount of information (San José et al., 2007). This is why the complexity of the purchase can foster the use of the Internet as a source of information (Osmonbekov et al., 2002; Garrido et al., 2006). Specifically, when thought or complex decisions must be made and firm managers must engage in meaningful dialogue and give-and-take, the Internet must provide rich communication and greater frequency since complex interaction requires subtle interchange and richness of information content to overcome ambiguity (Boyd & Spekman, 2001).

**H2b.** The complexity of the product or of the purchasing situation positively determines Internet use.

*Perceived risk.* Perceived risk depends on the level of present uncertainty in a certain purchasing situation (Gronhaug, 1976; Newall, 1977; Upah, 1980). Industrial buyers engage in increased information searching when the buying situation is risky (Moriarty & Spekman, 1984). As long as the Internet increases the amount of information available in the buying center, perceived risk may be reduced (Garrido et al., 2006). Specifically, researchers of industrial purchase behavior suggested that in decisions that have economic or performance uncertainty, personal sources of information acquire special importance.

**H2c.** Perceived risk associated with the purchase positively determines Internet use.

*Time pressure.* This variable refers to the degree to which buying center members feel under pressure when they have to reach a purchase decision relatively quickly (Kohli, 1989). Whenever the members of the buying center have to adopt decisions under time pressure, they likely will resort to using the Internet since it permits fast gathering of information, as compared to other sources (Boyle & Alwitt, 1999; Garrido, et al., 2006; Min & Galle, 1999; Osmonbekov et al., 2002; Tang et al., 2002).

**H2d.** Time pressure to make a purchase decision positively determines Internet use.

*Personal stake.* This refers to the degree a purchase decision affects a member of the buying center (Ghingold & Wilson, 1988; Patchen, 1974). The higher the responsibility of an individual in the purchase decision, the stronger will be the personal implications for that decision and, consequently, the perceived risk associated with it. As mentioned above, the Internet reduces perceived risk or, in other words, the perception of a possible unfavorable consequence of the purchase decision (Garrido et al., 2006).

**H2e.** The personal stake of individuals in a purchase decision positively determines Internet use in the buying process.

## Consequences of Business E-Procurement

In the hypotheses outlined above, we assumed that the degree of Internet use of in the purchasing process causes two types of effects: (a) on the organizational structure of the buying (*organizational effect*), and (b) on the outcomes of the purchase (*economical effect*).

## Consequences of E-Procurement on the Structure of the Buying Center

The buying center involves all those people involved in some way in the purchasing process (Webster & Wind, 1972). The buying center is part of the informal structure of the firm, which means it is comprised of people from many different departments, hierarchical levels, or functional areas, all of whom are involved in a specific purchasing process. When characterizing the structure of the buying center, researchers in the traditional literature have established the following aspects: size, participation, functional areas, and hierarchical levels (Garrido, 2001).

The use of the Internet in procurement influences the characteristics of the information available, both in terms of quantity and the way it is transmitted throughout the organization. We assumed that Internet use during the different purchase processes taking place in one company may affect the dimensions of the buying center structure. Next, we will discuss the effect of e-procurement use on the structure of the buying center, establishing different hypotheses.

*Size.* Size accounts for the number of individuals involved in the buying center. Bearing in mind that the buying center is part of the firm's informal structure, the number of people involved can differ from one purchase to the next. Researchers in the traditional literature on industrial purchasing showed that size increases with complexity (Gronhaug, 1975a; Johnston & Bonoma, 1981a; McWilliams et al., 1992), novelty and importance of the buying situation (Dawes et al., 1992), the personal stake of the individual in the purchase, and the level of formalization of the buying center (Dawes et al., 1992).

Based on these assumptions, Osmonbekov et al. (2002) suggested that the use of e-commerce tools by members of the buying center reduces both the formalization of the buying center and the complexity of the purchase decision, which in turn, reduces the size of the buying center.

As information is easier to access and transfer among buying center members, fewer members are required to reach decisions.

However, Garrido et al., (2006 and 2008) proposed the opposite effect of Internet use to that suggested by Osmonbekov et al., (2002) with regard to the size of the buying center. Although we agree that Internet use reduces the complexity of the buying situation, at the same time, like other information technology (IT) tools, it reduces asymmetries of information and facilitates the coordination of interdependent processes—such as those involved in a purchasing process—both internally and externally (Dewan et al., 1998) in ways that the previous IT tools have not permitted (Brynjolfsson et al., 1995; Afuah & Tucci, 2000). Based on these arguments, we hypothesize the following:

**H3a.** The use of e-procurement is positively related to the size of the buying center.

*Functional areas.* The purchasing process involves people from different functional areas such as purchasing, engineering, production, or marketing. Empirical research shows that the number of functional areas varies throughout the different stages of the purchasing process or depending on the category of the product (Bello & Lohtia, 1993; Johnston & Bonoma, 1981b; Lilien & Wong, 1984; McMillan, 1973).

Osmonbekov et al. (2002) pointed out that the automation of the procurement task provided by e-commerce tools and intranet buying applications tends to streamline the buying center by reducing the number and types of job functions actively involved in the procurement process. E-commerce tools allow buying center members to access product information, directly lowering procurement cycle times and reducing the functional range of employees directly involved in procurement periods.

Garrido (2001) found a positive correlation between the size of the buying center and the number of functional areas involved in the purchase process. Based on his result and the assumptions of H3a and, contrary to Osmonbekov et al. (2002), we advance the following proposition:

**H3b.** The use of e-procurement is positively related to the number of functional areas of buying center members.

*Hierarchical level.* People under different hierarchical levels can be seen participating in the purchasing process: senior managers, plant managers, production technicians, and others. The more important, complex, and uncertain the purchasing situation is for one organization, the higher the hierarchical level of the people involved in it (Cardozo, 1980; Johnston & Bonoma, 1981a; McCabe 1987; Morris et al., 1995).

Osmonbekov et al. (2002) pointed out that as organization leaders adopt e-commerce tools, the structure of buying centers tends to flatten out, given that software automation results in fewer levels of managers actively engaging in each particular procurement period.

Contrary to this proposition, we postulate that as the size of the buying center correlates positively with the intensity of the use of Internet tools in the procurement process (H3a), the number of people from different hierarchical levels will increase in the same manner. As we suggested in H3a, we support this hypothesis due to the fact that Internet use provides a quick and easy transmission of information between different organizational members belonging to different hierarchical levels. Based on these arguments, we hypothesize the following:

**H3c.** The use of e-procurement is positively related to the number of hierarchical levels of buying center members.

*Participation.* McQuiston (1989) defined participation in the buying center as the "amount of written or verbal communication offered to others in the buying center during the course of the purchase decision" (p. 68). Regarding the effect of participation, the only theoretical approach we discovered is the one proposed by Osmonbekov et al. (2002). The authors stated that e-commerce enhanced procurement and increased the individual degree of participation of buying center members for two main reasons. First, these tools suggested an overall decrease in the size of the buying center, which was expected to increase the relative weight of responsibility of each buying member in the purchasing decision. Second, e-commerce allowed much more information to be accessed and exchanged between members. Thus participants will increase their level of participation in the buying center given that much more information must be evaluated and exchanged.

Our point of view is that the individual degree of participation is independent of the size of the buying center, and therefore, we disagree with the first argument of Osmonbekov et al. (2002). We consider that only the amount of information or opinions provided by each member of the buying center can determine their level of participation. In this sense, and according to the second argument of Osmonbekov et al. (2002), given that the Internet offers a large amount of information that can be accessed by all the members in the organization, it will increase their level of participation in the decision-making process and will also help in adopting better purchasing decisions. To summarize the above discussion, we suggest the following:

**H3d.** The use of e-procurement is positively related to the individual participation of buying center members.

## Consequences of Internet Use on Procurement Outcomes

Researchers in most of the literature about Internet use in the purchasing process focused on *economic consequences.* Most authors (Avlonitis & Karayanni, 2000; Bartezzaghi & Ronchi, 2003; Kalakota & Robinson, 1999; and others) stated that Internet use in the purchasing process provides higher levels of efficiency and effectiveness. In fact, this last classification serves as the basis for the hypotheses set out in this paper on the economic consequences derived from the intensity of Internet use in the purchasing process. These effects are partly a consequence of the changes implemented in the structure of the buying center (Osmonbekov et al., 2002) to which we have referred in the above hypothesis.

**H4.** The intensity of e-procurement affects the results of procurement.

*Efficacy.* This refers to the meeting of objectives. Efficacy related to Internet use in procurement implies greater control over the supply chain, proactive management of the key procurement data, increased user satisfaction, and the responsiveness of the system. In our research, efficacy is related to meeting the objectives of using the Internet as a communications medium.

*Efficiency.* This refers to meeting the objectives at minimum cost. Efficiency related to Internet use in the purchasing process has been associated with different aspects: swift receipt of products, better quality of the purchased products at the same price, reduced maverick or unauthorized buying, reduced coordination costs, accurate delivery scheduling, and tighter integration of the procurement tasks with key back-office systems, bureaucracy elimination, and lower prices, among others. To summarize the previous discussion we suggest the following:

**H4a.** The intensity of e-procurement increases efficacy in the purchasing process.

**H4b.** The intensity of e-procurement increases efficiency in the purchasing process.

## IMPLICATIONS FOR MANAGERS

The contingency approach employed in this study makes it easier to adapt the different Internet tools to the specific characteristics of the buying situation in which they are primarily used. Firms' buyers who use the Internet when purchasing need to be aware of the different characteristics of each of the e-procurement tools available to members of the organization as well as the differences between each procurement situation and of each of the five phases in the purchasing process.

Such differences favor greater or more limited use of e-procurement during the acquisition process as a whole, as well as in each individual phase, in addition to which e-procurement tools are most appropriate for each case. We also have detailed implications and recommendations for those firms advertising or selling their products or services on the Internet. Potential buyers make the most use of Internet tools, especially visiting Web sites, when searching for suppliers. As a result, company marketers who are responsible for selling would be advised to design efficient Web sites that merge appropriate executions with large amounts of information so that after users visit their Web site, the company will be considered by purchasing agents in other firms and subsequently be chosen as suppliers. Moreover, these company marketers should provide access to their Web sites for purchasing firms in various ways, such as registering for the top positions in search engines, online directories, or other related Web sites.

Furthermore, firm leaders must take advantage of the potential offered by the Internet, as a means of providing products and services. To achieve this, firm marketers who sell must focus on the safety of their Web sites.

Changes in buying center size and the number of functional areas imply that all organizational members should now have, or be able to acquire quickly, e-commerce skills. Those with no skills will be unable to take advantage of these tools in detriment to the overall effectiveness and efficiency of the buying center. The number of Internet tools is high. Firm leaders should be familiar with all of these and use those which best fit their specific needs.

Firm leaders should also consider the implication of including more employees from more and different functional areas in making important decisions. More than ever, all buying center members must be capable of negotiating, communicating, evaluating, and, in general, handling the challenges of procurement.

The implications of neglecting Internet technologies can be dramatic. If business marketers do not capture the value provided by emerging technologies such as the Internet, value will migrate from their firms. Value migration is an issue that has affected most industries at one time or another. Shifts in markets are not so much due to products as to the innovative business designs of new businesses that allow them to capture value. Managers in these firms make better customer selection and differentiated offers, apply market strategies, and configure resources in order to capture value in the marketplace.

For researchers, the model suggested does not consider the many contingencies faced by members of the buying centers. For instance, different types of buying decisions are often encountered that require highly complicated decision processes. We consider it suitable to extend the study to different product lines and to decisions on service contracts, as well as to deepening the consequences of Internet use on different industries. Research is also required to explore how Internet use in the e-procurement phase affects the organizational structure of the buying center in terms of size (number of functional areas) and composition. Future research in this area should be focused more on qualitative studies.

## REFERENCES


Afuah, A., & Tucci, C. (2000). *Internet business models and strategies. Text and cases.* New York: McGraw-Hill.

Anderson, P. (1982). Marketing, Scientific Progress and Scientific Method. *Journal of Marketing*, *47*(4), 18–31. doi:10.2307/1251395

Avlonitis, G., & Karayanni, D. (2000). The Impact of Internet Use on Business-to-Business Marketing: Examples from American and European Companies. *Industrial Marketing Management*, *29*(5), 441–459. doi:10.1016/S0019-8501(99)00071-1

Bartezzaghi, E., & Ronchi, S. (2003). Internet Supporting the Procurement Process: Lessons from four Case Studies. *Integrated Manufacturing Systems*, *14*(8), 632–641. doi:10.1108/09576060310503447

Bello, D., & Lothia, R. (1993). Improving trade show effectiveness by analyzing attendees. *Industrial Marketing Management*, *12*, 311–318. doi:10.1016/0019-8501(93)90027-5

Boer De, L., Harink, J., & Heijboer, G. (2002). A Conceptual Model for Assessing the Impact of Electronic Procurement. *European Journal of Purchasing & Supply Management*, *8*(1), 25–33. doi:10.1016/S0969-7012(01)00015-6

Boyd, E., & Spekman, R. (2001). *Internet Usage within B2B Relationships and Its Impact on Value Creation: A Conceptual Model and Research Propositions*. Retrieved from http://papers.ssrNo-com/abstract=282521

Boyle, B., & Alwitt, L. F. (1999). Internet use within the US plastics Industry. *Industrial Marketing Management*, *28*, 327–341. doi:10.1016/S0019-8501(98)00012-1

Bryjolfsson, E., & Hitt, L. (1995). Information Technology as a factor of production. The role of differences among firms. *Economics of Innovation and New Technology*, *3*(3-4), 183–199. doi:10.1080/10438599500000002

Cardozo, R. (1980). Situational Segmentation of Industrial Markets. *European Journal of Marketing*, *14*, 264–276. doi:10.1108/EUM0000000004905

Dawes, P., Dowling, G., & Patterson, P. (1992). Factors Affecting the Structure of Buying Centers for the Purchase of Prefessional Business Advisory Services. *International Journal of Research in Marketing*, *9*, 269–279. doi:10.1016/0167-8116(92)90022-D

Dewan, S., Michael, S., & Min, C. (1998). Firm characteristics and investment in information technology: scale and scope effects. *Information Systems Research*, *9*(3), 219–232. doi:10.1287/isre.9.3.219

Garrido, M. J. (2001). *Estructura y Comportamiento del Centro de Compras Industrial. Un Análisis para las Empresas Industriales Españolas.* Doctoral Dissertation of the University of Valladolid, Spain.

Garrido, M. J., Gutierrez, A., & San José, R. (2006). Determinants of the internet use in the purchasing process. *Journal of Business and Industrial Marketing*, *21*(3), 164–174. doi:10.1108/08858620610662813

Garrido, M. J., Gutiérrez, A., & San José, R. (2008). Organizational and economic consequences of business e-procurement intensity. *Technovation*, *28*(9), 615–629. doi:10.1016/j.technovation.2007.12.004

Ghingold, M., & Wilson, D. (1988). Buying Center Structure: An Extended Framework for Research. In R. Spekman (ed.), *A Strategic Approach to Business Markets* 180-193. Chicago: AMA.

Gronhaug, K. (1975a). Search Behavior in Organizational Buying. *Industrial Marketing Management*, *4*, 15–23. doi:10.1016/0019-8501(75)90014-0

Gronhaug, K. (1976). Exploring Environmental Influences in Organizational Buying. *Journal of Marketing*, *13*, 225–229. doi:10.2307/3150731

Hunter, L. M., Chickery, J., Celuch, K., & Curry, K. (2004). Commercial Scenarios for the Web: Opportunities and Challenges. *Journal of Computer-Mediated Communication*, 1.

Johnston, W., & Bonoma, T. (1981a). The Buying Center: Structure and Interaction Patterns. *Journal of Marketing*, *45*(Summer), 143–156. doi:10.2307/1251549

Johnston, W., & Bonoma, T. (1981b). Purchase Process for Capital Equipment and Services. *Industrial Marketing Management*, *10*, 253–264. doi:10.1016/0019-8501(81)90033-X

Kalakota, R., & Robinson, M. (1999): *E-business 2.0: Roadmap for success*. Reading, MA: Addison-Wesley.

Kohli, A. (1989). Determinants of Influence in Organizational Buying: A Contingency Approach. *Journal of Marketing*, *53*, 50–65. doi:10.2307/1251342

Lilien, G., & Wong, A. (1984). An exploratory investigation of the structure of the Buying Center in the Metalworking Industry. *JMR, Journal of Marketing Research*, *21*, 1–11. doi:10.2307/3151787

McCabe, D. (1987). Buying group structure constriction at the top. *Journal of Marketing*, *51*, 89–98. doi:10.2307/1251250

McMillan, J. (1973). *Role Differentiation in Industrial Buying Decision.* In *Proceedings, American Marketing Association*, Chicago, 207-211.

McQuiston, D. (1989). Novelty, Complexity and Importance as Causal Determinants of Industrial Buyer Behavior. *Journal of Marketing*, *53*, 66–79. doi:10.2307/1251414

McWilliams, R., Naumann, E., & Scott, S. (1992). Determining Buying Center Size. *Industrial Marketing Management*, *21*, 43–49. doi:10.1016/0019-8501(92)90032-O

Min, H., & Galle, W. (1999). Electronic Commerce Usage in Business-to-business Purchasing. *International Journal of Operations & Production Management*, *19*(9), 909–921. doi:10.1108/01443579910280232

Moriarty, R. T., & Spekman, R. E. (1984). An empirical investigation of the information sources used during the industrial buying process. *JMR, Journal of Marketing Research*, *21*(2), 137–147. doi:10.2307/3151696

Morris, M., Hansen, S., & Pitt, L. (1995). Environmental turbulence and organizational buying. *Industrial Marketing Management*, *24*, 305–315. doi:10.1016/0019-8501(95)00014-2

Newall, J. (1977). Industrial Buying Behavior: A Model of the Implications of Risk Handling Behavior for Communication Policies in Industrial Marketing. *European Journal of Marketing*, *11*(3), 165–211. doi:10.1108/EUM0000000005008

Osmonbekov, T., Bello, D., & Gilliland, D. (2002). Adoption of Electronic Commerce Tools in Business Procurement: Enhanced Buying Center Structure and Processes. *Journal of Business and Industrial Marketing*, *17*(2), 151–166. doi:10.1108/08858620210419781

Patchen, M. (1974). The Focus and Basis of Influence in Organizational Decisions. *Organizational Behavior and Human Performance*, *11*, 195–211. doi:10.1016/0030-5073(74)90014-2

San Jose, R., Gutiérrez, A. M., & Gutierrez, J. (2007). Designing effective websites. The moderating role of user Internet experience. *Journal of Internet Commerce*, *6*(1), 35–60.

Sheth, J. (1973). A Model of Industrial Buying Behavior. *Journal of Marketing*, *37*, 50–56. doi:10.2307/1250358

Tang, J., Shee, D., & Tang, T. (2001). A Conceptual Model for Interactive Buyer-Supplier Relationship in Electronic Commerce. *International Journal of Information Management*, *21*, 49–68. doi:10.1016/S0268-4012(00)00050-5

Upah, G. (1980). Applying the Concept of Perceived Risk to Buying Influence in Industrial Firms. *Advances in Consumer Research. Association for Consumer Research (U. S.)*, *17*, 381–386.

Webster, F., & Wind, J. (1972). A General Model for understanding Organizational Buying Behavior. *Journal of Marketing*, *36*, 12–19. doi:10.2307/1250972

## KEY TERMS AND DEFINITIONS

**Buying Center:** Everyone who is involved in the purchase decision process. The buying center forms part of the informal structure of the firm and brings together all the staff from the various departments, hierarchical levels, or functional areas involved, particularly in the purchasing process.

**E-Commerce:** Any form of business transaction in which the parties interact, totally or partially, through electronic tools.

**E-Procurement:** E-procurement represents the integration and electronic administration of all the provisioning activities, including the purchase requisition, authorization, order, delivery, and payment between a buyer and a supplier.

**Industrial Marketing:** Marketing directed at people in organizations or institutions that acquire the goods and services to use them, to transform them, to incorporate them in their productive processes, or to re-sell them.

**Internet Tools:** Electronic instruments based on Internet technology with which parties can interact (e.g., Intranet, extranet, Web page, e-mail, videoconference, and discussion groups).

**Purchase Decision Process:** A process of decision-making in which the leaders of formal organizations establish the necessity for the purchase of products and services and then identify, evaluate, and select between brands and alternative suppliers.

**Purchasing Phases:** Each one of the sequential stages that can be identified in a high-involvement product purchasing decision process (recognition of a need, technical specifications, supplier search, alternatives evaluation, and purchase).

# Chapter 17
# Global Online Performance and Service Orientation

**Anna Morgan-Thomas**
*University of Glasgow, UK*

**Robert Paton**
*University of Glasgow, UK*

## INTRODUCTION

The competition currently facing **small and medium sized enterprises** (SMEs) is characterized by three interacting trends: **market globalization**; enhanced **e-commerce** technology; and the growth of the **service economy**. With respect to the first trend, globalization has led SMEs into world markets and some are rapidly becoming global players (Chetty and Blankenburg Holm, 2000; Oviatt and McDougall, 1997). Understanding the processes that underpin success is of paramount importance to academics and practitioners alike (Beamish et al., 1999; Cavusgil and Zou, 1994).

With respect to the second trend, e-commerce has redefined the nature of global business (Karavdic and Gregory, 2005; Quelch and Klein, 1996). By facilitating a direct link between the firm and customer, e-commerce provides a low cost gateway to global markets (Etemad and Wright, 1999). For many SMEs, online activity accelerates the growth dynamics by increasing global sales (Morgan-Thomas and Bridgewater, 2004; Raymond et al., 2005); reduces global operational costs (Lohrke et al., 2006; Matlay and Westhead, 2005); or enhances the rate and geographical spread of foreign market entries (Kim, 2003).

The third trend relates to the growth in the service economy. Over 75% of the United Kingdom and United States workforce can be classified as belonging to the **service sector**, with at least 50% of Japanese, German and Russian workers being similarly classified (OECD, 2006). In today's global market place, performance and long-term survival are more likely to be derived from the **service exchange** than transactions involving products (Vargo and Lusch, 2006) and there is an increasing emphasis on service provision even within manufacturing contexts (Bell, 1999; Tidd and Hull, 2003; Karmarkar, 2004). The focus is on **co-creation of value**, with ever-greater attention to the servicing of the exchange rather than

DOI: 10.4018/978-1-61520-611-7.ch017

the transaction (Prahalad and Krishman, 2008; Paton and McLaughlin, 2008; Vargo et al, 2008). **Service orientation** gains new relevance in the context of e-commerce and evidence suggests that e-commerce plays a key role in enhancing service orientation both in the domestic (Balasubramanian et al. 2003; Jayachandran et al., 2005) and global (Houghton and Winklhofer, 2004) contexts.

Against this background, the article examines the contribution of e-commerce to SME globalization. The focus here is explicitly on existing firms and their online activities. The key construct, **global online performance**, measures the extent to which **internationalization** objectives are achieved. Building on globalization and e-commerce literature (Cavusgil and Zou, 1994; Morgan et al., 2004), and framing the issue as one of capability development (Knudsen and Madsen, 2002; Zahra and George; 2002), the article examines **online capabilities, external knowledge sources** and **intentional efforts** as they relate to global online performance.

## BACKGROUND

The most salient property of e-commerce is its international reach: multiple foreign markets maybe entered (Kim, 2003; Quelch and Klein, 1996), without investing in overseas assets (Yamin and Sinkovics, 2006). Evidence suggests that online activity tends to be more dramatic and dynamic than traditional approaches (Kim, 2003) and is regarded as a means of achieving international growth (Gabrielsson et al., 2004).

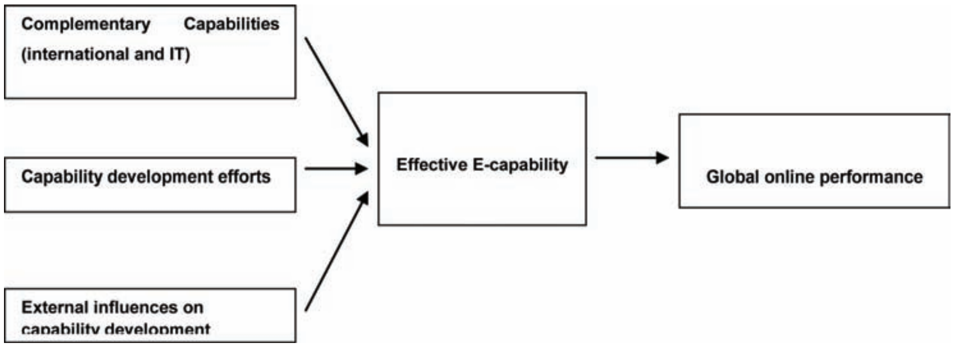
The international growth of SMEs has received much attention. Empirical studies on **born-globals** emphasize both the increasing speed and geographic diversity of internationalization (Oviatt and McDougall, 1997) and the rapidity at which international market entry occurs, particularly amongst high technology and knowledge intensive firms (McNaughton, 2000). In these studies globalization is seen as a dynamic process, individual to each firm, and characterized by flexible and dynamic business approaches (Morgan-Thomas and Jones, 2009).

There has been limited empirical research on the integration of e-commerce with export marketing. For example, researchers have considered its mediating role in the context of international strategy (Gregory et al., 2007; Moon and Jain, 2007; Prasad et al., 2001), or the benefits of e-commerce for globalization (Raymond et al., 2005). Although these studies provide insights into the factors relevant to global online performance, they do not explicitly measure the extent to which globalization objectives are met online. A prerequisite of performance related research is measurement, as it would highlight differences between adopters, thus providing practitioner and research guidance.

Performance measurement of online activities has been addressed domestically, specifically in the IT management literature. The **value stream** of IT research (Ray et al., 2005) attempts to explain differences in performance of IT applications including online applications (Barua et al., 2004). The approach advocated here relies on direct assessment of the impact of online activities (Barua et al., 2004). The basic premise of this approach is that the primary contribution of online activities is best captured in the specific context of the business processes, which the technology enables (Souitaris and Cohen; 2003).

To examine the effects of online activities on global performance, the authors propose an empirical model, arguing that the investigation of performance can be framed as a problem of **capability development** (Knudsen and Madsen, 2002; Morgan et al., 2003; Ray et al., 2005). Capabilities emerge as a result of deliberate actions to create new forms of competitive advantage; they emerge from learning-by-doing and as a result of deliberate investment (Ray et al. 2005). Applying **Zahra and George's** model (2002) to the online context the authors argue that the global online performance is dependent on two sets of

*Figure 1. Research model. (Source: Developed for research based on Zahra and George (2002))*




**complementary capabilities**: **global and online capabilities** (Figure 1). The model also includes **intentional capability development** efforts and external influences on capability development as important triggers to resource reconfiguration (Zahra and George, 2002).

## DETERMINING THE PERFORMANCE PARAMETERS

### Complementary International Capabilities

Capabilities refer to the firm's global knowledge, experience and its ability to support organizational objectives (Das, 1994). It has been reported that internationalization success requires knowledge of a country's environment (Chetty and Campbell-Hunt, 2003); global operations experience (Oviatt and McDougall, 1997); or competences gained through international engagement (Padmanabham and Cho, 1999). Experience leads to enhanced market understanding and performance: in both conventional (Beamish et al., 1999) and **online businesses** (Yamin and Sincovics, 2006). It is therefore expected that:

**H$_1$:** Complementary capabilities positively affect global online performance.

### Complementary IT Resources

Information and communication technologies (ICT), the online enablers, require specialized expertise to develop, maintain and operate (Bengtsson et al., 2007). The extent of one's existing ICT capability and understanding is often cited as predictor of future success (Grewal et al., 2001) and it positively impacts upon future online integration (Gregory et al., 2007; Moon and Jain, 2007). It is therefore expected that:

**H$_2$:** Complementary IT resources positively affect global online performance

### Intentional Efforts

Capabilities are accumulated, in part, through capability development (Zahra and George, 2002). Studies have shown that 'going global' requires senior management commitment (Beamish et al., 1999), as substantial financial resources are required for initial development and installation. More resources are needed to cover the expenditure during usage, maintenance, and subsequent enhancements (Chattreeje et al., 2002). It is therefore expected that:

**H$_3$:** Intentional efforts positively affect global online performance

### External Influences

The development of **e-commerce capabilities** can be influenced by external socio-economic factors (Gerwal et al., 2001; Gregory et al. 2007): some organizations simply follow the pack while others wish to be technologically savvy, or indeed they may be forced down this channel due customer preferences. It is therefore expected that:

**$H_4$: External influences** have a positive effect on global online performance

### Effective E-Capabilities

SMEs develop qualitatively different capabilities in e-commerce (Lohrke et al., 2006; Moon and Jain, 2007; Raymond et al., 2005). Some simply digitize information; while others focus on service provision developing **relational** or fully-fledged **transactional** websites (Lohrke et al., 2006). In the later case, the entire process of selling is e-enabled (Johnson and Bharadwaj, 2005). Many consider the development of **transactional e-capability** as being key to the global aspirations (Quelch and Klein, 1996; Lohrke et al., 2006). Service orientation and **relational e-capabilities** play a critical role in building, maintaining and shaping relationships (Jayachandran et al., 2005). This can lead to repeated interactions with customers and enhanced trust, loyalty and satisfaction (Balasubramanian et al. 2003). It is therefore expected that:

**$H_5$:** Global online performance is positively affected by the presence of relational and transactional e-capabilities

## THE ANALYTICAL APPROACH

The findings are based on the analysis of primary data from a large cross-industry survey of over 3000 UK firms. The data was collected via a fully structured questionnaire, addressed to named export executives (for full details see Morgan-Thomas and Bridgewater, 2004). A response rate of 24.9 per cent (705 firms) was achieved, including 603 replies from SMEs. Non-response bias was assessed by examining the differences between early and late respondents with regard to the means of the key variables and no significant differences were found.

The respondent firms represented a range of industries including manufacturing and service firms. The average firm in the sample had 40 employees and generated over £5 million in total sales. On average, the firms had initiated export activities 7 years prior to the survey, offered their products in 14 countries and had reached a level of 35 per cent of export sales. The key export market was the US. Considering their e-capabilities, just over a half of the firms had website features aimed at enhancing the business relationship. Only a minority 22 per cent conducted transactions online.

For details of the measurement model see Morgan-Thomas and Bridgewater (2004) and Appendix 1. The research hypotheses were tested by regressing the independent variables onto a multi-item measure of global online performance (see Table 1).

## THE FINDINGS

The data suggests partial support for $H_1$ concerning the impact of **complementary capabilities** on global online performance. Whilst the data supports positive interaction between performance and foreign intensity, there was no significant relationship with foreign diversity. Contrary to expectations, the length of export experience was negatively related to the development of e-capabilities.

The results do not support the contention that IT resources represent **complementary assets** in case of the development of e-capabilities: $H_2$ is insignificant. By contrast, $H_3$ is strongly supported;

*Table 1. Regression model*

| Dependent variable: global online performance (4-item measure) | | | |
|---|---|---|---|
| **Independent variables** | **Beta** | **Sig.** | **Hypothesis** |
| **Complementary international capabilities**<br>Foreign Intensity | 0.15 | 0.02 | $H_1$ |
| Length of Export Experience | -0.28 | 0.00 | $H_1$ |
| Foreign Diversity | -0.12 | 0.06 | $H_1$ |
| | | | |
| **Complementary IT resources** | 0.01 | 0.48 | $H_2$ |
| **Intentional effort** | 0.19 | 0.00 | $H_3$ |
| **External influences** | 0.25 | 0.00 | $H_4$ |
| **Relational capability** | 0.08 | 0.00 | $H_5$ |
| **Transactional capability** | 0.05 | 0.09 | $H_5$ |
| **Control variables** | | | |
| Time since adoption | 0.07 | 0.00 | |
| Industry sector (service vs. manufacturing) | -0.03 | 0.69 | |
| Competitive intensity | 0.09 | 0.00 | |
| | | | |
| No of observations | 603 | | |
| F statistics | 20.52 | | |
| $R^2$ | 0.282 | | |
| Adjusted $R^2$ | 0.265 | | |

the **intentional efforts** directed at capability development are positively related to the emergence of that capability, and its effect on performance. Finally, a positive relationship between external influence and **e-commerce** capability was found: $H_4$ is strongly supported. There is only partial support for the final hypothesis ($H_5$) concerning the effects of effective e-capabilities on global online performance: whilst the effects of **relational capabilities** are positive and significant, **transactional capability** does not seem to have a significant effect on performance.

## DISCUSSION

The study set out to measure global online performance and its drivers. Framing the issue as a problem of capability development, it has been argued that e-capabilities can emerge as a result of intention building as well as by experience. Building on Zahra and George's (2002) model, it is proposed that the global online performance will depend on existing resources as well as deliberate efforts aimed at capability development. In short, international capabilities, e-commerce resources, external factors and intent will shape performance.

The findings largely support these notions. In particular, global online performance seems strongly related to **foreign intensity**, **intentional efforts** and **external pressures**. For example, performance seems strongly dependent on export capability as manifested by a high intensity of foreign sales. Firms with existing competence perform better than those without; they more effectively embrace the Internet (Petersen et al, 2002). These results strongly confirm the evidence of path dependence in the development of new capabilities (Morgan et al., 2003; Knudsen and Madsen, 2002). One could argue that adding an online channel represents a refinement of current capabilities (Knudsen and Madsen, 2002). The results complement findings from the e-commerce integration research stream that suggest that e-capabilities enhance export performance (Moon and Jain, 2007; Prasad et al., 2001). Interestingly, the data seems to refute assertions that e-commerce provides a valid path for international development for inexperienced exporters (Quelch and Klein, 1996).

Path dependence could not be established between global online performance and IT capability. Previous studies in e-commerce integration (Gregory et al., 2007; Moon and Jain, 2007) found a positive relationship. However, these studies did not consider **global online export performance**. It is possible that IT *capabilities* lead to more advanced e-commerce applications, but the study suggests that they do not necessarily lead to higher online performance.

An important finding concerns the effect of **relational e-capabilities** on online growth. When it comes to the development of e-capability, it seems that the key benefit to the SME lies in supporting service relationships. This contradicts the literature on Internet new venture firms, which advocates the adoption of transactional e-commerce (Quelch and Klein, 1996). Similarly, the results seem to undermine the wisdom of process models of e-capability development that perceive **transactional capability** to be pivotal stage of digitisation (Lohrke et al., 2006). The primary contribution of e-commerce in this context appears to be that of enhancing customer service and building relationships.

The results seem to confirm that e-business solutions aimed at increasing connectivity enhance global development and that a service orientation enhances global e-commerce. The results corroborate previous findings, further confirming the relevance of customer relationships to performance in the context of digitization (Seithaml, et al. 2002). Importantly, the evidence provides strong support for the association between dynamic global growth and close relationships and network ties (Chetty and Blankenburg Holm, 2000). There may also be a link to the emerging field of services dominant logic, that places the emphasis on the value of an exchange being derived from its usage, in that the provider/user relationship plays a key role in securing ongoing **co-created value** (Vargo et al, 2008). This point will be expanded upon within the conclusions.

## CONCLUSION

The study attempted to tease out the manner in which a firms capabilities impact upon their global online performance. Findings seem to confirm that a firm's **capabilities** evolve over time and reflect the joint effects of passive learning-by-doing as well as deliberate efforts. Global online performance seems to depend on **relational e-capabilities** and existing capabilities, but not on IT resources or **transactional e-capabilities**.

These findings have important managerial implications. Online channels to international markets offer SMEs viable means of growth and provide resource leverage opportunities. A question of whether to get involved and how to shape the involvement in digital business is a key strategic decision for many SMEs. The research provides some guidance to exporting SMEs on best practice and suggests that they need not develop transactional capability to reap global rewards.

Four conclusions merit further consideration. Firstly, SMEs interested in the development of global activities are best advised to abstain from transactional strategies. Rather than to invest in transactional e-commerce, SMEs should be encouraged to develop service-oriented e-capabilities and a relational presence. Policy makers and government agencies that support the development of e-capabilities should take note. The results support calls for policies aimed at a tailored and incremental internationalization strategy rather than the pursuit of 'revolutionary' high impact and technologically advanced solutions.

Secondly, online growth seems to be **complementary** to, but not a substitute for, effective off-line activity. Early literature on e-commerce advocated that online should be a viable option for SMEs initiating export business as it provides a cost effective means of reaching global markets (Quelch and Klein, 1996). Although e-commerce has removed a number of export related barriers, perennial international business challenges remain (Yamin and Sincovics, 2006) and firms, which have encountered and successfully resolved many of these problems may more readily embrace and benefit from e-commerce.

Thirdly, the firm's IT capabilities do not represent a significant barrier to online success. It seems that simple e-commerce applications and possibly the outsourcing of IT, bridge the gap between SME technological capabilities and e-commerce requirements.

Finally, the research may be seen as further testimony to the changing face of both national and international trade: the growing *servitization* of world economies. Supply chains are becoming more complex and the members increasingly interdependent (Paton and McLaughlin, 2008). Value is now more likely to be derived, for all parties, from the **service exchange** (Lusch and Vargo, 2006). As has been mentioned, **relational** online presence services the exchange of knowledge and the betterment of understanding. Is it any surprise that global SMEs are deriving value from enhanced relationships with their supply chain and final customers? Are we witnessing firms engaging in the **co-creation of value**, placing the emphasis on the servicing of the exchange rather than the transaction alone (Prahalad and Krishman, 2008; Paton and McLaughlin, 2008; Vargo et al, 2008)? Vargo and Lusch (2006) predict a move to a **service dominant logic** (SDL), focusing on value in use and the notion of potential **co-created** value outcomes, this would require enterprises to place an emphasis on the **relational** aspects of their goods and services exchanges. A shift to SDL paradigms maybe evidenced in the results of the online export research findings.

## REFERENCES


Balasubramanian, S., Konana, P., & Menon, N. (2003). Customer satisfaction in virtual environments: a study of online investing. *Management Science*, *49*(7), 871–679. doi:10.1287/mnsc.49.7.871.16385

Barua, A., Konana, P., Whinston, A. B., & Yin, F. (2004). An Empirical Investigation of Net-Enabled Business Value. *MIS Quarterly*, *28*(4), 585–620.

Beamish, P. W., Karavis, L., Goersen, A., & Lane, C. (1999). The Relationship Between Organisational Structure and Export Performance. *Management International Review*, *39*(1), 37–54.

Bell, D. (1999). *The coming of post-industrial society: A venture in social forecasting*. New York: Basic Books.

Bengtsson, M., Boter, H., & Vanyushyn, V. (2007). Integrating the Internet and Marketing Operations. *International Small Business Journal*, *25*(1), 27–48. doi:10.1177/0266242607071780

Cavusgil, S. T., & Zou, S. (1994). Marketing strategy-performance relationship: An investigation of the empirical link in export market ventures. *Journal of Marketing*, *58*(1), 1–21. doi:10.2307/1252247

Chetty, S., & Blankenburg Holm, D. (2000). Internationalisation of small to medium-sised manufacturing firms: a network approach. *International Business Review*, *9*(1), 77–93. doi:10.1016/S0969-5931(99)00030-X

Chetty, S., & Campbell-Hunt, C. (2003). Explosive international growth and problems of success amongst small to medium-sized firms. *International Small Business Journal*, *21*(1), 5–27. doi:10.1177/0266242603021001719

Das, M. (1994). Successful and unsuccessful exporters from developing countries: Some preliminary findings. *European Journal of Marketing*, *28*(12), 19–33. doi:10.1108/03090569410074237

Etemad, H., & Wright, R. W. (1999). Internationalisation of SMEs: Management responses to a changing environment. *Journal of International Marketing*, *7*(4), 4–10.

Gabrielsson, M., Gabrielsson, P., & Kirpalani, V. H. M. (2004). Born globals: how to reach new business space rapidly. *International Business Review*, *13*, 555–571. doi:10.1016/j.ibusrev.2004.03.005

Gregory, G., Karavdic, M., & Sou, S. (2007). The Effects of E-Commerce Drivers on Export Marketing Strategy. *Journal of International Marketing*, *15*(2), 30–57.

Grewal, R., Comer, J. M., & Mehta, R. (2001). An investigation into the antecedents of organisational participation in business-to-business electronic markets. *Journal of Marketing*, *65*(3), 17–33. doi:10.1509/jmkg.65.3.17.18331

Houghton, K. A., & Winklhofer, H. (2004). The Effect of Website and E-Commerce Adoption on the Relationship between SMEs and Their Export Intermediaries. *International Small Business Journal*, *22*(4), 369–388. doi:10.1177/0266242604044305

Jayachandran, S., Sharma, S., Kaufman, P., & Raman, P. (2005, October). The role of relational information processes and technology use in customer relationship management. *Journal of Marketing*, *69*, 177–192. doi:10.1509/jmkg.2005.69.4.177

Johnson, D. S., & Bharadwaj, S. (2005). Digitisation of selling activity and sales force performance: an empirical investigation. *Journal of the Academy of Marketing Science*, *33*(1), 3–18. doi:10.1177/0092070304266119

Karavdic, M., & Gregory, G. (2005). Integrating e-commerce into existing export marketing theories: A contingency model. *Marketing Theory*, *5*(1), 75–104. doi:10.1177/1470593105049602

Karmarkar, U. (2004). Will you survive the services revolution? *Harvard Business Review*, *82*(6), 100–107.

Kim, D. (2003). Internationalisation of US Internet portals: does it fit the process model of internationalisation? *Marketing Intelligence & Planning*, *21*(1), 23–36. doi:10.1108/02634500310458126

Knudsen, T. R., & Madsen, T. K. (2002). Export strategy: a dynamic capabilities perspective. *Scandinavian Journal of Management*, *18*(4), 475–498. doi:10.1016/S0956-5221(01)00019-7

Lohrke, F. T., MacClure Franklin, G., & Frownfelter-Lohrke, C. (2006). Internet as an information conduit: a transaction cost analysis model of US SME Internet use. *International Small Business Journal*, *24*(2), 159–178. doi:10.1177/0266242606061838

Matlay, H., & Westhead, P. (2005). Virtual Teams and the Rise of E-Entrepreneurship in Europe. *International Small Business Journal*, *23*(3), 279–302. doi:10.1177/0266242605052074

McNaughton, R. B. (2000). Determinants of Time-Span to Foreign Market Entry. *Journal of Euromarketing*, *9*(2), 99–112. doi:10.1300/J037v09n02_06

Moon, B.-J., & Jain, S. C. (2007). Determinants and Outcomes of Internet Marketing Activities of Exporting Firms. *Journal of Global Marketing*, *20*(4), 55–71. doi:10.1300/J042v20n04_05

Morgan, N. A., Kaleka, A., & Katsikeas, C. S. (2004, January). Antecedents of export venture performance: A theoretical model and empirical assessment. *Journal of Marketing*, *68*, 90–108. doi:10.1509/jmkg.68.1.90.24028

Morgan, N. A., Zou, S., Vorhies, D. W., & Katsikeas, C. S. (2003). Experiential and Informational Knowledge, Architectural Marketing Capabilities, and the Adaptive Performance of Export Ventures: A Cross-National Study. *Decision Sciences*, *34*(2), 287–321. doi:10.1111/1540-5915.02375

Morgan-Thomas, A., & Bridgewater, S. (2004). Internet and exporting: determinants of success in virtual export channels. *International Marketing Review*, *21*(4-5), 393–408. doi:10.1108/02651330410547108

Morgan-Thomas, A., & Jones, M. V. (2009). (forthcoming). Post Entry Internationalisation Dynamics: Differences Between SMEs in The Development Speed of Their International Sales. *International Small Business Journal*.

Organisation for Economic Cooperation and Development. (2006). *The knowledge Based Economy*. Paris: OECD.

Oviatt, B. M., & McDougall, P. P. (1997). Challenges for Internationalisation Process Theory: the Case of International New Ventures. *Management International Review*, *37*(2), 85–99.

Padmanabham, P., & Cho, K. R. (1999). Decision specific experience in foreign ownership and establishment strategies: evidence from Japanese firms. *Journal of International Business Studies*, *30*(1), 25–44. doi:10.1057/palgrave.jibs.8490059

Paton, R. A., & McLaughlin, S. (2008). Services innovation: knowledge transfer and the supply chain. *European Management Journal*, *30*(1), 77–83. doi:10.1016/j.emj.2008.01.004

Petersen, B., Welch, L. S., & Liesch, P. W. (2002). The Internet and foreign market expansion by firms. *Management International Review*, *42*(2), 207–221.

Prahalad, C. K., & Krishman, M. S. (2008). *The new age of innovation: Deriving co-created value through global networks*. New York: McGraw-Hill.

Prasad, V., Ramamurthy, K., & Naidu, G. M. (2001). The Influence of Internet-Marketing Integration on Marketing Competencies and Export Performance. *Journal of International Marketing*, *9*(4), 82–110. doi:10.1509/jimk.9.4.82.19944

Quelch, J. A., & Klein, L. R. (1996). The internet and international marketing. *Sloan Management Review*, *37*(3), 60–76.

Ray, G., Muhanna, W. A., & Barney, J. B. (2005). Information technology and the performance of customer service process: a resource-based analysis . *MIS Quarterly*, *29*(4), 625–652.

Raymond, L., Bergeron, F. O., & Blili, S. (2005). The Assimilation of E-business in Manufacturing SMEs: Determinants and Effects on Growth and Internationalisation. *Electronic Markets*, *15*(2), 106–118. doi:10.1080/10196780500083761

Seithaml, V. A., Parasuraman, A., & Malhotra, A. (2002). Service Quality Delivery through Web Sites: A Critical Review of Extant Knowledge. *Journal of the Academy of Marketing Science*, *30*, 362–375. doi:10.1177/009207002236911

Souitaris, V., & Cohen, M. (2003). Internet-Business or Just Business?: Impact of 'Internet-Specific' Strategies on Venture Performance. *European Management Journal*, *21*(4), 421–438. doi:10.1016/S0263-2373(03)00080-X

Tidd, J., & Hull, F. M. (2003) *Services Innovation: Organisational responses to technological opportunities and market imperatives*. London: Imperial College Press.

Vargo, S. l., Maglio, P. P., & Archpru, M. (2008). On value and value co-creation: A service systems and service logic perspective. *European Management Journal*, *26*(3), 145–152. doi:10.1016/j.emj.2008.04.003

Vargo, S. L., & Lusch, R. F. (2006) Service Dominant Logic: What it is, What it is not, What it might be. In R.F. Lusch & S.L. Vargo (Eds.), *The Service Dominant Logic of Marketing: Dialog, Debate and Direction* (pp. 43-56). Armonk, NY: M.E. Sharpe Inc.

Yamin, M., & Sinkovics, R. (2006). Online internationalisation, psychic distance reduction and the virtuality trap. *International Business Review*, *15*(4), 339–360. doi:10.1016/j.ibusrev.2006.03.002

Zahra, S., & George, G. (2002). Absorptive capacity: A review, reconceptualisation, and extension. *Academy of Management Review*, *27*, 185–203. doi:10.2307/4134351

## ADDITIONAL READING

Christiaanse, E., & Venkatraman, N. (2002). Expertise exploitation in electronic channels' . *MIS Quarterly*, *26*(1), 15–39. doi:10.2307/4132339

Jones, M. V., & Coviello, N. E. (2005). 'Internationalisation: Conceptualising an Entrepreneurial Process of Behaviour in Time . *Journal of International Business Studies*, *36*(3), 284–303. doi:10.1057/palgrave.jibs.8400138

Morgan-Thomas, A., & Bridgewater, S. (2004). Internet and exporting: determinants of success in virtual export channels . *International Marketing Review*, *21*(4-5), 393–408. doi:10.1108/02651330410547108

Paton, R. A., & McLaughlin, S. (2008). Services innovation: knowledge transfer and the supply chain . *European Management Journal*, *30*(1), 77–83. doi:10.1016/j.emj.2008.01.004

Prahalad, C. K. Krishman, M. S. (2008). The new age of innovation: Deriving co-created value through global networks, McGraw-Hill, New York.

Seithaml, V. A., Parasuraman, A., & Malhotra, A. (2002). Service Quality Delivery through Web Sites: A Critical Review of Extant Knowledge' . *Journal of the Academy of Marketing Science*, *30*, 362–375. doi:10.1177/009207002236911

Shu, K., & Kraemer, K. L. (2002). e-Commerce Metrics for Net-Enhanced Organisations: Assessing the Value of e-Commerce to Firm Performance in the Manufacturing Sector . *Information Systems Research*, *13*(3), 275–295. doi:10.1287/isre.13.3.275.82

Vargo, S. l., Maglio, P. P., & Archpru, M. (2008). On value and value co-creation: A service systems and service logic perspective . *European Management Journal*, *26*(3), 145–152. doi:10.1016/j.emj.2008.04.003

## KEY TERMS AND DEFINITIONS

**Co-Created Value:** occurs when the parties engaged in a service or knowledge exchange combine 'forces' to ensure that each derives enhanced benefit from the relationship.

**E-Capabilities:** reflect qualitative and quantitative differences between firms in the level of adoption of e-commerce and its strategic usage.

**Global Online Performance:** denotes the extent to which firm's globalization objectives are achieved via e-commerce and measures online contribution to global sales, profits, number of foreign market and overall global performance.

**Goods Dominant Logics:** place the emphasis on closing the transaction.

**International Capabilities:** capture the depth and breadth of firm's knowledge, experience and abilities to support the process of internationalization.

**Online Globalization:** denotes the processes of international expansion of the firm achieved solely in online environments or with the assistance of online business.

**Service Dominant Logics:** place the emphasis on managing the exchange to maximize the potential for co-creating value.

## APPENDIX 1: MEASUREMENT MODEL

| **Multi-item measures (CFA model)** | **Standardized factor loading** |
|---|---|
| **Complementary IT resources** (α = .82, CR = .82, AVE = .54) | |
| My company operates complex and very sophisticated IT infrastructure | .78 |
| Employs a high proportion of IT support and IT literate staff | .65 |
| Invests heavily in IT systems and applications | .90 |
| *Prior to the internet, has been using IT system(s) that support sales and marketing (e.g. electronic databases, EDI** | |
| **Capability development effort** (α = .79, CR = .78, AVE = .54) | |
| *Level of initial investment in internet related hardware / software was high** | |
| Ongoing internet budget is very high | .62 |
| There is substantial planning for internet activities | .70 |
| *Top management is commited and supportive of the internet** | |
| Overall investment in terms of time and resources is high | .87 |
| **External influences on capability development** (α = .68, CR = .66, AVE =.50) | |
| We are under pressure from our customers to adopt the internet | .67 |
| Many of our competitors use the internet | .84 |
| **Online contribution to export performance** (α = .93, CR = .93, AVE = .62) | |
| The internet has significantly improved…. | |
| …export profits | .88 |
| …number of foreign markets served | .87 |
| …export sales | .94 |
| …overall performance | .80 |
| **Competitive intensity** (α = .79, CR = .78, AVE = .64) | |
| The level of competition in my industry is very high | .66 |
| There are many competitors in our market | .92 |
| **items removed in measure development procedures* | |

# Chapter 18
# Electronic Funds Transfer Systems and the Landscapes of Global Finance

**Barney Warf**
*University of Kansas, USA*

## ABSTRACT

*Electronic funds transfer systems (EFTS) are the primary means by which capital moves through the world economy, including real time gross settlement systems for handling international payments as well as foreign exchange transactions. This paper starts by noting how the world of the Bretton-Woods system differed from the hypermobile, digitized world that followed. Next, it summarizes some major public and private EFTS networks and the repercussions for capital markets, stock exchanges, and foreign exchange markets. Third it summarizes how EFTS challenge national monetary controls and the implications. Finally, it points to the centrality of EFTS in the emergence and growth of offshore banking centers.*

## INTRODUCTION

Electronic funds transfer systems (EFTS) comprise the architecture of global capital markets, foreign exchange markets, and transactions payments, and form part of the profoundly important shift into digital money that began in the late 20$^{th}$ century (Schiller, 1999). Aided by a massive worldwide network of fiber optics, international banks and speculators can shift significant sums around the world at a moment's notice, wrecking havoc with national monetary controls. As a result, the mounting velocity of global capital has accelerated to unprecedented speeds: freed from many technological and political barriers to movement, capital has become not merely mobile, but *hypermobile* (Corbridge, Martin and Thrift, 1994; Cohen, 1998). EFTS, therefore, are not simply economic in nature, but have important public policy ramifications (Walker, 1978; Solomon, 1997b).

Since their first signs of existence in the 1970s, EFTS have spawned a copious literature, often utopian and technologically determinist in nature. By fomenting a "paperless economy,"

DOI: 10.4018/978-1-61520-611-7.ch018

EFTS, which include business-to-consumer and business-to-business transactions, were assured to provide relief from growing mountains of paper transactions, reduce transactions costs, increase the velocity of money, improve capital market efficiency, and generate economies of scale in finance (Richardson, 1974; Colton, 1980; Gallagher, 1987; Kirkman, 1987). The reality has been more complex.

This essay explores the economic and spatial implications of EFTS. It opens by briefly summarizing the world financial system prior to the birth of electronic money. Second, it reviews the major public and private EFTS systems, emphasizing how digital money was freed to roam the world at the speed of light. Third, it focuses on the challenge to national sovereignty that EFTS pose by progressively undermining the capacity of central banks to control national money supplies. Fourth, it points to the new geographies of finance unleashed by electronic money as found in the growth of offshore financial centers around the world.

## FINANCE BEFORE EFTS

Prior to the rise of EFTS, global finance was a relatively placid world. Under the **Bretton-Woods system** from 1947 to 1973, there were few exchange rate fluctuations; most currencies were pegged to the U.S. dollar, which was, in turn, was pegged to gold, at $35/ounce. Currency appreciations or depreciations reflected government fiscal and monetary policies within relatively nationally contained financial markets in which central bank intervention was effective. Trade balances and foreign exchange markets were strongly connected: rising imports caused a currency to decline in value as domestic buyers needed more foreign currency to finance purchases. Rising exports had the opposite effect, raising the price of domestic currencies on the international market. Currency fluctuations figured prominently in rectifying trade imbalances. The largely unregulated Euromarket was also important to this system.

The system ended abruptly with the U.S. abandonment of the gold standard in 1971 and the collapse of the Bretton-Woods system in 1973 (Leyshon, 1992; Leyshon and Thrift, 1997; Strange, 1994). Hereafter, supply and demand would dictate the value of a state's currency. Soon currency exchange became the world's largest industry by volume: roughly $4 trillion in electronic funds crossed national borders each day in 2007, orders of magnitude more than the total value of international trade in goods.

## THE BIRTH OF EFTS

**Capital markets** worldwide were profoundly affected by the digital revolution, which eliminated transactions and transmissions costs for the movement of capital much in the same way that deregulation and the abolition of capital controls decreased regulatory barriers (Batiz and Woods, 2002; Solomon, 1997a). Banks, insurance companies, and securities firms were at the forefront of the construction of an extensive network of telecommunications networks, particularly a seamlessly integrated worldwide skein of fiber optics lines, much of which forms the backbone of today's Internet (Langdale, 1985; Warf, 1995). This infrastructure was decisive in enabling the birth of EFTS, which comprise the nervous system of the international financial economy and allow banks to move capital around a moment's notice, arbitrage interest rate differentials, take advantage of favorable exchange rates, and avoid political unrest.

One of the primary forms that EFTS take is **Real Time Gross Settlement (RTGS) systems** (O'Mahony et al., 2001), which handle money flows among financial institutions and governments. The largest of these is the U.S. Federal Reserve Bank's Fedwire system, which allows any depository institution with a Federal Reserve account to transfer funds to the Federal Reserve account of any other depository institution. In 2005, total Fedwire traffic amounted to $2.1 trillion per day (Federal Reserve, 2009). The other major U.S. payments mechanism is the privately-owned Clearing House Interbank Payments System (CHIPS) in New York, operated by the New York Clearing House Association, a consortium run by private firms that clears about $1 trillion in daily transactions, half of which is in foreign exchange. In Europe, the Belgian-based Society for Worldwide Interbank Financial Telecommunications (SWIFT), formed in 1973, plays a comparable role; SWIFT extends into 208 countries and handles €2.6 billion daily in transactions. In the United Kingdom, settlements are made through the Clearing House Association Payments System (CHAPS) run by the Bank of England since 1984, while in the European Community, a system linking the banks of member states known as Trans-European Automated Real-time Gross settlement Express Transfer (TARGET), which began in 1999, is used to settle transactions involving the Euro. In Japan, starting in 1988, the Bank of Japan Financial Network System (BOJNET) fills a comparable function.

Private firms have similar systems. Citicorp, for example, has a Global Information Network that allows it to trade $200 billion daily in foreign exchange markets around the world. MasterCard has its Banknet, which links all its users to a centralized database and payments clearing system. Reuters, with 200,000 interconnected terminals worldwide linked through systems such as Instinet and Globex, alone accounts for 40 percent of the world's financial trades each day. Other systems include the London Stock Exchange Automated Quotation System (SEAQ), the Swiss Options and Financial Futures Exchange (SOFFEX), and the Computer Assisted Order Routing and Execution System at the Tokyo stock exchange. Such networks provide the ability to move money around the globe at stupendous rates (the average currency trade takes less than 25 seconds); supercomputers used for that purpose operate at teraflop speeds, or one trillion computations per second.

Similarly, in the securities markets, **electronic funds transfer systems** facilitated the emergence of 24 hour/day trading, linking stock markets through computerized trading programs. Electronic trading frees stock analysts from the need for face-to-face interaction to gain information (O'Connell 1995). On-line trading also allows small investors to trawl the Internet for information, including real-time prices, eroding the advantage once held by specialists, and execute trades by pushing a few buttons (e.g., via e-trade). Trade on many exchanges rose exponentially as a result. The National Association of Security Dealers Automated Quotations (NASDAQ), the first fully automated electronic marketplace, is now the world's largest stock market; lacking a trading floor, NASDAQ connects millions of traders worldwide through the over-the-counter market, processing 2,000 transactions per second. EASDAQ, the European version of NASDAQ launched in 1996, operates similarly, albeit on a smaller scale. Facing the challenge of on-line trading head-on, Paris, Belgium, Spain, Vancouver and Toronto all recently abolished their trading floors. The volatility of trading, particularly in stocks, also increased as hair-trigger computer trading programs allow fortunes to be made (and lost) by staying microseconds ahead of (or behind) other markets.

Liberated from gold, travelling at the speed of light, as nothing but assemblages of zeros and ones, global money performs a syncopated electronic dance around the world's neural networks in astonishing volumes. The world's currency markets, for example, trade roughly four trillion U.S. dollars every day in 2007, dwarfing the funds that changes hands daily to cover global trade in goods and services. The ascendancy of electronic money shifted the function of finance from investing to speculation, institutionalizing volatility in the process. Foreign investments have increasingly shifted from foreign direct investment (FDI) to intangible portfolio investments such as stocks and bonds, a process that reflects the securitization of global finance. Unlike FDI, which generates predictable levels of employment, facilitates technology transfer, and alters the material landscape over the long run, financial investments tend to create few jobs and are invisible to all but a few agents, acting in the short run with unpredictable consequences. Further, such funds are often provided by non-traditional suppliers: a large and rapidly rising share of private capital flows worldwide is no longer intermediated by banks but by non-bank institutions such as securities firms and corporate financial operations. Thus, not only has the volume of capital flows increased, but the composition and institutions involved have changed.

Globalization and electronic money had particularly important impacts on currency markets. Since the shift to floating exchange rates, trading in currencies has become a big business, driven by the need for foreign currency associated with rising levels of international trade, the abolition of exchange controls, and the growth of pension and mutual funds, insurance companies, and institutional investors. The vast bulk (85 percent) of **foreign exchange** transactions involves the U.S. dollar. Typically, the moneys involved in these markets follow the sun. For example, the foreign exchange (FOREX) market opens each day in East Asia while it is still evening in North America; funds then travel west, bouncing from city to city over fiber optic lines, e.g., from Tokyo to Hong Kong to Singapore to Bahrain to Frankfurt, Paris, or London, then to New York, Los Angeles, and back across the Pacific Ocean. (Given the continuous circularity of this movement, funds can originate anywhere and circle the globe within 24 hours).

The neoclassical economic case for capital mobility holds that such fluidity allows countries with limited savings to attract financing for domestic investments, that it enables investors to diversify their portfolios, that it spreads risk more broadly, and that it promotes intertemporal trade. Capital mobility implies that firms can smooth consumption by borrowing money from abroad when domestic resources are limited and dampen business cycles. Conversely, by investing abroad, firms can reduce their vulnerability to domestic disturbances and achieve higher risk-adjusted rates of return. Advocates of unfettered capital flows hold that such mobility creates opportunities for portfolio diversification, risk sharing, and intertemporal trade, all important criteria for the IMF. The major problems concerning capital mobility in this view center upon the asymmetry of information in financial markets and "moral hazard," reliance upon the state (or IMF) to bail them out during crises. Yet neoclassical theory is flawed in several respects, not the least of which is an inadequate appreciation of politics and space, the ways in which national, class, gender, and other non-market relations shape and constrain flows of money, even electronic money, and information, and how the intersections of capital and nation-states play out unevenly across the globe. Capital flight, for example, can generate financial chaos as much as it harmonizes investments. Central to this issue is the relative degrees of influence and power that global capital and individual nation-states exhibit at varying historical conjunctures.

## EFTS AND THE CHALLENGE TO NATIONAL SOVEREIGNTY

The rise of EFTS has fundamentally undermined the traditional role of national monetary policy. National borders mean little in the context of massive movements of money around the globe: it is far easier to move $1 billion from New York to Tokyo than a truckload of grapes from California to Arizona. Under Bretton-Woods, national monetary controls over exchange, interest, and inflation rates were essential to financial and trade stability; today, however, those same national regulations appear as a drag on competitiveness and have lost much of their effectiveness. In the U.S., for example, the Federal Reserve changed the reserve ratio of banks as well as the prime inter-bank loan rate multiple times in the 1990s and the 2000s, only to find that its control over the national money supply had diminished to the point of near irrelevance. The New York Federal Reserve's Foreign Exchange Office, the operational arm of the Treasury Department's Exchange Stabilization Fund, likewise attempted repeatedly to stabilize the U.S. dollar against other currencies, with mounting difficulty.

Thus, EFTS not only changed the configuration and behavior of financial markets but also their relations to the nation-state. Raymond Vernon's (1971) classic work *Sovereignty at Bay* argued convincingly that the nation-state (as classically conceived), sovereignty and the national economy were on their death-bed, victims of multinational corporations and international capital. Advocates of this perspective, of course, have long exaggerated claims that the nation-state was dying to the point of asserting that a seamlessly integrated "borderless" world was in the making. The brave new world of digital finance, however, lends credence to Vernon's predictions in ways he or his advocates may not have anticipated.

Classic interpretations of the national state rested heavily upon a clear distinction between the domestic and international spheres, a world carved into mutually exclusive geographic jurisdictions. State control in this context implies control over territory. In contrast, the rise of electronic money has generated a fundamental asymmetry between the world's economic and political systems. World-systems theorists have long maintained that the fundamental political geography of capitalism is not the nation-state but the interstate system, which offers capital great leverage by flowing across borders in ways that the reach of regulatory authorities cannot.

EFTS present the global system of states with unprecedented difficulties in attempting to reap the benefits of international finance while simultaneously attempting to avoid its risks. For example, Kobrin (1997, p. 75) notes

*E-cash is one manifestation of a global economy that is constructed in cyberspace rather than geographic space. The fundamental problems that e-cash poses for governance result from this disconnect between electronic markets and political geography. The very idea of controlling the money supply, for example, assumes that geography provides a relevant means of defining the scope of the market. It assumes that economic borders are effective, that the flow of money across them can be monitored and controlled, and that the volume of money within a fixed geographic area is important. All of those assumptions are increasingly questionable in a digital world economy.*

Changes in the structure of institutional investing have had profound impacts on this market: rapid movement of funds worldwide has meant that under- or overvalued currencies are likely to be subjected to speculative attacks from large hedge funds or financial institutions. The power of electronic money is evident when currency speculators mount an attack on a given national currency, such as those launched against the Thai baht in 1997, which initiated the disastrous Asian financial crisis (Henderson, 1998). Under such circumstances, political authorities can attempt to manipulate exchange rates where the currency remains shackled by a "managed float" or "crawling peg" system, typically harnessed to the U.S. dollar, but often creating internal and external price distortions. Capital controls offer short-term benefits but discourage long-run investments such as infrastructure development, and often get mired in corruption. More drastically, they can raise interest rates. The goal in such situations is to convince speculators that the national bank will stay the course and commit whatever reserves are necessary to shore up its currency by using the same leveraging tools as their private adversaries, but few states possess the resources to maintain such a defense for long.

In short, Vernon's predictions, however premature, may have considerably more validity at present than they did when his book first appeared. This is not to say that the nation-state is obsolete, or event that it will be in the near future, but rather that electronic money has markedly shifted the nature of international finance and investment, undermining the effectiveness of national monetary controls.

## ELECTRONIC FUNDS AND THE GEOGRAPHIES OF OFFSHORE FINANCE

Another important repercussion of EFTS is the growth of **offshore banking** centers, which arose in tandem with the global fiber optics network and owe their very existence to digital monetary flows across national borders. As the technological barriers to moving money around internationally have fallen, legal and regulatory ones have increased in importance, and financial firms have found the topography of regulation to be of the utmost significance in choosing locations. Offshore centers are the "black holes" in the global topography of financial regulation, a status that emanates directly from the enhanced ability of large financial institutions to shift funds electronically to take advantage of the lax regulations, freedom from taxes and currency controls, and other restrictions to be found on the periphery of the global financial system. Thus, Hudson (2000) argues that the phenomenon of offshore banking is redefining national sovereignty, uncoupling political and financial control from the territories that long held sway over financial institutions.

Usually in response to highly favorable tax laws implemented to attract foreign firms, offshore banking has become important to many micro-states in the Caribbean (e.g., the Cayman Islands, Bahamas, Panama), Europe (e.g., Luxembourg, Jersey, Gibraltar, San Marino, Liechtenstein, and the Isle of Man), the Middle East (e.g., Cyprus, Bahrain), and the south Pacific (e.g., Vanuatu) (Cobb, 1998; Roberts, 1994; Warf, 2002). Such places provide commercial investment services (i.e., loans and advice), foreign currency trades, asset protection (insurance), investment consulting to high net worth individuals (HNWI), international tax planning, and trade finance (e.g., letters of credit). Offshore banking centers also reflect the shift from traditional banking services (loans and deposits) to lucrative nontraditional functions, including debt repackaging, and cash management. Given the extreme mobility of finance capital and its increasing separation from the geography of employment, offshore banking can be expected to do relatively little for the nations in which it occurs. Employment in offshore banking is relatively capital-intensive when compared to the labor-intensive headquarters in global cities For example, in the Cayman Islands, the world's largest center of offshore finance, Roberts (1995) notes that 538 foreign banks employ only 1,000 people; most are "brass plate" or shell banks.

Electronic money can be exchanged an infinite number of times without leaving a trace, making it difficult for regulatory authorities to track down transactions both legal and illegal. The intermediaries that now serve as checkpoints for recording such transactions are eliminated by peer-to-peer transactions. The opportunities for money laundering – a staple of the drug trade – are thus made all the more attractive. Tax evasion has become increasingly serious as electronic money has become the norm; moreover, the jurisdictional question – who gets to tax what – is vastly complicated. Digital counterfeiters can also take advantage of this situation, working anywhere and using the Internet to spend currencies in any other place. Encryption offers one route to limit such activity; secure e-cash transactions require strong encryption technology, but make it as difficult for authorities to identify criminal activities as much as legitimate ones.

Offshore banking centers have long suffered from the cloud of suspicion that they constitute little more than havens for tax evasion and money laundering of illicitly obtained funds (Hampton, 1996a; Hampton and Christensen, 1999). As EFTS have come to dominate global finance, the use of offshore banking centers for illegitimate purposes has grown apace. Indeed, just as large corporations can use the Internet and fiber optics to move funds from place to place, so can actors in the "dark side" of the global economy, including tax evaders, drug cartels, arms traffickers, terrorists, and corrupt government officials. Given that they often straddle the boundary between "legitimate" and "illegitimate" financial activities, a key issue in the success or failure of offshore banking centers is the degree of confidentiality that investors feel they can obtain. Indeed, the reliability of offshore banking centers is often judged by the quality of laws protecting the privacy of investors owning deposits there. The use of shell companies, including holding corporations and increasingly, foundations, blurs legal lines of liability, keeping insurance rates low, and protecting assets (both legal and otherwise) from public scrutiny through deliberately impenetrable webs of cross-ownership that typically deflect even the most dogged of auditors. Thus, despite the putatively a spatial nature of electronic money and the extreme fungibility of electronic financial capital, place still matters in the geography of offshore banking in the forms of locally embedded local policies, contrary to simplistic hyperbole about the "death of distance" (Cairncross, 1997) or the "end of geography" (O'Brien, 1992).

## CONCLUSION

Electronic money has profoundly reconfigured the world's capital markets. Clearly, deregulated, hypermobile funds have changed the ground rules of the global economy. EFTS, often manifested in the form of real time gross settlement systems, allow trillions of dollars daily to circulate among places at the speed of light. Since the collapse of Bretton-Woods and the birth of the global "casino economy" (Strange, 1998), such funds have grown in magnitude to dwarf world trade in agricultural and manufactured goods. Currency fluctuations have became progressively divorced from trade imbalances and more subject to the whims of global capital markets. Currencies that used to *reflect* the relative health of a national economy – its balance and terms of trade, inflation, investment, and interest rates – now in large part *determine* that health. Currency fluctuations, in short, have switched from effect to determinant of national economic security. In this context, conventional nationalist monetary tools have relatively little impact in terms of restoring market confidence.

Intimately associated with this transformation is a shift in national sovereignty, as individual states have gradually come to terms, for better or worse, with their declining capacity to determine exchange rates for their respective currencies, thus sacrificing much of their leverage over trade balances, inflation, and interest rates. As national economic sovereignty has come under attack, power in global financial markets has steadily shifted toward a loose assemblage of unregulated actors capable of wrecking havoc in the midst of financial speculative bubbles. Finally, the holes generated in the web of international financial regulations include geographical as well as economic manifestations, most obviously in the form of offshore financial centers, many of which operate on the margins of global circuits of capital.

All of these phenomena testify to the significance of EFTS, whose repercussions are not confined to the realm of the economic, but extend deeply into political spheres as well. Indeed, given the enormity of the financial crisis of 2008-2009 sweeping the globe, the role of EFTS in promulgating instability in the world economy is worthy of closer inspection. Future research directions may include the role of international regulatory institutions in the stabilization of global electronic financial flows.

## REFERENCES

Batiz, B., & Woods, D. (2002). Information technology innovations and commercial banking: A review and appraisal from an historical perspective. *Electronic Markets - The International Journal of Electronic Commerce & Business Media, 12*(3), 192-205.

Cairncross, F. (1997). *The death of distance*. Boston: Harvard Business School Press.

Cobb, S. (1998). Global finance and the growth of offshore financial centers: The Manx experience. *Geoforum*, *29*, 7–21. doi:10.1016/S0016-7185(97)00022-5

Cohen, B. (1998). *The geography of money*. Ithaca, NY: Cornell University Press.

Colton, K. (1980). *Computers and banking: Electronic funds transfer systems and public policy.* New York: Plenum Publishing.

Corbridge, S., Martin, R., & Thrift, N. (Eds.). (1994) *Money, power and space*. Oxford: Blackwell.

Federal Reserve. (2009). *Fedwire funds transfer system*. Retrieved February 12, 2009 from http://www.federalreserve.gov/paymentsystems/coreprinciples/default.htm

Gallagher, M. (1987). *Electronic funds transfer systems: The revolution in cashless banking and payment methods*. Oxford: Blackwell.

Graham, S. (1999). Global grids of glass: On global cities, telecommunications, and planetary urban networks. *Urban Studies (Edinburgh, Scotland)*, *36*, 929–949. doi:10.1080/0042098993286

Hampton, M. (1996). *The offshore interface: Tax havens in the global economy*. New York: Palgrave MacMillan.

Hampton, M., & Christensen, J. (1999). Treasure Island revisited: Jersey's offshore finance centre crisis: Implications for other small island economies. *Environment & Planning A*, *31*, 1619–1637. doi:10.1068/a311619

Henderson, C. (1998). *Asia falling*. New York: McGraw-Hill.

Hudson, A. (2000). Offshoreness, globalization and sovereignty: A postmodern geo-political economy? *Transactions of the Institute of British Geographers*, *25*, 269–283. doi:10.1111/j.0020-2754.2000.00269.x

Kahler, M. (Ed.). (1998). *Capital flows and financial crises*. Ithaca, NY: Council on Foreign Relations.

Kirkman, P. (1987). *Electronic funds transfer systems: The revolution in cashless banking and payment methods*. Oxford: Blackwell.

Kobrin, S. (1997). Electronic cash and the end of national markets. *Foreign Policy*, 65–77. doi:10.2307/1149333

Kurtzman, J. (1993). *The death of money*. Boston: Little, Brown and Co.

Langdale, J. (1985). Electronic funds transfer and the internationalisation of the banking and finance industry. *Geoforum*, *16*, 1–13. doi:10.1016/0016-7185(85)90002-8

Leyshon, A. (1992). The transformation of regulatory order: Regulating the global economy and environment. *Geoforum*, *23*, 249–267. doi:10.1016/0016-7185(92)90041-2

Leyshon, A., & Thrift, N. (1997). *Money/space: Geographies of monetary transformation*. New York: Routledge.

O'Brien, R. (1992). *Global financial integration: The end of geography*. Washington, DC: Council on Foreign Relations.

O'Mahony, D., Peirce, M., & Tewari, H. (2001). *Electronic payment systems for e-commerce.* London: Artech.

Richardson, D. (1974). *Electric money: Evolution of an electronic funds transfer system*. Cambridge, MA: MIT Press.

Roberts, S. (1995). Small place, big money: The Cayman Islands and the international financial system. *Economic Geography*, *71*, 237–256. doi:10.2307/144310

Schiller, D. (1999). *Digital capitalism: Networking the global market system*. Cambridge, MA: MIT Press.

Solomon, E. (1997a). *Virtual money*. Oxford: Oxford University Press.

Solomon, E. (1997b). *Electronic funds transfers and payments: The public policy issues.* New York: Springer.

Solomon, R. (1999). *Money on the move: The revolution in international finance since 1980*. Princeton, NJ: Princeton University Press.

Strange, S. (1998). *Mad money: When markets outgrow governments*. Ann Arbor, MI: University of Michigan Press.

Vernon, R. (1971). *Sovereignty at bay*. New York: Basic Books.

Walker, D. (1978). Electronic funds transfers and payments: The public policy issues. *Journal of Banking & Finance*, *2*, 65–78. doi:10.1016/0378-4266(78)90031-6

Warf, B. (1995). Telecommunications and the changing geographies of knowledge transmission in the late 20th century. *Urban Studies (Edinburgh, Scotland)*, *32*, 361–378. doi:10.1080/00420989550013130

Warf, B. (1999). The hypermobility of capital and the collapse of the Keynesian state. In R. Martin (Ed.), *Money and the space economy* (pp. 227-240). London: Wiley.

Warf, B. (2002). Tailored for Panama: Offshore banking at the crossroads of the Americas. *Geografiska Annaler B*, *84*, 47–61. doi:10.1111/j.0435-3684.2002.00112.x

## KEY TERMS AND DEFINITIONS

**Bretton-Woods System:** International system of regulation erected by the U.S. that lasted from 1945 to 1973, designed to provide order to post-WWII financial markets.

**Capital Markets:** Supply and demand of debt and equity securities, commodities, and other financial instruments.

**Electronic Funds Transfer Systems:** Means of moving money digitally either among financial institutions and governments or to individuals and households

**Foreign Exchange:** Instruments of payment among different national currencies.

**Offshore Banking:** Financial institution located outside of the country of depositors, typically in tax havens on the periphery of the global banking system.

**Real Time Gross Settlement System:** electronic systems for streamlining transactions among large financial institutions, typically governments and networks of banks

# Section 3
# E-Marketplaces

# Chapter 19
# Intermediaries in E-Commerce: Value Creation Roles

**Nirvikar Singh**
*University of California, Santa Cruz, USA*

## INTRODUCTION

Very early in the evolution of e-commerce, predictions were made that a significant degree of disintermediation would occur, i.e., that middlemen would be eliminated from the value chain through the use of the Internet. The reasoning was as follows. The economic benefit of middlemen, or intermediaries, is that they reduce transaction costs for functions that are outside the firm (Coase, 1937). Therefore, as digital technology reduced transaction costs in the open market, the role of these middlemen would be threatened (Tapscott, 1996; Downes & Mui, 1998). However, intermediaries have proven to be remarkably robust, even as they have transformed their roles and functions. The success of e-commerce firms like Amazon, eBay, and Yahoo is a testament to the continued value of intermediation. Even in an economy reshaped by digital technology, intermediaries still add value, and find new ways of doing so.

This article examines the evolution and robustness of intermediation in e-commerce, by examining the fundamental economics of intermediation in terms of economies of specialization, scale, and scope. It considers ownership, transformation, and agency as different dimensions of intermediaries. It examines various intermediary roles, and how they are combined, driven by economies of scope and strategic attempts to capture value. It discusses how the various intermediary roles are changing in e-commerce, through the impact of digital technology. The specific case of financial intermediaries, at the forefront of digital technology usage, provides several examples (Singh, 2000). The conclusion is that intermediaries are important and varied enough that they will survive and thrive in the era of e-commerce. Disintermediation will not be a general outcome. Traditional intermediaries that perform manual tasks, or are part of slow or inefficient value chains are in danger, but the economic roles that intermediation plays are unchanged by e-commerce, and will be carried out in new ways.

DOI: 10.4018/978-1-61520-611-7.ch019

## BACKGROUND

The term 'intermediary' covers many different types of functions, so an ideal classification is difficult. If an intermediary is literally a 'middle-man', coming between a buyer and a seller in a specific transaction, then the term has a relatively narrow scope. An example of such an intermediary is a specialist on the floor of the New York Stock Exchange (NYSE). However, within the entire value chain for a product or service, from raw inputs to final consumption, many types of organizations or individuals can be viewed as intermediaries. Distributors and wholesalers are an obvious example, but retailers, too, are intermediaries between producers and consumers. Even a computer manufacturer like Dell is an intermediary in this broadest sense, because it collects hardware and software components from a variety of suppliers, and assembles them into computers that are ready to use. Similarly, UPS is an intermediary when it delivers the Dell computer to the household or firm that ordered it.

There is one crucial difference between Dell and UPS, which provides a first basis for classifying intermediaries (Besanko et al, 2008). When Dell obtains components and assembles them into a working computer, it takes ownership of those components. It also oversees the locational transformation: the buyer does not make a separate transaction for the delivery. What Dell sells is the computer delivered to the doorstep, including the delivery charge. UPS is also an intermediary, but it does not take ownership of the computer. Therefore we can divide intermediaries into those which take ownership, creating two separate market transactions, and those who do not, leaving just one market transaction. The specialist on the NYSE floor mostly plays the latter role, matching brokers representing buyers and sellers. Sometimes the specialist also buys or sells out of his or her inventory, thus taking ownership as well.

If the intermediary does not take ownership, there is another important possible dimension of difference. To continue with the NYSE example, brokers who bring buy or sell orders to a specialist are acting on behalf of those who have placed the orders. In other words, the brokers act as agents, either for the buyer or the seller. An agent in this sense is anyone who is assigned a task on behalf of another (Casadesus-Masanell & Spulber, 2007). This assignment may be through a specific contract, or through a general rule. A stockbroker follows general rules laid down by the employer, and by the Securities and Exchange Commission (SEC) for every order, without requiring a contract each time. NYSE specialists, however, do not typically act as agents of either the buyer or the seller, but play a neutral role. (There are exceptions: specialists play an agency role for brokers when they execute prior trading instructions for floor brokers.) Other examples of agent-brokers are real estate brokers. There are invariably two brokers in a real estate transaction, representing the interests of the buyer and the seller respectively – though legally they are both the seller's agent, since the seller pays both commissions (Wiley & Zambano, 2008). Real estate brokers do not take ownership, but only facilitate market transactions. Ownership and agency are mostly mutually exclusive characteristics of intermediaries, but they may not be totally so. Car dealers, for example, are agents (franchisees) of the manufacturers, but take ownership of the cars they sell. In reality, a great variety of arrangements are possible.

A third dimension of classification is that of transformation of the product or service. As illustrated by the UPS transportation example, transformation (of location) may take place without ownership. Outsourcing may also involve transformation without ownership. In a non-physical example, an advertising agency can change the image of a product with a successful advertising campaign, but does not buy or resell the product. Some intermediaries do not transform a product or service. An intermediary that collects and disseminates information does not change the product, but creates value by improving the quality of the transactions that take place. Matching buyers with sellers, or informing buyers about the quality of products sold and mitigating problems of asymmetric information, are examples where information adds value to market transactions. Unsurprisingly, the Internet has become a fertile field for 'information intermediaries' (Bhargava & Choudhary, 2004).

An intermediary is a kind of specialist, so economies of specialization are a key explanation for intermediation. As with any other occupation, a broker, agent or middleman has fixed costs of getting started, and also learns by doing. It pays to specialize to become more efficient. Intermediation activities may also be a byproduct of broader specialization. For example, a lawyer masters a general set of knowledge and skills, which may be used for agency tasks that do not involve third parties explicitly, but which are also used in the context of intermediation (e.g., drawing up contracts for corporate transactions). Specialization is also supported by economies of scale (Chandler, 1990). A real estate broker who knows the neighborhood can use this knowledge to serve multiple prospective house buyers. The same knowledge acquired by a single buyer will provide benefits only to herself. This is related to, but distinct from fixed costs of getting started, just as static economies of scale are connected to cumulative economies of scale over time.

While economies of specialization and scale provide the fundamental economic reason for intermediation, economies of scope define the particular character of intermediary roles. A real estate broker uses specialized information to reduce search costs for buyers and sellers, but also to reduce the transaction costs of negotiating a price for the deal and of completing it successfully. Much of this specialized information involves coordinating the activities of other specialized intermediaries: the house inspector, the escrow agency, and perhaps the mortgage lender or mortgage broker. The real estate broker specializes to the extent that she or he knows what tasks need to be performed for a successful transaction, but does not perform all those tasks herself. However, a broker that just found a house for a buyer, but could not draw up a standard sale agreement would be of much less value to the buyer. There are economies of scope in having both these tasks, and the coordination of other transactional steps, performed by a single intermediary.

The operation of economies of specialization, scale and scope is very similar in the case of financial service intermediaries. The value created by intermediaries in all these cases reflects the cost savings versus 'doing it yourself'. Some homeowners sell their homes without using an agent. In these cases, the value that would otherwise be captured by the broker is presumably greater than the additional cost borne by the homeowner. One way of looking at the future of intermediation in various contexts is through comparing the changing relative costs of specialization versus 'do-it-yourself'. The important point to note is that, while the costs of do-it-yourself change thanks to the Internet and information technology, so do the costs of specialized intermediation.

Economies of specialization, scale and scope are chiefly 'technological' determinants of intermediation. Intermediation may also be more efficient for incentive reasons. An intermediary who participates regularly and frequently in a market, whether as an agent or a neutral broker, has different incentives than a buyer or seller who is an infrequent participant. Thus even if such buyers or sellers have the same knowledge as an intermediary, they do not have the same ability to build and to convey reputation. The incentive to maintain a reputation can make an intermediary an effective market participant, by enabling transactions to take place that would otherwise fail because of asymmetries in information that lead to lack of trust. Intermediaries may also serve another incentive role. They can be provided with

*Table 1. Eight intermediary roles*

| | |
|---|---|
| Transforming products | Being long-term players with reputations |
| Being physically closer to the final buyer | Economizing on search costs for consumers |
| Smoothing the market by carrying inventory | Matching buyers and sellers |
| Providing expert actions or information | Economizing on costs of completing and implementing the transaction |

incentive contracts that make them behave in a way that might not be possible for the buyer or the seller. Thus, commissions for sales people can be structured in a way that makes them very aggressive. Agents may also be useful as negotiating intermediaries simply because their preferences are different.

## INTERMEDIARY VALUE CREATION ROLES

The creation of value in intermediation is chiefly driven by economies of scale and specialization, but how these economies manifest themselves will vary according to the roles the intermediary performs. The various roles will often be combined as a consequence of economies of scope. Combination may increase the value created, because of economies of scope, and also play a role in the capture of value. We discuss eight intermediary functions (Table 1), and analyze the impact of e-commerce on these different value-creating roles.

All manufacturers take raw materials or intermediate products and transform them, chemically or physically, including assembling and packaging. Wholesalers, distributors and retailers may perform some of those operations as well. Logistics firms transform location, and advertising and marketing transform image. E-commerce has its greatest impact on transformation for digital products. Information products (text, audio, and video) delivered digitally, over the Internet, no longer need to be assembled or packaged in the same way as before. The transformation role is not eliminated, but is changed because of the different product form. Instead of newspaper pages being composed for physical printing, they must be composed for Web publishing. News can also easily be unbundled from individual newspapers and re-aggregated by intermediaries or by users themselves (Águila-Obra et al, 2007). Similarly, locational transformation is not achieved by a chain of physical movements, but by sending digital files over the Internet. Some kinds of intermediaries (conventional wholesalers, distributors, delivery services) are replaced by new intermediaries (ISPs, Internet portals, Web hosting services, and file-sharing services). Rather than disintermediation, there is a replacement of old by new intermediaries. Finally, information technology makes customized transformation easier, both through collecting information from potential buyers, and through enabling technologies within the firm. These opportunities are particularly large for digital products. Customization in financial management is an example of applying information technology: the Internet and Web make analytical tools more freely available, and reduce the cost of building tailored portfolios of assets.

Distributors, wholesalers and retailers traditionally fit the role of being closer to the consumer. Physical retailers have provided the most common interface for final buyers to make their selections and purchases, but long distance communications and logistics have long made mail and telephone shopping attractive alternatives, using catalogs and infomercials. E-commerce supplements and accelerates existing trends (Bakos, 1993). Web pages are virtual storefronts, where potential customers can browse and buy. The distributor and retailer might be bypassed (e.g., Dell), or replaced by a different kind of intermediary (e.g., Amazon.com).

Intermediaries smooth market fluctuations by carrying inventory. Selling out of inventory allows an intermediary to make up temporary shortfalls in production. Examples include NASDAQ dealers and NYSE specialists (where the products are financial assets with digital records of ownership), as well as wholesalers and retailers. For physical products, producers can carry inventory, but the advantage of having an intermediary perform the role comes through economies of scale and scope in managing inventory. For financial assets, there is no producer to provide an alternative, so the role of financial intermediaries is quite important. E-commerce can reduce the need for inventories and market smoothing if it makes production-to-order easier. First, it improves communication across different entities, including the buyer's ability to convey wants quickly and efficiently to the seller, and the seller's ability to convey its derived wants (triggered by the buyer's request) to its own components suppliers. Second, communication within the organization and the production process are speeded up by the internal use of information technology. For digital products, since reproduction is cheap and quick, inventory can become irrelevant: copies for each user do not have to be stored.

An intermediary may provide expertise in the form of specific actions or information provided to potential buyers. Individual sellers also serve potential buyers, but an intermediary offers neutrality across sellers, and therefore credibility, as well as expertise. Product quality ratings based on expertise are well-suited for provision over the Internet. This role is closely related to economizing on search costs. The Web is less well suited for providing complex applications of expertise, such as medical or legal advice, though simpler forms of these are now available. In general, to the extent that e-commerce involves dealing with unknown or new products and sellers, the role of being an information intermediary, in the sense of providing expert information, will increase in importance. The wider reach of electronic markets can spread the fixed costs of expertise over higher volumes, making expert intermediaries more important. Expertise may be the main source of value creation by financial intermediaries. Financial markets are complex, fast-moving, and critical for the real economy of physical goods. In principle, brokers, traders, and other financial specialists have provided the required expertise. In practice, the bundling of this role with other sources of value creation, and with gatekeeper roles that captured value more than creating it, diminished the relative importance of expertise. Now that basic information on financial assets and access to trading them are freely available on the Internet, the broker or other financial intermediary has to provide expertise unbundled from those other offerings. This has happened in retail finance. In transactions such as corporate mergers and acquisitions, IPOs, and other cases where the scale is large and risks are high, expertise remains bundled with other roles.

Reputation, such as through brand names, substitutes for direct quality information. Firms have an incentive to provide high quality in order to build and to protect their reputations. What factors make intermediaries important providers of reputation? Size and scope clearly matter: Amazon's strategy in online retailing included building a worldwide consumer brand name and reputation as quickly as possible. It expanded rapidly its scale of operations, and the scope of what it sells. Being a long-term player is also important. Reputation is valuable for future operations, and only a firm that will be in business for a long time has an incentive to maintain reputation by maintaining quality. Reputational considerations can be important in overcoming asymmetric information problems. For example, retailers that have to keep selling to new customers are more concerned about reputation loss from selling low-quality goods than individual sellers who are in the market only once. E-commerce involves more rapid information flows, and the swift aggregation of information. Buyers with bad experiences can post messages on web sites, and reputation can be affected quickly and severely. Good reputations may also be more easily and widely disseminated. The fixed costs of reputation-building can be spread over global rather than regional or national markets. Therefore, reputation is both more important and more vulnerable as a result of e-commerce. Intermediaries that specialize in building and maintaining reputation may therefore have a more significant role in e-commerce (Palmer et al, 2000).

Intermediaries economize on buyer search, because they have incentives to put information online where sellers might not. For example, intermediaries may post comparison price information online (e.g., travel web sites). Where sellers search, as in B2B transactions, intermediaries may reduce seller search costs as well. Intermediaries can also facilitate the search process and provide access to information, without actually certifying or evaluating the information, distinguishing this role from information transfer as part of expertise and reputation provision. Internet search engines play a fundamental role in economizing on search. The economy in searching the newspaper classifieds comes from creating a centralized location for information: many different sellers will list in the same place, allowing the buyer to scan columns on a page to gather information. Web sites provide a similar, but even greater economy. While search engines pull together information from diverse places, online listings provide a central location that reduces the demands on the underlying physical infrastructure. E-commerce greatly expands the role for intermediaries in economizing on search, as they can provide price and other comparisons and aggregate information for all kinds of goods and services. Intermediaries provide large quantities of information on the Internet in a manageable form for users. Earlier, financial market information was channeled through a handful of firms, which charged high prices to corporate customers, mostly in the financial sector. Now, much of this information is available through new intermediaries to anyone with Internet access.

The role of matching buyers and sellers is closely related to economizing on search costs, since the goal of search by buyers and sellers is to achieve a desirable value-creating match. It is also a role where neutrality is valued. Exchanges and other formal market institutions clearly fulfill this function. Matching can involve simply matching buyers who want certain goods with sellers who have those goods to sell, but can extend to implementing mechanisms that match particular buyers with particular sellers, depending on their willingness to pay. The NYSE and the NASDAQ, for example, use different rules for matching at this level (Domowitz, 1993). Information technology allows the matching role of intermediaries to expand and be more sophisticated – markets for physical goods (e.g., C2C auctions such as those conducted by eBay, and electronic B2B exchanges) can be more like markets for financial assets, which have long been electronic in their internal workings, though not in the interfaces between individual investors and the various financial services specialists. The Internet has changed this interface as well, allowing retail investors to view exchange-level transaction data, and place orders directly without relying on a human broker.

Intermediaries also economize on transaction costs through expertise in completing transactions, or economies of scale. Intermediaries may draw up contracts and help in negotiating terms, because they have specialized knowledge. Individual payments and payment clearing are also managed by intermediaries. Automating such transactions and replacing paper flows with flows of electronic information illustrates how information technology economizes on transaction costs. The cost of moving pieces of paper from one location to another is higher, and the integration of transaction information into business databases, now digital themselves, is also higher with paper transactions. Financial markets have moved toward eliminating paper wherever possible, making transactions wholly electronic. In some cases, new intermediaries have arisen to facilitate completion of transactions agreed over the Internet. Thus, PayPal did not replace existing financial intermediaries, but used their infrastructure while providing a new mechanism for individual transfers of money initiated online.

The eight roles above are typically combined: it is rare for a particular intermediary to provide only one function. There are two sources of efficiency from combining roles in one intermediary. The first is economies of scope in providing various kinds of informational services (price, availability, product characteristics, evaluation, buyer needs). Evaluation of products may involve economies in the use of information technology to integrate a range of information. The economies may also be achieved on the buyer's side, by reducing search costs. Dealing with a single intermediary may economize on transaction costs of all kinds. Another example of economies of scope arises where reputation is transferred across related activities: being good at providing product information and purchase opportunities in B2C markets might allow an intermediary to credibly provide the service of matching buyers and sellers in C2C auctions. The second reason for combining intermediary roles is incentive provision. An intermediary that carries out a range of functions can be provided incentives more effectively than if the different roles are split among several people or organizations.

Combining tasks may also be important for value capture, rather than value creation. Combining different roles gives the intermediary more sources of value. This does not, itself, justify combination, but if the intermediary's strategic position is thereby improved, it may be beneficial to expand the firm's scope. The essence of value capture is in the ability to limit competition. Providing a range of services may make it more difficult for a competitor to enter the market, and allow greater value capture. This can be especially important in e-commerce, where conventional entry barriers may be harder to maintain.

## FUTURE RESEARCH DIRECTIONS

Since the technologies underlying e-commerce are still evolving, there is considerable scope for evolution of intermediary roles. Empirical research on particular sectors, such as financial services, real estate and health can help to identify the nature of the evolution of intermediaries. In particular, the provision of content in digital form (e.g., news, entertainment and educational material) will continue to increase, and online intermediaries will expand their presence, with implications for industrial structure and job markets. Analyzing these structural shifts in the economy will also be an important research area. Online intermediaries are also at the heart of social networking, by providing platforms for communities to be created or operate in cyberspace. The analysis provided in this article points toward an analytical framework for understanding how social networking providers can create value for members of their networks, through matching, lowering transaction costs, economizing on search costs, and building reputations. Research on these new business models for e-commerce intermediaries will also be important in the future.

## CONCLUSION

This article has used economic analysis to examine the ways in which intermediaries create value, and how those value creation roles are evolving in e-commerce settings. The interplay of economies of scale, scope and specialization underpins various intermediary roles and their combination in different markets to create value for market participants. The technologies of the Internet and World Wide Web change the relative importance of different intermediary functions, the ways in which they are combined, and the manner in which they are carried out, but there is no case for predicting uniform disintermediation. In fact, in some markets, new intermediaries have arisen on top of older ones, extending the value chain rather than shrinking it. In other cases, digital intermediaries replace traditional ones. This article provides a framework for understanding and predicting such structural changes in markets as e-commerce options expand.

## REFERENCES


Bakos, Y. (2001). The emerging landscape for retail e-commerce. *The Journal of Economic Perspectives*, *15*(1), 69–80.

Besanko, D., Dranove, D., Shanley, M., & Schaefer, S. (2008). *Economics of strategy*. New York: Wiley.

Bhargava, H. K., & Choudhary, V. (2004). Economics of an information intermediary with aggregation benefits. *Information Systems Research*, *15*(1), 22–36. doi:10.1287/isre.1040.0014

Casadesus-Masanell, R., & Spulber, D. F. (2007). Agency Revisited. *Documentos de Trabajo,* 3. Working Paper Series published by Fundación BBVA, Spain.

Chandler, A. D., Jr. (1994). *Scale and scope: The dynamics of industrial capitalism*. Cambridge, MA: Harvard University Press.

Coase, R. (1937). The nature of the firm. *Economica*, *4*(16), 386–405. doi:10.1111/j.1468-0335.1937.tb00002.x

Domowitz, I. (1993). A taxonomy of automated trade execution systems. *Journal of International Money and Finance*, *12*, 607–631. doi:10.1016/0261-5606(93)90028-A

Downes, L., & Mui, C. (2000). *Unleashing the killer app: Digital strategies for market dominance*. Boston, MA: Harvard Business School Press.

Palmer, J. W., Bailey, J. P., & Faraj, S. (2000). The role of intermediaries in the development of trust on the WWW: The use and prominence of trusted third parties and privacy statements. *Journal of Computer-Mediated Communication*, *5*(3).

Singh, N. (2000). *Electronic Commerce: Economics and Strategy*. Book Draft. Retrieved from http://people.ucsc.edu/~boxjenk/bookchapters/Bkch8.pdf

Tapscott, D. (1996). *The Digital Economy: Promise and Peril in the Age of Networked Intelligence*. New York: McGraw Hill.

Wiley, J. A., & Zumpano, L. V. (2008). The real estate brokerage market and the decision to disclose property condition defects. *Real Estate Economics*, *36*(4), 693–716. doi:10.1111/j.1540-6229.2008.00227.x


## ADDITIONAL READING


Águila-Obra, A. R., Padilla-Meléndez, A., & Serarols-Tarrésb, C. (2007). Value creation and new intermediaries on internet. An exploratory analysis of the online news industry and the web content aggregators. *International Journal of Information Management*, *27*, 187–199. doi:10.1016/j.ijinfomgt.2006.12.003

Anderson, P., & Anderson, E. (2002). *The new e-commerce intermediaries* (MIT Sloan Management Review). Boston: MIT Sloan School of Management.

Berger, S. C., & Gleisner, F. (2009). Emergence of financial intermediaries in electronic markets: the case of online P2P lending. Business Research, *Official Open Access Journal of VHB (Verband der Hochschullehrer f¸r Betriebswirtschaft e.V.), 2*(1), 39-65.

Carbonell, M., José, M. S., & Lopez, J. (2008). Secure multiparty payment with an intermediary entity. *Computers & Security*, *28*, 289–300. doi:10.1016/j.cose.2008.12.002

Chircu, A. M., & Kauffman, R. J. (2000). Reintermediation strategies in business-to-business electronic commerce. *International Journal of Electronic Commerce*, *4*, 7–42.

Clerides, S., Nearchou, P., & Pashardes, P. (2008). Intermediaries as quality assessors: tour operators in the travel industry. *International Journal of Industrial Organization*, *26*, 372–392. doi:10.1016/j.ijindorg.2007.02.001

Cotter, T. (2005). *Some observations on the law and economics of intermediaries.* Legal Studies Research Paper Series, Accepted Paper 2005-14. Lexington, VA: Washington and Lee University School of Law.

Evans, D. S. (2009). (forthcoming). The online advertising industry: economics, evolution, and privacy. *The Journal of Economic Perspectives*.

Fishman, A. (2007). Financial intermediaries as facilitators of information exchange between lenders and reputation formation by borrowers. *International Review of Economics & Finance*, *18*, 301–305. doi:10.1016/j.iref.2008.02.005

Galeotti, A., & Moraga-González, J. L. (2009). Platform intermediation in a market for differentiated products. *European Economic Review*, *53*, 417–428. doi:10.1016/j.euroecorev.2008.08.003

Gritzalis, D., Moulinos, K., & Kostis, K. (2001). A privacy-enhancing e-business model based on infomediaries. In V.I. Gorodetski et al. (Eds.), *MMM-ACNS, LNCS* 2052 (pp.72– 83).

Grover, V., & Teng, J. T. C. (2001, April). E-Commerce and the information market. *Communications of the ACM*, *44*(4). doi:10.1145/367211.367272

Houghton, K. A., & Winklhofer, H. (2004). The effect of website and e-commerce adoption on the relationship between SMEs and their export intermediaries. *International Small Business Journal*, *22*(369), 1–21.

Kennes, J., & Schiff, A. (2007). Simple reputation systems. *The Scandinavian Journal of Economics*, *109*(1), 71–91. doi:10.1111/j.1467-9442.2007.00481.x

Lambert, S. (2006). *Do we need a real taxonomy of e-Business Models?* Flinders University-School of Commerce Research Paper Series, 06–6, Australia.

Marchal, E., Mellet, K., & Rieucau, G. (2007). Job board toolkits: Internet matchmaking and changes in job advertisements. *Human Relations*, *60*(1091), 1–24.

Masters, A. (2007). Middlemen in search equilibrium. *International Economic Review*, *48*(1). doi:10.1111/j.1468-2354.2007.00428.x

Methlie, L. B., & Pedersen, P. E. (2002, June). *A taxonomy of intermediary integration strategies in online markets.* Paper presented at the 15 Bled Electronic Commerce Conference, eReality: Constructing the eEconomy, Bled, Slovenia.

Pavlou, P. A., & Gefen, D. (2004). Building effective online marketplaces with institution-based trust. *Information Systems Research*, *15*(1), 37–59. doi:10.1287/isre.1040.0015

Prieger, J. E., & Heil, D. (2009, May). The microeconomic impacts of e-business on the economy. In I. Lee (Ed.), *Encyclopedia of E-Business Development and Management in the Digital Economy*. Hershey, PA: IGI.

Qureshi, S., & Davis, A. (2007). Overcoming the digital divide through electronic commerce: harnessing opportunities in IT for development. In *Proceedings of the 40th Hawaii International Conference on System Sciences* (pp.1-11).

Reiley, D. L., & Spulber, D. F. (2001). Business-to-Business electronic commerce. *The Journal of Economic Perspectives*, *15*(1), 55–68.

Spulber, D. (2003). The intermediation theory of the firm: integrating economic and management approaches to strategy. *Management and Decision Economics*, *24*, 253–266. doi:10.1002/mde.1120

Tang, Q. C., & Cheng, H. K. (2006). Optimal strategies for a monopoly intermediary in the supply chain of complementary web services. *Journal of Management Inquiry*, *23*(3), 275–307.

Vesala, T. (2008). Middlemen and the adverse selection problem. *Bulletin of Economic Research, 60*(1), 0307-3378.

Wang, S., & Archer, N. P. (2007). Electronic marketplace definition and classification: literature review and clarifications. *Enterprise Information Systems*, *1*(1), 89–112. doi:10.1080/17517570601088380

Wenninger, J. (2000). *The emerging role of banks in e-commerce.* Federal Reserve Bank of New York. *Current Issues in Economics and Finance, 6*(3).

## KEY TERMS AND DEFINITIONS

**Agent:** anyone who is assigned a task on behalf of another

**B2B:** Business-to-business; used to refer to inter-firm transactions

**B2C:** Business-to-consumer; used to refer to sales to individuals in households

**C2C:** Consumer-to-consumer; used to refer to transactions between individuals

**Disintermediation:** Elimination of intermediaries or middlemen by internalizing their functions on either side of the transaction or value chain

**Economies of Scale:** A situation in which average or unit costs of production for a good or service are lower for higher volumes or levels of production

**Economies of Scope:** A situation in which average costs of production of for different goods or services are lower when the goods or services are produced together rather than separately

**Intermediary:** Any individual or organization that provides a value creating function somewhere along the value chain, excluding initial production of raw materials and final consumption

**Value Chain:** The sequence of activities that directly transform raw materials into final goods and services for consumption, as well as activities that indirectly support these transformations

**Value Creation:** The process of increasing the consumption or use value of tangible and intangible goods, through physical, chemical, locational and other transformations

# Chapter 20
# Identifying the Factors that Lead to a Successful Intermediary in Electronic Commerce

**Margaret Jackson**
*RMIT University, Australia*

**Marita Shelly**
*RMIT University, Australia*

## ABSTRACT

*The Internet has changed the way we interact with others in both our business and personal spheres. Electronic commerce has developed beyond buying and selling of goods electronically. It is now leading to new online intermediaries such as aggregators of information, peer-to-peer and social networking sites which allow sharing between individuals without the need for commercial service providers, and new on-line payment mechanisms such as BPAY in Australia, which provide additional services to those from existing credit providers. Using a case study approach, this chapter explores the factors that have led to the success of financial intermediaries and in particular, BPAY Ltd.*

## INTRODUCTION

The Internet has changed the way we interact with others in both our business and personal spheres. Electronic commerce and mobile commerce are becoming mainstream as a result of the increased use of the Internet and wireless by individuals, business and government. Electronic commerce has developed beyond buying and selling of goods electronically. It is now leading to new online intermediaries and new on-line payment mechanisms which provide additional services to those provided by existing credit providers. These new intermediaries are adding value through providing choice to users and through increased use and acceptance of technology as a way to conduct business and to communicate.

This chapter explores the factors that have led to the success of a new financial intermediary in electronic commerce. We sought to understand where the impetus for new intermediary roles came from, whether it arose from existing roles in the process being converted, or whether it was driven by external factors such as governments seeking increased efficiencies. We were also interested in understanding whether it is possible to identify

DOI: 10.4018/978-1-61520-611-7.ch020

key factors for the success or survival of a new electronic intermediary role and whether the most successful roles are those in which an existing paper-based process is replaced by an electronic process or when an entirely new process is developed due to the availability of new technology. In particular, the case study explored the rise of one new Australian intermediary and whether the factors which led to its success could result in a model applicable to other new intermediaries in electronic commerce.

## RESEARCH METHODS

This research was undertaken in two stages. First, previous studies on electronic intermediaries were identified and were used to derive a model that could be used to determine the factors that lead to the success or failure of an electronic payment intermediary. Second, a case study of a new Australian intermediary, BPAY Ltd, was undertaken and mapped against the model. The case study approach was chosen for this project as it allowed the project team to 'investigate a contemporary phenomenon within its real-life context' (Yin, 1994, p. 13). The researchers were able to explore both 'how' and 'why' this intermediary succeeded, while other similar intermediaries might fail.

Data for the case study was collected through a search of publicly available material, from documents provided by BPAY and from interviews. Seven participants were interviewed. They had knowledge of BPAY's operations and activities from the beginning of 1997 onwards. The participants included the current and former General Managers, and five former and current members of the BPAY Board or Management Committee. The transcribed interview data and literature review were analysed and themes were identified, and are discussed below.

## BACKGROUND

Given the relatively recent development of electronic commerce and banking, there have been only a few studies on the success or otherwise of electronic banking intermediaries. A study by Kniberg in 2002 found that a payment system[1] will generally have eleven characteristics; security, ease of use, cost, credibility, range of payment amounts, speed, ease of joining, pervasiveness, credit, economic model and personal integrity which will determine the success or failure of the system.

The success or failure of a payment system will be influenced by the value or benefit of each of the characteristics to the consumer and or the merchant or biller (Kniberg, 2002). Kniberg concluded that a successful payment solution is more likely to have developed from building on an existing billing relationship between a company and its customers (Kniberg, 2002).

Kniberg also found that many payment solutions failed due to the fact that they focused too much on security. Trust is arguably more important to users and merchants than security. Users and merchants are more likely to use an 'insecure' (as judged by Kniberg) payment system from a trusted company, such as Visa, than a secure payment system from an untrusted or unknown company (Kniberg, 2002). Other than trust, a payment solution may succeed or fail on the basis of pervasiveness, ease of joining, ease of use, transaction costs and transaction speed (Kniberg, 2002).

Chau and Poon's (2003) case study on the Octopus smart card[2] found that despite lower security measures than the Visa Debit and the Mastercard Mondex cards, this electronic payment system was a success with 95 per cent of Hong Kong's population aged between 16 and 65 years using the system and 10.5 million transactions occurring via Octopus each day (Octopus Cards, n.d.). They found that the success of the system was due to four factors: an established market base with high transaction volume; an efficient system; a direct conversion approach and trust between stakeholders (Chau & Poon, 2003). The operators of public transport in Hong Kong recognised that a smart card system would decrease processing costs per transaction and in due course, this investment into infrastructure would result in a profit (Chau & Poon, 2003). They chose a contact-less smart card as they considered it improved processing efficiency and convenience and reduced the risk of losing the card as the readers can activate the card data without the holder removing the card from a purse or wallet. However, Chau and Poon (2003) argue that for the Octopus system to move into the next phrase of business development, in addition to enhancing its auto-recharge capabilities, the system should transform into a full payment intermediary working as a clearing house system for financial transactions such as bill payments.

In 2005, researchers from the Department of Information Systems at the University of Melbourne conducted a case study of a failed Australian Electronic Payment System (EPS) to which they gave the pseudonym, Oz Pay (Lim, Lee & Kurnia, 2006). The EPS arose from a collaborative initiative between government, universities and research organisations. It was a browser based system and required customers to open an account with the EPS and to transfer money to that account from their bank. Both individuals and merchants could use it. Its objective was to collect online payments, replacing credit cards. It also offered customers a way to purchase goods and, in its final year, a way to purchase prepaid mobile phone credit from their phones.

The researchers identified eight reasons for the failure of the EPS. They were:

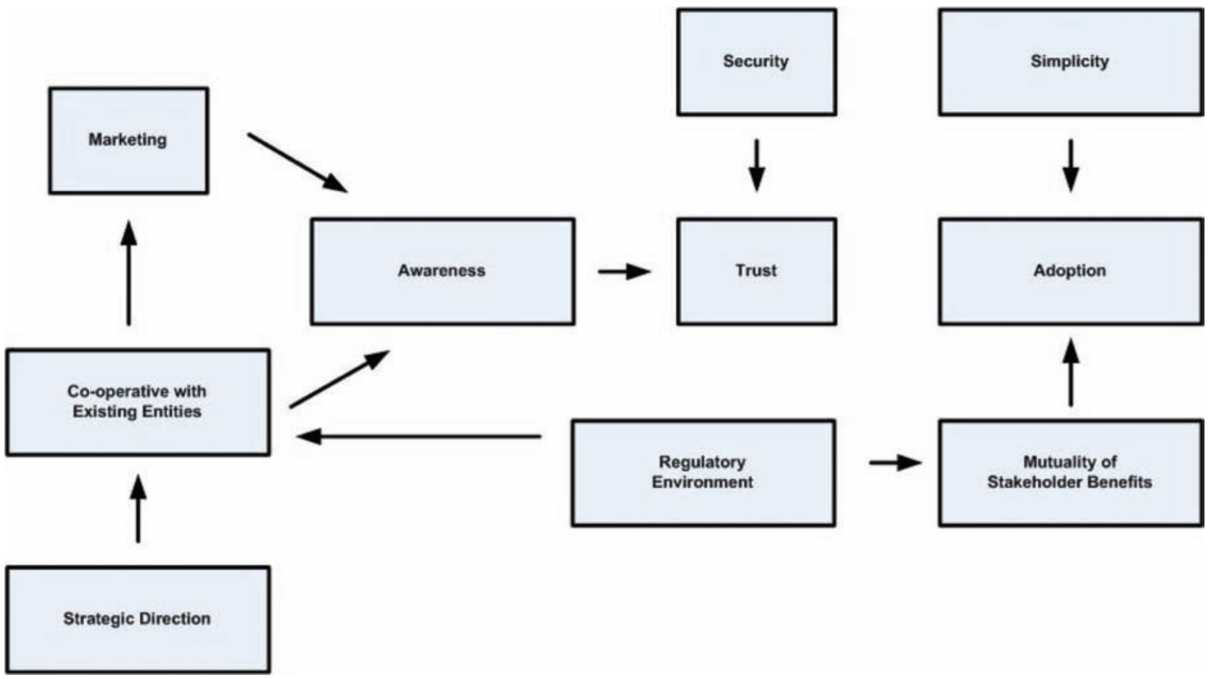
1. It failed to form a partnership with an existing organisation in the electronic environment, such as a bank or portal (p. 6).
2. It was perceived by users as not having a very secure system or possessing a system with the same vulnerabilities as other EPSs (pp. 6-7).
3. It failed to install trust in users, as it was a company that was not generally known to customers and had no alliances with trusted organisations.
4. Its system was very complicated for both merchants and users to use (p. 7).
5. The sender/payer received no particular benefits and had to open an additional deposit account so any savings made by payers were offset by complexity (p. 8).
6. Oz Pay did not sufficiently market or promote their system (pp. 8-7).
7. Stakeholders within Oz Pay were not united in the strategic direction to be taken for Oz Pay (p. 9). Board infighting exacerbated the problem.
8. Oz Pay focused on the technology rather than customer need (p. 9).

For this case study, we have adopted the following model based on the studies discussed above. This model is then used to analyse why BPAY Ltd has succeeded as an electronic intermediary.

## WHAT IS BPAY?

BPAY was created in 1997 as a joint venture by the four main banks, (Australian New Zealand Banking Group (ANZ), Commonwealth Bank of Australia (CBA) National Australia Bank (NAB) and Westpac Banking Corporation (WBC)) Bank West and St George's Bank, to enable Australians to pay their bills via telephone or Internet banking services, through their home banks or other financial institutions that participate in the BPAY system. Very simply, BPAY is an electronic bill payment system. The system offers consumers an alternative way to paying bills in person or via mail in a more convenient and efficient way. Although owned by the major banks, it has a unique non – one bank alignment, with over 17,000 merchants

*Figure 1. Factors affecting the adoption of electronic payment systems*




signed to the BPAY system as at December 2009. BPAY enables both a credit and debit card payment system, and has a strong captive business since each bank is a major biller.

BPAY operates in a similar way to the credit card schemes of Visa and Master Card. The scheme is a joint venture, with the members (authorised deposit-taking institutions) involved contractually bound to each other through the BPAY rules and operating procedures (BROP). BPAY performs a processing function between two financial institutions, the biller's bank and the customer's bank (Standing Committee on Economics Finance and Public Administration, 2005). BPAY allows customers who are registered for Internet or telephone banking with their financial institution, to pay a bill, if the biller is signed up as a BPAY biller, by electronic transfer from their bank account to the biller's bank account via Internet or telephone banking.

## DRIVERS BEHIND THE DEVELOPMENT OF BPAY

In May 1996, the Commonwealth Treasury established a Financial System Inquiry (the Inquiry) to assess the impact of the deregulation of the Australian financial system which occurred after the Campbell Committee review of the system in 1981 (Commonwealth of Australia, 1996, p. iii).

On the basis of existing trends both in Australia and internationally, the Inquiry found that 'retail payments and financial service distribution channels would be one area significantly affected by technological changes' (Commonwealth of Australia, 1997, p. 95).

The Inquiry found that the Internet had the potential to transform both operations within financial institutions and communications between customers, and, as it became more widely accessible and security was improved through the use of encryption and authentication, it was more likely that households would use the Internet for banking and other financial services (Commonwealth of Australia, 1997, pp. 96-103). In addition to the Internet, the Inquiry predicted that a range of access devices and electronic channels would enable consumers to undertake their banking and other financial services in a variety of locations and allow for the convenience of a 24 hour service (Commonwealth of Australia, 1997, pp. 97-100).

In relation to payment mechanisms, 'the Inquiry strongly advocated the substitution of electronic forms of payment for paper-based transactions as a means of achieving substantial gains in efficiency' (Reserve Bank of Australia & ACCC, 2000, p. 3).

## The First Stage of Development (1997)

The concept of the BPAY model was well developed by early 1997. The banks had realised that no single bank was going to be able to provide a bill payment system that would add value to all customers and all billers. Although the Commonwealth Bank of Australia (CBA) already had a highly successful bill payment service, the biggest consumer base of all the major banks and also the biggest biller list of their own, it could see the benefits of having an electronic network providing access to all of the billers and bill payers in Australia.

The model involved a centralised switch that would be jointly owned and accessible to all participants and which would control the transactions going from a payer institution to a biller institution. What was very clearly agreed upfront was that the billers and the consumers would be a competitive market and that all in the scheme would compete for billers and customers.

There were nine financial institutions on launching at the end of 1997, rapidly growing to 136 by June 2001 and 37 billers on launching. The transaction volume was 0.91 million, and the transaction value was $0.16 million.

## The Next Few Years

Within two years of the launch, there were 1028 billers, growing rapidly to 4,713 by June 2001 and to 10,972 by June 2003. BPAY received a significant boost to its rapidly growing business when the Australian Tax Office joined BPAY as a provider. The impact of the Australian Tax Office presence opened up BPAY, not just to consumers but to small businesses.

There were a number of challenges that needed to be dealt with in the first few years of operation. First, a major challenge was getting the business rules right, trying to cover all the options that could happen from the perspective of the financial institution, the biller and the consumer.

Second, there were ethical/social responsibility issues at the beginning. Although the biller institutions were responsible for who they signed up as billers, the Board became very involved in who was being signed up by the banks. One early concern, for example, was whether or not to accept gaming billers. As they were legitimate businesses conducting legal activities, they were accepted.

Third, there were issues about whether the banks brought their credit cards schemes on as billers. Eventually, one bank did and the rest followed.

Fourth, there were invisible system problems caused by the rapidly expanding required processing capacity of the scheme that led to two instances where payments were delayed by a day, because the capacity of the system had been exceeded. These problems, once known, were relatively easy to address.

Finally, there were new competitors entering the bill payment market.

## Where is BPAY Now?

The rise of Internet use has had an enormous impact on BPAY's growth. BPAY started as a telephone banking system in 1997 at a time when only one of the banks, St George Bank, had established a good Internet site. Consumers became comfortable with telephone banking and then BPAY became a driver for Internet banking as the technology became available.

In 1997 and 1998, when BPAY was starting, the Internet was only just becoming popular with consumers. In 1998, 16 per cent of Australian households had the Internet at home. In 2002, 25 per cent had home access, and by June 2008, 67 per cent of households had Internet access (ABS, 2008). Figures from Nielson/NetRatings show that by 2005, there were 6.6 million consumers using the Internet for bill payments or for purchasing and or selling goods and approximately 5.8 million users banking online (DCITA, 2005, p. 13).

By June 2001, 56 per cent of BPAY bill payments were paid by phone and 44 per cent over the Internet. This had changed by June 2007 to 76 per cent paid over the Internet and 24 per cent by phone.

The most significant competitors to BPAY at present are over the counter payments at Australia Post, direct debit payments and credit card payments direct to billers over the phone or Internet. Reserve Bank figures show that for the period between May 2006 and May 2007, debit card (including EFTPOS and scheme debit) numbers increased by over one million to 26.8 million and credit and charge card numbers increased by just under 580,000 to 13.4 million (RBA Statistics, 2007a, 2007b).

In 2005, bill paying by direct debit was used for 2 per cent of bill paying and BPAY was used for 28 per cent. In 2006, direct debit was used for 24 per cent of bill paying; BPAY for 31 per cent.

Probably the only other significant competitor is PayPal, which had 3 million Australian customers in 2007.

## FUTURE RESEARCH DIRECTIONS

Applying the amended model of success factors discussed in the section on Previous Studies on Electronic Intermediaries, we see that BPAY is a perfect fit for the model:

1. Co-operation with existing entities: BPAY was the result of joint venture by six strong banks.
2. Marketing: BPAY developed a strong brand and marketed it well, resulting in good awareness by customers.
3. Strategic direction: The commitment of the banks to the development of the BPAY model was strong and consistent as required at the start of the venture.
4. Security and trust: The branding of BPAY and the fact that it worked well for consumers resulted in strong trust for BPAY.
5. Simplicity: Customers found it easy to use and very convenient. It was logically aligned with what people do.
6. Mutuality of stakeholder benefits: All parties in bill payment – billers, banks and customers - benefited from BPAY.
7. Regulatory environment: BPAY, while a part of the Australian payments system, has been able to self-regulate its own affairs in terms of fees and its own operating rules, scheme fees and charges, and interbank fee arrangements. This self-regulation appears to have enabled it to remain relevant and competitive in the bill payment market.

For any new service to work, there must be awareness of it, trust in using it and acceptance by all parties of the value of it to their business. It is hoped that the model in figure one can be used to assess the success of other new intermediaries.

## CONCLUSION

In only ten years, BPAY has become a household name in Australia. It is a service used automatically by customers. Even those who might hold reservations about using the Internet in other ways feel secure in paying bills over the Internet through BPAY. With the combination of growth in Internet use and a supportive economic environment, BPAY was established at the right time and with the right partners.

To succeed, a new electronic intermediary needs more than good technology. It must meet the needs of all participants in the supply chain, be convenient, secure and trusted.

## REFERENCES

Australian Bureau of Statistics. (2008). *Household use of information technology Australia 2007-08*. Retrieved February 16, 2009, from http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/8146.0Main+Features12007-08?OpenDocument

Chau, P., & Poon, S. (2003). Octopus: An e-cash payment system success story. *Communications of the ACM*, *46*, 129–133. doi:10.1145/903893.903927

Commonwealth of Australia. (1996). *Financial system inquiry discussion paper, November*. Retrieved June 20, 2007, from http://fsi.treasury.gov.au/content/DiscussionPaper.asp

Commonwealth of Australia. (1997). *Financial system inquiry final report: Wallis report*. Retrieved June 13, 2007, from http://fsi.treasury.gov.au/content/FinalReport.asp

Department of Communications Information Technology and the Arts (DCITA). (2005). *Trust and growth in the online environment*. Retrieved September 18, 2007, from http://www.dcita.gov.au/__data/assets/pdf_file/34142/Trust_and_Growth_Report.pdf

Kniberg, H. (2002). *What makes a micro payment solution succeed*. Unpublished masters thesis, Institution for Applied Information Technology, Stockholm, Sweden. Octopus Cards Limited. (n.d.). *Statistics*. Retrieved April 21, 2008, from http://www.octopuscards.com/corporate/why/statistics/en/index.jsp

Lim, B., Lee, H., & Kurnia, S. (2006, December) *Why did an electronic payment system fail? A case study from the system provider's perspective*. Paper presented at the 2006 Collaborative Electronic Commerce Technology and Research Conference, Adelaide, Australia.

Reserve Bank of Australia. (2007a). *Credit and charge card statistics - C1*. Retrieved July 24, 2007, from http://www.rba.gov.au/Statistics/AlphaListing/alpha_listing_c.html

Reserve Bank of Australia. (2007b). *Debit card statistics*. Retrieved July 24, 2007, from http://www.rba.gov.au/Statistics/AlphaListing/alpha_listing_d.html

Reserve Bank of Australia & Australian Competition and Consumer Commission. (2000). *Debit and credit card schemes in Australia: A study of interchange fees and access.* Retrieved July 3, 2007, from http://www.accc.gov.au/content/item.phtml?itemId=306324&nodeId=6a68084d29bfcfaeb1517122aa02e184&fn=Debit%20and%20Credit%20Card%20Schemes%20in%20Australia.pdf

Standing Committee on Economics, Finance and Public Administration. (2006). *Review of the reserve bank and payments system board annual report 2005*. Retrieved July 24, 2007 from http://www.aph.gov.au/house/committee/efpa/rba2005/report.htm

Yin, R. (1994). *Case study research: Design and methods*. Thousand Oaks, CA: Sage Publications.

## ADDITIONAL READING

Abrazhevich, D. (2001). Electronic payment systems: Issues of user acceptance. In B. Stanford-Smith & E. Chiozza (Eds.), *E-work and e-commerce* (pp. 354-360). Amsterdam, NL: IOS Press.

Abrazhevich, D., & Markopoulos, P. (2002). Diary study on internet payment systems. In H. Sharp, P. Chalk, J. LePeuple, J. Rosbottom (Eds.), *Human Computer Interaction 2002, Proceedings,* London, UK, September 2-6, 2002 (pp. 42-46). London, UK: British Computer Society.

Allen, H. (2003). Innovations in retail payments: e-payments. *Bank of England Quarterly Bulletin*, *43*(4), 428–438.

Baddeley, M. (2004). Using e-cash in the new economy: An electronic analysis of micropayment systems. *Journal of Electronic Commerce Research*, *5*(4), 239–253.

Bailey, J. P., & Bakos, Y. (1997). An exploratory study of the emerging roles of electronic intermediaries. *International Journal of Electronic Commerce*, *1*(3), 7–20.

Bajkowski, J. (2007, July 21-22). The man who stole the mail. *The Weekend Australian Financial Review*.

Carr, D. (1999, July). Internet bill presentment and payment. *Briefing Paper for the Australian Market.*

Clarke, A. (2007). *How to do online bill payment right*. Cambridge, MA: Forrester Research Inc.

TNS Consulting. (2006, November). *Usage and attitudes in the bill payment market.* Washington, DC: TNS Consulting.

He, F., & Mykytyn, P. P. (2007). Decision factors for the adoption of an online payment system by customers. *International Journal of E-Business Research*, *3*(4), 1–32.

*Internet Research: Electronic Networking Applications and Policy, 8*(3), 202-218

Janssen, M., & Sol, H. G. (2000). Evaluating the role of intermediaries in the electronic value chain. *Internet Research*, *10*(5), 406–417. doi:10.1108/10662240010349417

Liao, Z., & Wong, W. K. (2004). *The sustainability of a smartcard for micro e-payments*. Paper presented at the Australian Conference of Information Systems, Tasmania, Australia.

Mallat, N., & Tuunainen, V. K. (2008). Exploring merchant adoption of mobile payment systems: An empirical study. *E-Service Journal*, *6*(2), 24–57. doi:10.2979/ESJ.2008.6.2.24

Mann, R. J. (2004). Regulating internet payment intermediaries. *Texas Law Review*, *82*(3), 681–716.

Miller, S. (1999, December). Smarter billing. *CPO*.

Patil, V., & Shyamasundar, R. K. (2005). E-coupons: An efficient secure and delegable micro-payment system. *Information Systems Frontiers*, *7*(4/5), 371–389. doi:10.1007/s10796-005-4809-1

Peffers, K., & Ma, W. (2003). An agenda for research about the value of payment systems for transactions in electronic commerce. *Journal of Information Technology Theory & Application*, *4*(4), 1–16.

Peha, J. M., & Khamitov, I. M. (2004). PayCash: a secure and efficient internet payment system. *Electronic Commerce Research and Applications*, *3*(4), 381–388. doi:10.1016/j.elerap.2004.06.001

Raja, J., & Senthil velmurgan, M. (2008). E-payments: Problems and prospects. *Journal of Internet Banking and Commerce*, *13*(1), 1–17.

Reserve Bank of Australia. (2006).*Payment systems development and architecture: Some background.* Retrieved February 24, 2009, from http://www.rba.gov.au/Speeches/2006/sp_ag_270906_paper.pdf

Shon, T.H., & Swatman, P.M.C. (1998). Identifying effectiveness criteria for internet payment systems.

Simpson, B. (2004). What's next for electronic payments? *Collections & Credit Risk*, *9*(3), 22–26.

Singh, S. (2006). The social dimensions of the security of internet banking. *Journal of Theoretical and Applied Electronic Commerce Research*, *1*(2), 72–78.

Singh, S., Jackson, M., Beekhuyzen, J., & Cabraal, A. (2006). *The bank and I*. Paper presented at the CHI Workshop on Privacy-Enhanced Personalization, Montreal, Canada.

Wright, D. (2002). Comparative evaluation of electronic payment systems. *Infor*, *40*(1), 71–85.

## KEY TERMS AND DEFINITIONS

**Australia:** The geographical location of the research

**BPAY Ltd:** An example of a financial intermediary that facilitates bill payments between customers and suppliers.

**Case Study:** A research method that can be used when to investigate the how and why of 'a contemporary phenomenon within its real-life context' (Yin, 1994, p.13).

**Electronic Bill Payment:** Refers to a payment via the Internet for goods or services using credit, debit or electronic transfer of funds.

**Electronic Commerce:** Refers to the buying and selling of products and services via electronic systems such as the Internet.

**Financial Intermediaries:** Refers to a third party which is typically a financial institution that facilitates a financial transaction between two other parties such as a supplier of services or products and a customer.

**Payment System:** Refers to a system that is used to settle financial transactions or to transfer funds between financial institutions.

## ENDNOTES

1 I-mode, PayPal, premium SMS and credit card payment systems are all considered successful payment solutions while beenz, 'cash' and Millicent are three examples of unsuccessful payment solutions (Kniberg, 2002).

2 Introduced in September 1997 to be used within Hong Kong's public transport system it is now widely used for purchases in convenience stores, fast food stores, supermarkets, vending machines and parking.

# Chapter 21
# A Framework for Identifying B2B E-Marketplace Strategies

**George Mangalaraj**
*Western Illinois University, USA*

**Chandra S. Amaravadi**
*Western Illinois University, USA*

## ABSTRACT

*Different types of Electronic Marketplace (EM) strategies have been articulated in the literature. EM strategies vary from public exchanges to private extranets. This chapter reviews existing literature and provides a parsimonious framework for classifying EMs. The proposed framework utilizes two dimensions: relationship and product's level of value addition. Based on the framework, the research theoretically derives five dominant EM strategies. The authors also highlight the applicability of their framework by providing illustrative examples of current industry practices in the realm of B2B EM.*

## INTRODUCTION

Business-to-Business(B2B) ecommerce has been in existence ever since GM introduced Electronic Data Interchange in the 1980's as a technology to do business with its suppliers (Premkumar, 2003). The utilization of the Internet for business paved the way for web-based B2B. The arena in which B2B commerce takes place is called an Electronic Marketplace (EM). B2B is a more significant component of e-commerce than B2C and correspondingly of more interest. While there are different perspectives of interest in this area, such as technological innovations, information visibility etc., this research focuses on EM strategies or approaches by B2B companies towards E-commerce business. We define this as selection of parameters of an EM such as participants, market-mechanisms, fee-structure etc. For most practical purposes, it boils down to the selection of a market mechanism. The failure of many B2B companies following the dot.com bust underscores the need for such study. There must be a framework for practitioners to identify successful B2B strategies and to position their organizations effectively within the full range of strategies (Chatterjee & Ravichandran, 2004). The topic is thus of importance to IS researchers. While literature in the area is still relatively sparse, a number of research-

DOI: 10.4018/978-1-61520-611-7.ch021

ers have introduced classifications of strategies, the earliest of which is one by Malone, Yates, & Benjamin (1987) who developed theirs based on research of others. According to them, there are two forces controlling the flow of products and services in an economy: *markets* which regulate flow of goods through supply and demand and *hierarchies* or managerial structures that regulate steps of the value chain (essentially a captive supplier). Their hypothesis is that products supplied by markets are cheaper (because they are efficient), but have higher co-ordination costs (due to large number of sellers) while the case is reversed for hierarchies i.e. high production costs and low co-ordination costs and because of this they successfully predicted the proliferation of electronic markets. In their words, "Some firms will be able to benefit directly from this shift by becoming "market makers" for the new electronic markets." Over the years, additional frameworks have been proposed. This research reviews existing classifications of B2B/Electronic marketplaces and synthesizes a typology that can be used for selecting a suitable B2B strategy. The result is a strategic grid that organizations can utilize to select a particular strategy based on their unique requirement.

## BACKGROUND

A number of B2B classifications have been introduced in the literature, but there is little consensus among researchers (please refer to Table 1), allowing room for additional classifications. Pavlou & El Sawy (2002) classify marketplaces based on number of buyers and sellers. They place within their classification, exchanges (many to many), monopolies (few to many), dyads (few to few) and monopsonies (many to few). A similar approach is followed by Barnes-Vieyra & Claycomb (2001) who classify marketplaces by number of participants. In their classification they considered one seller to many buyers, many sellers to one buyer, and many sellers to many buyers. Additionally, they also consider the presence of intermediary such as aggregator or broker in situations where there are many buyers. Wise & Morrison (2000) do no classify marketplaces, but provide the following categorization of EM strategies: "Mega-exchange," "Specialist Originator," "E-speculator", "Sell-side asset exchange," and "Solution provider." This appears in various forms in the literature as "market mechanisms." Kaplan & Sawhney (2000) classify E-market places based on what businesses buy and how they buy. These are now classified as "product" and "buyer behavior" dimensions respectively (see table 1). Clarke & Flaherty (2003) utilize a three dimensional scheme to classify portals: horizontal-vertical ("industry focus"), public-private ("ownership") and informational-transactional ("functionality"). They recommend portal development strategies and link design steps with e-commerce objectives.

Chatterjee & Ravichandran (2004) classify inter-organizational systems (IOS) based on control ("ownership"), technology specificity, integration with internal systems and relational support i.e. arm's length vs. partnerships. They hypothesize that product characteristics and relationship characteristics determine the nature of an IOS. Richard & Devinney (2005) provide a typology synthesized from the literature that consists of the following dimensions: users, ownership, owner transaction participation, focus, functionality and other features. The emphasis of their study was on IT strategies followed by B2B firms. Petersen, Ogden, & Carter (2007) provide the following typology of B2B strategies ("market mechanisms"): project specification managers, supply consolidators, liquidity creators, aggregators and transaction facilitators. They point out, in a prescriptive fashion, the potential impact of these strategies on the value chain. Walters (2008) identifies three strategies followed by intermediaries in supply chains – information rich, relational and joint learning and illustrates these with a case study of

*Table 1. EM classification dimensions*

| Dimension | Definition | Research Articles |
|---|---|---|
| Ownership | EMs could be privately owned by the seller or the buyer, publicly owned by a third-party, and industry-association owned such as consortia (Clarke & Flaherty, 2003). | Wang & Archer (2007); Clarke & Flaherty (2003); Richard & Devinney (2005); Saprikis, Vlachopoulou, & Manthou (2009) |
| Industry focus | Based on industry specializations, EMs are classified into vertical and horizontal EMs. Vertical EMs focus on a particular industry whereas horizontal EMs focus on a broad range of industries (Richard & Devinney, 2005). | Wang & Archer (2007); Clarke & Flaherty (2003); Richard & Devinney (2005); Saprikis, Vlachopoulou, & Manthou (2009) |
| Number of participants | Refers to number of buyers and sellers. There could be M buyers and N sellers where M could be many, one (monopsony) or two (dyad) and N could also be many, one (monopoly) or two (dyad) (Pavlou & El Sawy, 2002). | Barnes-Vieyra & Claycomb (2001); Richard & Devinney (2005); Wang & Archer (2007); Pavlou & El Sawy (2002) |
| B2B strategies/ Market mechanisms | EMs could function as an exchange where buyers and sellers meet to transact business. An EM can also act as an aggregator who derives market power by combining demand within and across buying enterprises (Petersen, et al., 2007). | Wang & Archer (2007); Wise & Morrison (2000); Petersen, Ogden, & Carter (2007); Kaplan & Sawhney (2000); Saprikis, Vlachopoulou, & Manthou (2009) |
| Product | Products and services exchanged could be operational (also known as MRO or raw materials), manufacturing goods (assemblies) or services (Grieger, 2003; Kaplan & Sawhney, 2000). | Wang & Archer (2007); Chatterjee & Ravichandran (2004); Kaplan & Sawhney (2000) |
| Relationship | There could be little relationship between buyers and sellers (arms length relationships) or there could be tightly knit strategic alliances such as long term supplier-buyer relationship (Segev & Gebauer, 2001). | Wang & Archer (2007); Chatterjee & Ravichandran (2004); Pavlou & El Sawy (2002) |
| Participant behavior | One-off (spot) or repeat purchase (systematic) (Stockdale & Standing, 2002). | Wang & Archer (2007); Kaplan & Sawhney (2000); Stockdale & Standing (2002) |
| Power asymmetries (neutral/bias) | EM is biased towards one set of participants more than the others (Wang & Archer, 2007). | Wang & Archer (2007); Chatterjee & Ravichandran (2004); Pavlou & El Sawy (2002) |
| Functionality | EMs may be purely transactional where in it carries out sales transactions or helps in sharing information between buyers and sellers (Clarke & Flaherty, 2003). | Richard & Devinney (2005); Clarke & Flaherty (2003); Walters (2008) |

a Hong Kong web-based supplier. Finally Wang & Archer (2007) present a detailed literature review of EMs and identify commonly used dimensions: number of participants, relationship dimension, participant behavior, ownership, industry scope, market mechanism, products, power asymmetries and fee structure. Our review builds on their work with the addition of "EM functionality" dimension which merits separate consideration because it provides additional clarification on the nature of the buyer-seller relationship.

From the literature review, it is evident that early classifications tended to be sparse while the later ones tended to be more comprehensive, obviously benefiting from hindsight. It is also evident that classification itself was rarely the objective of the research works, rather issues such as strategies, value potential or IT systems were the focus. Moreover, bursting of the E-commerce bubble warrants examination of EM strategies that have withstood the test of time.

Following table 2 presents the EM related research reviewed in this study along with the dimensions examined in them. Except for Wang & Archer (2007), most of the studies have considered very few dimensions in their research.

## Proposed Framework for EM Strategies

As discussed, a number of B2B classifications have been introduced but these have been criti-

*Table 2. EM related research and considered dimensions*

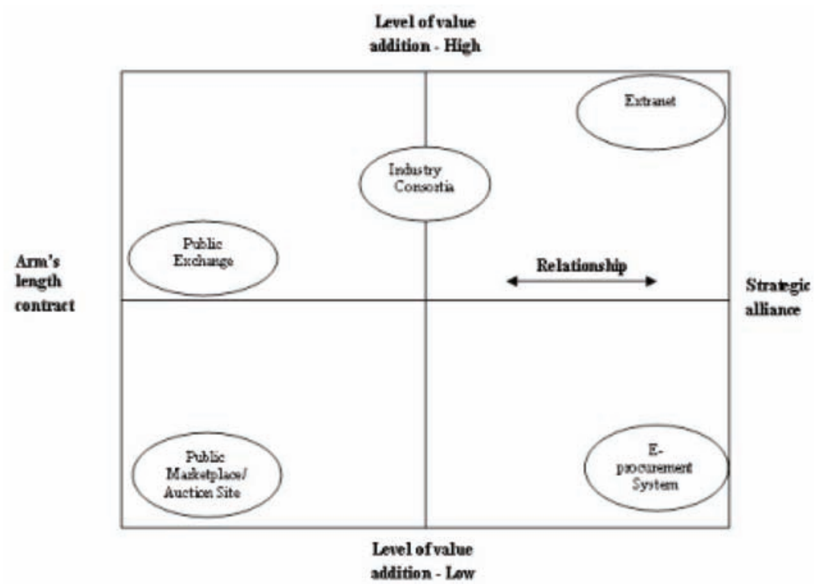
| Dimension | Wise & Morrison (2000) | Kaplan & Sawhney(2000) | Barnes-Vieyra & Claycomb (2001) | Pavlou & El Sawy (2002) | Stockdale & Standing (2002) | Clarke & Flaherty (2003) | Chatterjee & Ravichandran (2004) | Richard & Devinney (2005) | Wang & Archer (2007) | Petersen, Ogden, & Carter (2007) | Walters (2008) | Saprikis, Vlachopoulou, & Manthou (2009) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ownership | | | | | | x | | x | x | | | x |
| Industry focus | | | | | | x | | x | x | | | |
| Number of participants | | | x | x | | | | x | x | | | x |
| Strategy/Market Mechanism | x | x | | | | | | | x | x | | x |
| Product | | x | | | | | x | | x | | | |
| Relationship | | | | x | | | x | | x | | | |
| Participant behavior | | x | | | x | | | | x | | | |
| Power asymmetries | | | | x | | | x | | x | | | |
| Functionality | | | | | | x | | x | | | x | |
| Fee structure | | | | | | | | | x | | | |
| Owner Participation | | | | | | | | x | | | | |

cized for a lack of parsimony (Wang & Archer, 2007). The objective of our framework is to synthesize the literature and derive a minimalist classification scheme which is useful as a starting point for a larger planned empirical study of B2B organizations. While arriving at various EM classification schemes, researchers have used one dimension (Barnes-Vieyra & Claycomb, 2001), two dimensions (Kaplan & Sawhney, 2000), three dimensions (Clarke & Flaherty, 2003) or more than three dimensions (Richard & Devinney, 2005; Wang & Archer, 2007). According to Weick (1979), a research cannot be simultaneously general, simple and accurate; any two could be achieved reasonably. We will aim to achieve simplicity and accuracy, this will mean reducing the number of dimensions to two. Three dimensional classifications are hard to visualize and will not serve our purpose.

The E-market place can be fundamentally visualized as a relationship between the buyer and seller - a buyer has a product/service which the seller purchases; hence it is necessary to have *relationship* as one of the dimensions of the framework. As pointed out in the introduction, this has historically been a characteristic of electronic markets (Malone, et al., 1987), with relationships ranging from a pure exchange (a "market") with many buyers and sellers to a captive relationship between the buyer and seller (a "hierarchy"). The *relationship* dimension is echoed in Pavlou & El Sawy (2002) and Chatterjee & Ravichandran (2004) classifications. Criteria such as *# of participants* and *participant behavior* are subsumed by the relationship dimension (please refer to Table 1). For example in a strategic alliance, there will be few participants and these may buy frequently to take advantage of the tie-up.

The second major dimension that is important to the nature of a B2B company is the nature of the product offered: is it operational (also known as MRO or raw materials), manufacturing goods (sub-assemblies) or services. Porter's value chain concept is a useful way to capture this dimension, thus the *level of value addition* is our second dimension. This characteristic is echoed in Kaplan and

*Figure 1. Proposed framework for EM strategies*




Sawhney (2002) and Chatterjee & Ravichandran (2004) classifications. Lending support to our classification, Chatterjee & Ravichandran (2004) claim that product and relationship characteristics are largely responsible for determining the structure of B2B systems. It must be noted that the *ownership* dimension is rendered redundant by the choice of these two dimensions, since as discussed in the following paragraphs, the different types of ownership conveniently become points in the grid as evidenced in figure 1. A similar argument may be made for the *functionality* dimension. Our framework does not consider *industry focus* (whether vertical or horizontal) and *power asymmetries* (neutral or biased). Save for these, the framework renders six of the remaining eight dimensions (see table1) extraneous. Thus there is a compelling argument for the framework that is proposed. The following paragraphs further elaborate and justify the dimensions selected.

## Relationship

Type of relationship sought is an important aspect in any supply contract. Organizations follow a range of inter-firm relationships in sourcing products and services varying from "arms-length" contracts to "strategic alliances" (Monczka, Petersen, Handfield, & Ragatz, 1998). Type of relationship sought is dependent on compatibility of mutual interests, mutual need, and willingness to share information (Segev & Gebauer, 2001). Each of these relationship types offers differing benefits to participating organizations. For instance, "strategic alliance" fosters higher collaborative environment in supplier relationships and therefore offers greater benefits to alliance partners.

The relationship dimension is closely related to other dimensions used in prior EM classifications such as:

a. Market-Hierarchy distinction also captures the type of relationship that is proffered by the buying organization. For instance, hierarchy is more related to strategic alliance type of relationship and market is more of arms-length relationship as described in the literature (Segev & Gebauer, 2001).
b. Number of participants: Strategic alliance will be entered with one or very few

organizations while arm's length contract may be applicable for many vendors (Pavlou & El Sawy, 2002).

c. Ownership: Organizations maintaining strategic alliance with the supplier is going to use EM that is private whereas arm's length contract will be entered with many suppliers and hence public EM is suitable for it. Consortia type EMs will fall somewhere in the middle (Richard & Devinney, 2005).

## Level of Value Addition

This dimension considers the nature of product/service that is sold and its value addition in terms of the overall value chain activities of the organization The concept of "Value Addition" has become popular with Porter's value chain framework, defined as the set of activities through which a product or service is created and delivered to customers (Porter, 2001). Organizations purchase a variety of products/services electronically and some of them may be basic inputs to the value creation activities whereas others may provide high-end inputs to the value creation activities. The level of value addition by the products/services procured to the buyers' organization may influence the EM strategy it intends to follow. For example, if the product/service is critical, an organization may attempt to stabilize the source by entering into long term relationships.

The dimension is closely related to "product characteristics" that was used in earlier EM classifications. As stated "product characteristics" refers to different types of products sold such as MRO, manufactured products or services. Kaplan and Sawhney (2000) used *manufacturing input* and *operating inputs* as product types. In general, *manufacturing inputs* can be considered as critical goods that contribute directly to the value addition. However, Kaplan and Sawhney's (2000) study primarily explored public exchanges whereas we have considered the entire gamut of B2B strategies. A related concept from the sellers' perspective called "Value Creation" has been utilized in previous literature. For instance, Petersen et al. (2007) examined value addition in the purchasing process by specific sellers. According to them, some of the value adding activities a seller could perform includes training, transportation, reverse logistics, maintenance; and so forth. Similarly, Walters (2008) explored how value can be added by B2B intermediaries in Hong Kong through sharing of information, communication and collaboration, and collaborative learning. The dimension, "value addition" of products/services used by the organization has not been, to the best of our knowledge, explored in the past.

As mentioned earlier, "relationship" and the "level of value addition" are important in determining the EM strategy adopted by organization. These dimensions are related to other dimensions often used in the literature (e.g., Market-Hierarchy, number of participants, ownership, participant behavior, and product characteristics). Utilizing this typology, we present a 2x2 matrix (see figure 1) that charts out some of the prevalent strategies used by organizations. We also highlight the applicability of the framework in actual industry scenario through some illustrative examples derived from publicly available news sources.

## Public Exchange

*Public exchange* is defined as an interfirm intermediary that enables firms to conduct online transactions and related services (Pavlou & El Sawy, 2002). In the early years, public exchanges were the most popular and successful in B2B e-commerce arena (Milliou & Petrakis, 2004). Public exchanges are preferred for procuring scarce and rare items (Chatterjee & Ravichandran, 2004).

*Illustrative Example:* ChemConnect is one of the successful public exchanges that are around even after the dot.com boom was bust (Angwin, 2004). ChemConnect allows buyers and sellers to conduct transactions on variety of chemicals. It also helps in negotiations and collaborations in the supply chain network. Clearly, the relationship in this scenario is more of arm's length contracts enforced through the exchange and products (i.e. chemicals) procured may be used in the production process.

## Industry Consortia

*Consortia* are jointly owned and operated by companies in a particular industry. Consortia are also known as community marketplaces (Guo, 2007). Consortia do not directly trade but provide the necessary infrastructure to execute transactions between buyers and sellers (Richard & Devinney, 2005). Vendors register with the consortia to sell to different players in an industry. Organizations can rely on consortia to buy products of moderate value addition. Research also indicates that companies such as Boeing, apart from having its own EM, also participate in the development of consortia based EMs to reach wider supplier base (Guo, 2007).

*Illustrative Example:* Exostar, which operates in the airline manufacturing industry, is jointly owned by Boeing Co., BAE Systems, Lockheed Martin, Raytheon, and Rolls-Royce. More than 34,000 trading partners communicate on the system (Bowman, 2009). The consortia based EM allow the buying organizations to easily reach many shortlisted suppliers who supply critical aircraft components.

## Extranet

An *extranet* is the electronic computer-to-computer exchange of information between business partners via a virtual network within the Internet (Anandarajan, Anandarajan, & Wen, 1998). Extranet facilitates information sharing between strategic partners who were given access to systems (Tan, Shaw, & Fulkerson, 2000). Chan & Davis (2000) state that organizations should enable extranet based relationships with strategic partners such as large suppliers. Extranet allows organizations to connect with critical suppliers for purchasing products/services that are critical for the organization. Moreover, extranet is more of an internal system that is made available to critical suppliers and it dispenses the need to have intermediary such as public exchange to carryout transactions.

*Illustrative Example:* Levinson (2006) highlights how some of the customers of Panasonic International asked it to carryout transactions over Extranet instead of traditional Electronic Data Interchange. This illustrates that the criticality of the product procured may motivate buyers to ask their suppliers to transact over Extranets. Extranet also allows for closer relationship/interactions between suppliers and buyers. The same article also mentions that the volume of business carried out over the extranet in 2006 increased from that of previous years.

## Public Marketplace/Auction Site

*Public marketplace* provides liquidity and price benefits that may not be available in private marketplaces (Premkumar, 2003). Organizations may choose to buy non-production products/services from these public marketplaces. Transactions entered through the public marketplace would be based on arms length contracts as opposed to other forms of relationships prevalent in strategies such as Extranet and E-procurement system. Public marketplace/auction sites facilitate one-off transactions whereas in public exchanges there may be repeat purchases for the same production input from many sellers.

*Illustrative Example:* Last year, EquipNet announced the launch of an auction site where used and surplus manufacturing equipments were sold to various buyers (Potenza, 2009). This public auction site mainly provides a non-negotiated way to acquire various products that may not directly go in to the products produced. Characteristics of the EquipNet's business domain clearly show the arms-length relationship between buyers/sellers in trading non-production goods.

### E-Procurement System

*E-procurement systems*, also known as *desktop procurement systems* (Segev & Gebauer, 2001) are increasingly becoming popular in the industry. These systems are primarily used to purchase indirect materials for operations, sales, maintenance, and administration (Albrecht, Dean, & Hansen, 2005). Examples of such items include office consumables, printing supplies, cleaning supplies, etc. These systems also allow the decentralization of purchasing function across different departments. Only products from vendors connected with the buyers will be available through the e-procurement systems (Albrecht, et al., 2005). E-procurement systems are well suited for purchasing low value-adding products/services from one or few suppliers.

*Illustrative Example:* Recently AmSurg, Cincinnati Children's Hospital Medical Center and the University of Connecticut Health Center chose to deploy SciQuest's e-procurement system to purchase of non-managed low supplies (Phillips, 2009). Before the deployment of e-procurement system, unmanaged supplies were bought at retail or non-contracted prices, these unmanaged purchases amount to millions of dollars annually for most healthcare organizations. Deployed system also allowed aggregation of the buying power of numerous locations to drive volume discounts on all purchases and generate efficiencies of scale (Phillips, 2009).

### Implications for Research and Practice

For the research, we have extensively reviewed various important dimensions useful in classifying EM strategies. The study also furthers our understanding of various EM strategies in which research is still evolving (Wang & Archer, 2007). Though the framework proposed in our study is parsimonious, it captures many important dimensions that determine EM strategies. It is applicable to both buyers and sellers. For instance, consider a hypothetical personal computer manufacturing company called *Big Brand PC* purchasing components for its assembly operations. If it needs processors and motherboards that are critical components, it could use an *Extranet strategy* (see table 3). On the hand, if it is purchasing generic products such as cables and ties, it could use a *Public Exchange*. Thus the framework is helpful in determining a suitable B2B strategy. For the sellers, the framework is useful as a positioning matrix where different B2B companies can be placed on the grid. Obviously crowded areas of the matrix are to be avoided so as to obviate head-to-head competition. Such matrices are discussed in basic books on strategy so we will not discuss this further.

## FUTURE RESEARCH DIRECTIONS

This study provides a theoretical framework for identifying EM strategies. Empirical validation of the framework is clearly the next step. Since many B2B companies have become defunct, the proposed framework could be fruitfully used to examine successful EM strategies. In addition, there is very little known about individual EM strategies and successful buyer-seller behavior therein. Further research could be carried out to examine the benefits and shortcomings of these individual strategies.

## CONCLUSIONS

This study provides a framework for EM strategies adopted by organizations using two dimensions, *relationship characteristics* and *level of value addition*. These dimensions capture/subsume many

*Table 3. Illustrative example for the various B2B EM strategies*

| Strategy | Example items sourced | Rationale | Example B2B platform |
|---|---|---|---|
| Extranet | Processors, Memory, Motherboard | These are critical components that needs strategic alliance with few partners | Internally created and maintained portal |
| Consortium | Electronic chips and other components | Gains access to leading suppliers through the consortium | e2open.com |
| Public exchange | Cable ties, cooling fans | Standardized products that can be sourced from the market | allproducts.com |
| E-procurement System | Office consumables with stable need | Limits to select group vendors who supply consumables based predefined relationships | Internally created and maintained portal |
| Public marketplace | Non-frequent purchases of products such as machinery and equipment | Provides access to products/services that are not frequently needed through arms-length contracts | go-dove.com |

of the characteristics used in the past to describe EM strategies such as "product", "ownership" "relationship" and "number of participants." Based on the proposed framework, this study highlights five dominant EM strategies prevalent in the industry. Organizations may utilize combination of these strategies, if not all of them, to procure products and services.

## REFERENCES

Albrecht, C. C., Dean, D. L., & Hansen, J. V. (2005). Marketplace and technology standards for B2B e-commerce: progress, challenges, and the state of the art. *Information & Management*, *42*, 865–875. doi:10.1016/j.im.2004.09.003

Anandarajan, M., Anandarajan, A., & Wen, H. J. (1998). Extranets: a tool for cost control in a value chain framework. *Industrial Management & Data Systems*, *98*(3), 120. doi:10.1108/02635579810213125

Angwin, J. (2004). Top Online Chemical Exchange Is an Unlikely Success Story. *The Wall Street Journal.* Retrieved June 29, 2009, from http://webreprints.djreprints.com/907660072246.html

Barnes-Vieyra, P., & Claycomb, C. (2001). Business-to-business e-commerce: Models and managerial decisions. *Business Horizons*, *44*(3), 13–20. doi:10.1016/S0007-6813(01)80030-6

Bowman, R. J. (2009). If Supplier Portals Were So Great, Then What Went Wrong? *Supply Chain Brain.* Retrieved from http://www.supplychainbrain.com/content/headline-news/single-article/article/if-supplier-portals-were-so-great-then-what-went-wrong/

Chan, S., & Davis, T. R. V. (2000). Partnering on Extranets for Strategic Advantage. *Information Systems Management*, *1*(1), 1–7. doi:10.1201/1078/43190.17.1.20000101/31215.8

Chatterjee, D., & Ravichandran, T. (2004). Beyond exchange models: Understanding the structure of B2B information systems. *Information Systems and e-Business Management, 2*(2-3), 169-186.

Clarke, I., & Flaherty, T. B. (2003). Web-based B2B portals. *Industrial Marketing Management*, *32*(1), 15–23. doi:10.1016/S0019-8501(01)00199-7

Grieger, M. (2003). Electronic marketplaces: A literature review and a call for supply chain management research. *European Journal of Operational Research*, *144*(2), 280–294. doi:10.1016/S0377-2217(02)00394-6

Guo, J. (2007). Business-to-business electronic market place selection. *Enterprise Information Systems*, *1*(4), 383–419. doi:10.1080/17517570701648109

Kaplan, S., & Sawhney, M. (2000). E-Hubs: The new B2B marketplaces. *Harvard Business Review*, *78*(13), 97–103.

Levinson, M. (2006, May). B2B E-Commerce - How to Keep the Web from Becoming a Trap. *CIO*.

Malone, T. W., Yates, J., & Benjamin, R. I. (1987). Electronic markets and electronic hierarchies. *Communications of the ACM*, *30*(6), 484–497. doi:10.1145/214762.214766

Milliou, C., & Petrakis, E. (2004). Business-to-business electronic marketplaces: Joining a public or creating a private. *International Journal of Finance & Economics*, *9*(2), 99–112. doi:10.1002/ijfe.234

Monczka, R. M., Petersen, K. J., Handfield, R. B., & Ragatz, G. L. (1998). Success factors in strategic supplier alliances: The buying company perspective. *Decision Sciences*, *29*(3), 553–577. doi:10.1111/j.1540-5915.1998.tb01354.x

Pavlou, P. A., & El Sawy, O. A. (2002). A classification scheme for B2B exchanges and implications for interorganizational ecommerce. In M. Warkentin (Ed.), *Business to Business Electronic Commerce: Challenges and Solutions* (pp. 1-21). Hershey, PA: Idea Group.

Petersen, K. J., Ogden, J. A., & Carter, P. L. (2007). B2B e-marketplaces: a typology by functionality. *International Journal of Physical Distribution & Logistics Management*, *37*(1), 4–18. doi:10.1108/09600030710723291

Phillips, K. (2009). Healthcare Organizations Rely on SciQuest To Optimize Supply Chains and Generate Savings. *SciQuest.* Retrieved June 28, from http://news.prnewswire.com/DisplayReleaseContent.aspx?ACCT=104&STORY=/www/story/06-18-2009/0005046586&EDATE=

Porter, M. E. (2001). Strategy and the Internet. *Harvard Business Review*, *79*(3), 63–78.

Potenza, B. (2009). *EquipNet Officially Launches EquipNet Auctions*. Retrieved June 28, from http://sev.prnewswire.com/machinery/20090624/NE3782724062009-1.html

Premkumar, G. P. (2003). Perspectives of the e-marketplace by multiple stakeholders. *Communications of the ACM*, *46*(12), 279–288. doi:10.1145/953460.953512

Richard, P. J., & Devinney, T. M. (2005). Modular Strategies: B2B Technology and Architectural Knowledge. *California Management Review*, *47*(4), 86–113.

Saprikis, V., Vlachopoulou, M., & Manthou, V. (2009). A typology framework of Greek business-to-business electronic marketplaces. *International Journal of Business Innovation and Research*, *3*(3), 252–267. doi:10.1504/IJBIR.2009.024178

Segev, A., & Gebauer, J. (2001). B2B Procurement and Marketplace Transformation. *Information Technology and Management*, *2*, 241–260. doi:10.1023/A:1011442008251

Stockdale, R., & Standing, C. (2002). A framework for the selection of electronic marketplaces: a content analysis approach. *Internet Research: Electronic Networking Applications and Policy*, *12*(3), 221–234. doi:10.1108/10662240210430900

Tan, G. W., Shaw, M. J., & Fulkerson, B. (2000). Web-based Supply Chain Management. *Information Systems Frontiers*, *2*(1), 41. doi:10.1023/A:1010093803431

Walters, P. G. P. (2008). Adding value in global B2B supply chains: Strategic directions and the role of the Internet as a driver of competitive advantage. *Industrial Marketing Management*, *37*(1), 59–68. doi:10.1016/j.indmarman.2007.06.010

Wang, S., & Archer, N. P. (2007). Electronic marketplace definition and classification: literature review and clarifications. *Enterprise Information Systems*, *1*(1), 89–112. doi:10.1080/17517570601088380

Weick, K. (1979). *The Social Psychology of Organizing* (2nd ed.). New York: Random House.

Wise, R., & Morrison, D. (2000). Beyond the Exchange: The Future of B2B. *Harvard Business Review*, *78*(6), 86–96.

## ADDITIONAL READING

Grieger, M. (2003). Electronic marketplaces: A literature review and a call for supply chain management research. *European Journal of Operational Research*, *144*(2), 280–294. doi:10.1016/S0377-2217(02)00394-6

Pavlou, P. A., & El Sawy, O. A. (2002). A classification scheme for B2B exchanges and implications for interorganizational ecommerce. In M. Warkentin (Ed.), *Business to Business Electronic Commerce: Challenges and Solutions* (pp. 1-21). Hershey, PA: Idea Group.

Wang, S., & Archer, N. P. (2007). Electronic marketplace definition and classification: literature review and clarifications. *Enterprise Information Systems*, *1*(1), 89–112. doi:10.1080/17517570601088380

Wise, R., & Morrison, D. (2000). Beyond the Exchange: The Future of B2B. *Harvard Business Review*, *78*(6), 86–96.

## KEY TERMS AND DEFINITIONS

**Electronic Marketplace:** Place where industrial buyers and sellers conduct transaction by electronic means. There is no restriction here on buyer-seller cardinality i.e. there can be one buyer and multiple sellers, one seller and multiple buyers etc.

**EM Strategy:** Refers to the specific approach taken by an e-commerce business in terms of products, markets, infrastructure etc.

**Exchange:** Exchange is a specialized version of an Electronic Market Place where the number of buyers and sellers is large.

**Inter-Organizational System:** Information systems that involves multiple organizations such as buyer-supplier purchasing system.

**Market Mechanism:** Is the method used to determine pricing. It could be auction, reverse auction, fixed pricing, etc.

**MRO:** Maintenance, Repair and Operational inputs – used to characterize the “product” dimension.

**Operational Inputs:** Refers to raw materials.

# Chapter 22
# Electronic Logistics Marketplaces

**Yingli Wang**
*Cardiff Business School, UK*

**Mohamed Naim**
*Cardiff Business School, UK*

**Andrew Potter**
*Cardiff Business School, UK*

## INTRODUCTION

As B2B e-business shifted to the Internet, Electronic Marketplaces (EMs) have grown rapidly in usage (Rask & Kragh, 2004). Definitions of an EM are diverse. One of the earliest and broadest definitions is offered by Bakos (1991), who referred to an EM as "an inter-organizational system that allows the participating buyers and sellers to exchange information about price and product offerings". In the context of logistics, EMs can be termed Electronic Logistics Marketplaces (ELMs), referring to an electronic hub using web-based systems that link shippers and carriers together for the purpose of collaboration and/or trading (Wang, Potter, & Naim, 2007a).

ELM is a context specific type of EM, which facilitates the provision of logistics services. Traditional forms of communication between a shipper and a carrier are rather fragmented when a shipper has a number of carriers to manage. Such one-to-one exchanges can be costly and sometimes very time-consuming. Communicating through an ELM allows the connection of a number of shippers and carriers using a single interface, normally a Web-based system. This has brought advantages to organizations in terms of low cost inter-organization information connectivity, (near) real time visibility, and flexible partnership configurations.

This article defines and describes ELMs in terms of their;

1. architectures, features and functionalities
2. impact on logistics practice and benefits to stakeholders
3. future requirements

DOI: 10.4018/978-1-61520-611-7.ch022

## ARCHITECTURES, FEATURES AND FUNCTIONALITIES

### Type of ELM

A basic ELM is normally composed of three key parties: shipper, carrier and technology provider with the primary objective of efficient and effective delivery. In some circumstances customers (the recipients of the products) get involved as well. Emerged since the late 1990s, two main types of ELM came into practice: open and closed. The former is mainly for trading purposes and the latter is used to facilitate long-term collaboration between shipper and carrier. It should be noted that there is not a binary distinction between open and closed ELM, there is possibly a spectrum with differing degrees of openness and closure.

Early ELMs were open systems, such as www.teleroute.com, and are mainly price driven. They tend to be a neutral marketspace and focus on matching the supply and demand of transport and logistics services between shippers and carriers. A typical example is an online freight exchange for the spot trading of transport services.

Despite the benefits of lower search and coordination costs from using open ELMs, there is an increasing need for companies, and particularly shippers, to retain their linkages with preferred business partners (Dai & Kauffman, 2002). Carriers, in particular hauliers, are often reluctant to join an open ELM, as they fear being judged purely on carriage rates and not on total service delivery. A trend was observed that "early days of freight exchanges must now put less emphasis on open-market exchanges and more on their ability to work with closed communities of users who trade with each other" (Lewis, 2002; Rowlands, 2003). This has resulted in the recent development of closed ELMs.

A closed system is developed towards the needs of particular shippers and/or carriers. Membership is only available to those who are invited to collaborate. Contracts often already exist between the shipper and carrier. Customers are usually long-term and actively involved in the logistics process. To date, most of the closed ELMs are initiated and led by the users of logistics service providers, i.e. shipper(s) or logistics brokers like a 4PL company.

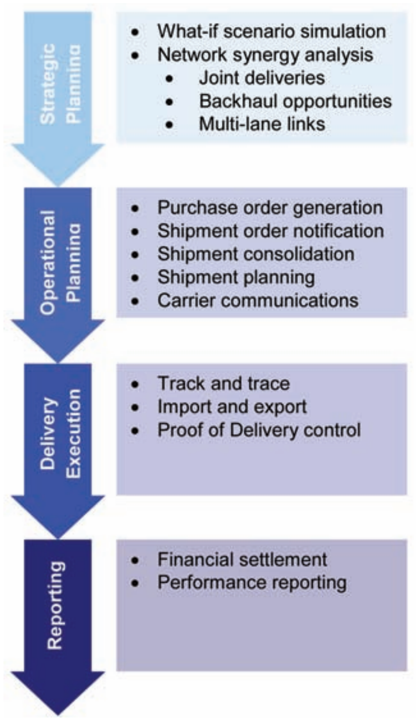
While open ELMs are already well established, closed ELMs have emerged recently and hence are still at their infancy stage. But this novel form is seen to bring greater benefits to the organizations than the open ones. Hence the closed ELM is the focus of this article.

### Functions of a Closed ELM

The operational scope provided by closed systems goes beyond basic load posting and matching services, and shifts to complex offerings that might encompass complete order fulfillment services. The use of closed ELMs is expected to lead to improved pipeline visibility and to the more efficient planning, execution and responsiveness of all supply chain players (Cruijssen, Dullaert, & Fleuren, 2007). Larger carriers or shippers can leverage such ELMs by collaborating on a single platform and eliminating the complex and costly integration of different inter-organizational systems. Small carriers may be able to use them to reach wider sources of logistics demand, or to collaborate with other similar companies. Rather than focusing on the identification and selection of trading participants as per open ELMs, the closed ELM focuses more on execution and long-term value-added activities between shippers and carriers.

As the functions offered by ELMs are different, there may be other parties involved such as freight forwarders and financial service providers. Figure 1 provides an overview of typical ELM operations.

*Figure 1. The functions found within an ELM (source: Authors)*




## Architectures

In total there are three main types of closed ELMs in practice that are explained by Figure 2. Three fundamental elements, i.e. process, technology and collaboration, have been deployed to analyse each type of ELM's information architecture. This is in line with the recommendation given by Baeza-Yates and Nussbaum (2006) and McLaren et al., (2002).

- Technology:

The traditional method for B2B integration includes EDI and Enterprise Application Integration (EAI) systems. While ELMs may utilise EDI messages, they provide a higher degree of process coordination and enable transactions between multiple parties rather than the one-to-one communication provided by EDI and EAI. They are designed for participants to share a single system, rather than attempt to integrate separate systems. It is also worth pointing out that using a hosted platform has gained popularity recently. It is known as 'on-demand' or 'Software-as-a-Service' (SaaS) business model which offers very low fixed cost and usage-based variable costs termed 'pay as you go' pricing. ELMs could therefore enable not only large companies but also medium and small sized firms to use logistics services.

- Process

Process encapsulates various logistics activities conducted in a closed ELM. In practice, it is often referred to as the operational scope of an ELM that has been discussed above. Consequently the operational scope includes various functions an ELM provides in order for those logistics activities to be executed smoothly. The typical functions have been discussed in the previous section, and the implementation of these functions is supported by web-based technologies, for instance web services.

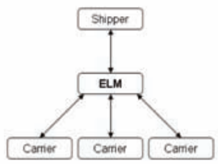
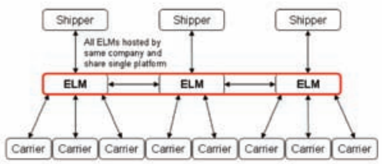
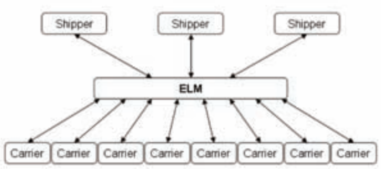
- Collaboration

Collaboration is a process of decision-making among interdependent parties. It means two or more parties work together, have mutual understanding and a common vision, and achieve collective objectives. It enables coordination of operations across business entities, as supply chain management needs systematic effort to provide integrated value to meet customer needs and expectations. For instance, collaboration between shippers and carriers will improve equipment utilization by enabling the consolidation of inbound and outbound deliveries.

## Private Marketplace

This type of marketplace may be classified as a 'closed form' in that it is led by a dominant party,

*Figure 2. Three types of closed ELMs (Source: adapted from Wang, Y. et al, 2007 a&b)*

| *Types of Closed ELM* | *Information Architectures* | *Operational scope (process/functions)* | *Collaborative Arrangement* | *Underlying technology* |
|---|---|---|---|---|
| Private ELM |  | • Order receiving<br>• Loads building<br>• Shipment planning<br>• Job tendering<br>• Tracking and tracing<br>• Proof of delivery (POD)<br>• Self billing<br>• Reporting | II<br>Has optimisation of carriers and of shippers. But carriers and shippers themselves do not collaborate. | - Client –server with Web based functions<br>- Pricing model: software licensing fee and implementation fee |
| Shared ELM |  | • Purchase order generation<br>• Shipment planning<br>• Carrier sourcing<br>• Visibility and events<br>• Import and export<br>• POD<br>• Self billing<br>• Reporting | I + II + III<br>I+III limited to technical collaboration | - Hosted, Web-based<br>- pay-as-you-go (PAYG) per transaction |
| Collaborative ELM |  | • Joint Planning<br>• Communication (accept/deny loads)<br>• Tracking and tracing<br>• Pre-invoicing and Performance report | I + II + III | Hosted, Web-based functions<br>- PAYG per transaction |

Key: I, horizontal collaboration (HC) between shippers; II, vertical collaboration (VC) between shipper and carrier; III, HC between carriers.

usually a shipper, who invites carriers to join. Therefore such a marketplace is focused on optimizing the dominant party's distribution network. The network is usually facilitated by a software provider utilising an Internet platform. While such a marketplace is relatively simple to operate, in a form of centralized hub & spoke communication system, setup costs are usually high as there is a need to ensure interoperability between different stakeholder information systems.

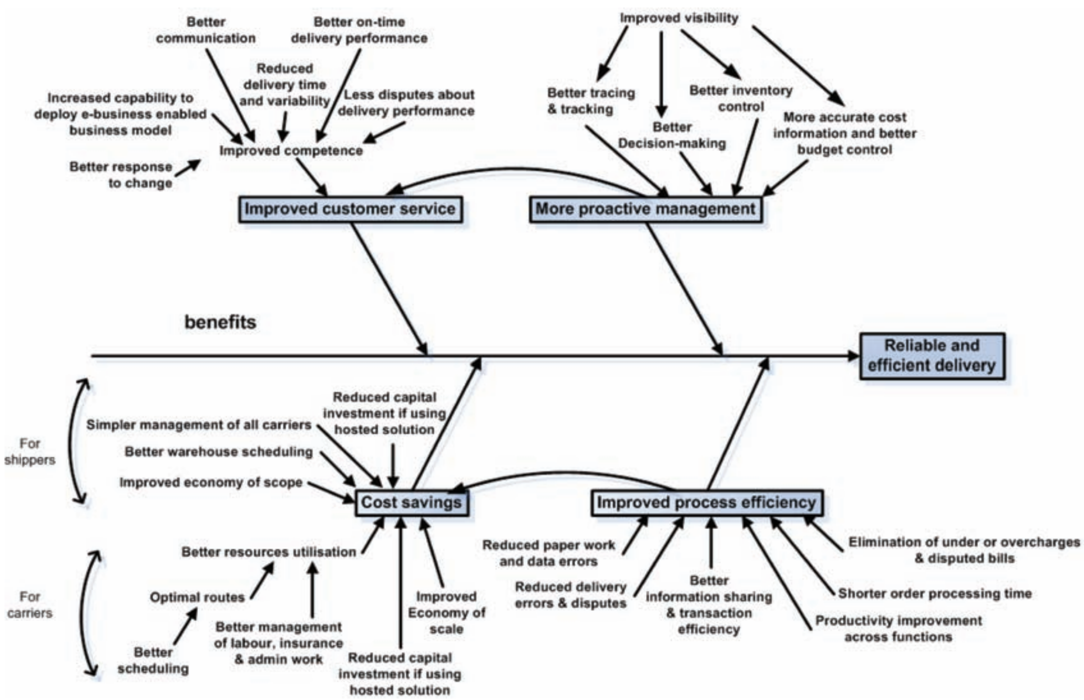
## Shared Marketplace

In this type of marketplace a number of shippers share the same information system platform, usually run by a single software provider, but will be provided with dedicated ELMs. However, there is the opportunity to communicate between ELMs so that the shippers may share carrier capacities among their different distribution networks. Some technical enhancements are usually added compared to the Private Marketplace and able to accommodate a number of communication media such as, mobile phone, email, EDI and Internet. The technology provider usually deploys an on-demand pricing model for the charges to the users. Also, there is a need to agree data confidentiality between the shippers if they want to collaborate across individual ELMs.

## Collaborative Marketplace

This type of marketplace is formed and led by a partnership of companies, who may be shippers, customers, carriers or a combination of all three. The aim is to look for economies of scale and scope in order to fully utilise all transport assets and maximize availability of service. This type of marketplace allows multidirectional communication with optimization undertaken via a centralized planning system. Again, the on-demand model is a popular option for this type of ELM. Informa-

*Figure 3. Benefits from using an ELM (Source: Wang, Y. 2008)*




tion sharing protocols have to be developed to ensure commercial confidentiality. The inherent technological and procedural complexities make this type of ELM the most difficult to implement and is rarely seen in successful operation.

## IMPACT AND BENEFITS OF AN ELM

There are a broad range of benefits from the use of ELMs. Many of the benefits are dependent upon the functionality of the marketplace itself and could be grouped under four categories: improved process efficiency, improved customer service, more proactive management and cost savings. These then finally lead to overall better service and reduced cost. These benefits are summarized in Figure 3.

Improved process efficiency is achieved through streamlining the processes, and providing the supply chain with more accurate information. Information is transmitted electronically between all parties involved in the ELM. This increases the speed of information transfer. Improved data integrity and traceability is another important factor impacting process efficiency. In an ELM, all shipments are recorded, along with details of which carrier transported the load. Further, track and trace allows confirmation that a load has been collected, indicates its location en-route and reveals when delivery has occurred. In many cases this information is linked to a self-billing function, where the shipper calculates how much the carrier should be paid. This replaces the more traditional approach of the carrier providing an invoice. Therefore, any disputes relating to whether a delivery has been made or if the carrier actually undertook the movement can be resolved quickly and easily. Reduced human interventions also lead to less paper work and data errors.

Another area of benefit was in more proactive management of deliveries through the increased supply chain visibility among supply chain partners. The track and trace facility within ELMs enables managers to see where loads are. Should a delay occur, the improved visibility offered by the ELM enables this to be detected earlier and therefore decisions can be taken to ensure customer service is maintained. This may involve re-routing the vehicle or, if the ELM is being used within a global supply chain, possibly choosing an alternative mode of transport. Inventory control in these long supply chains can also be improved by identifying where stock is and when it is likely to arrive.

A third area of benefit was cost savings. While improved process efficiency contributes towards this, there are other benefits accrued by both the shipper and carrier. In the case of the former, there is the opportunity to simplify the day-to-day management of carriers, as all information is transmitted through a single interface. Equally, where the marketplace permits horizontal collaboration, it is possible for the shipper to benefit from improved flexibility in the provision of transport services, and therefore gain economies of scope. From a cost perspective, the range of different available ELMs means that it is possible for the shipper to avoid significant setup costs through the use of a hosted system. Shipper benefits may also extend beyond the transport journey, with the opportunity to improve warehouse operations through greater visibility of incoming and outgoing loads. From the carrier's perspective, a key benefit is the better use of resources. The greater visibility of loads and their progress enables scheduling to be more effective and avoids delays having a knock-on effect. In addition, because the ELMs examined in this research were closed systems, once a carrier joined, there is the potential for them to receive more loads and therefore gain economies of scale.

Finally, ELMs can deliver improved customer service, with proactive management being just one part of this. A shipper can be more responsive to customer requests, especially if they can draw on a large pool of different transport options. They can also reduce order-to-delivery time as information flows between shippers and carriers are faster. When delays occur, the shipper has earlier notification of this and so can contact the customer to warn them of the delay while, if a dispute should arise in respect of delivery performance, it is possible for more accurate information to be obtained to identify the root causes of the problem. The fact that in some circumstances the ELM is neutral can further enhance this benefit, as there is less suspicion that the data is distorted. Finally, from a carrier's perspective, being able to participate within an ELM improves their capabilities, and therefore competitiveness in delivering a solution that meets the needs of the shipper.

As can be seen from the discussion above, there are a wide range of benefits that can be obtained for both the shipper and carrier participating in an ELM. However, many of the benefits are specifically related to the delivery of improved service to the shipper's customer while maintaining efficiency. While the exact benefits will vary between applications, it appears that there may be greater benefits in adopting an ELM for the shipper rather than the carrier.

One should note that there are some barriers for using a closed ELM too. A key factor which was found by Wang et al. (2007a) was the collaborative arrangement between participants. The misalignment of different parties' needs and unbalanced cost/benefits allocation could lead to the failure of the whole system. Accordingly, it is important for open dialogue to exist between shippers and carriers to ensure a clear understanding of shippers' motivations for introducing the marketplace. Interoperability between an ELM and participating companies' in-house information systems is perceived as a major technical challenge, though many ELM technology providers are able to use enterprise integration technology to translate individual company's data into standard format specified and deployed by an ELM. Promoting industry wide data transfer standardization will simplify and ease data transactions but also needs collective action (Claudia-Melania, América, & César, 2009).

Overall, the use of ELMs in practice has largely changed the structure of supply chains, increased the end-to-end visibility of order-to-delivery processes, and the way shippers and carriers collaborate and communicate with each other. Using it appropriately, organizations might enjoy economic benefits as well as environmental benefits (for example the reduction of empty running leads to less CO2 emissions).

## THE FUTURE OF GLOBAL ELMS

Current examples of ELMs are limited in terms of modality and geographical scale. We found that an ELM is extremely useful for logistics provisions in the context of global supply chains. Therefore its application to different transport modes and its potential in facilitating co-modality merits further examination. There could also be different practices in different countries in the use of ELM. Future research needs to address these.

This article focuses only on the shipper-initiated ELMs due to the lack of examples of carrier-led system. An in-depth study of carrier-led ELM if possible can provide additional insights. We expect such type of ELM to emerge in maritime shipping or airline industries where carriers might have enough power to influence shippers.

## CONCLUSION

Focusing our discussion on the closed system, we have looked at three types of ELM in terms of their architecture, functionality and features: private, shared and collaborative ELM. Benefits and impact of these ELMs are also discussed.

ELMs are seen as emerging business models to facilitate the effective provision and execution of logistics processes, where there is a need for extensive connectivity of business partners with appropriate relationship configurations. Companies with limited resources and capabilities should examine the costs and benefits of different ELMs, and select the most appropriate ELM according to business needs. There is no one-size-fits-all solution. Companies should use open ELMs as a speedy solution when logistics demand surges, and build private or shared ELMs with selected partners to gain operation efficiency and provide superior services to customers. For strategic benefits, shippers, or other parties who manage the distribution network for shippers, should explore the potential of setting up a collaborative ELM.

The ELM landscape is still evolving. Different structures and functionalities distinguishing closed ELMs from trading-oriented open ELMs are emerging, but are far from being set. Closed ELMs are still in an early phase of this evolution, but have great potential in supporting the effective and efficient provisions of logistics services. It seems that closed ELM will continue to prosper along with the development of ICT, and especially Web-based technology. Both shippers and carriers should keep abreast of technological developments, as technical innovations are at the core of many companies' aspirations to gain logistics efficiency.

## REFERENCES

Baeza-Yates, R., & Nussbaum, M. (2006). *The Information Architect: A Missing Link?* Retrieved March 10, 2006, from http://www.dcc.uchile.cl/~rbaeza/manifest/infarch.html

Bakos, J. Y. (1991). A strategic analysis of electronic marketplaces. *MIS Quarterly*, *15*(3), 295–310. doi:10.2307/249641

Claudia-Melania, C., América, A., & César, T. (2009). A framework proposal for seamless interoperability in a collaborative networked environment. *Computers in Industry*, *60*(5), 317–338. doi:10.1016/j.compind.2009.01.009

Cruijssen, F., Dullaert, W., & Fleuren, H. (2007). Horizontal cooperation in transport and logistics: a literature review. *Transportation Journal*, *46*(3), 22–39.

Dai, Q., & Kauffman, R. J. (2002). Business models for internet-based B2B electronic markets. *International Journal of Electronic Commerce*, *6*(4), 41–72.

Lewis, C. N. (2002 January). Freight exchanges. *E-logistics Magazine* [Online], 16. Retrieved May 30, 2008, from http://www.elogmag.com/magazine/16/index.shtml

McLaren, T., Head, M., & Yuan, Y. (2002). Supply chain collaboration alternatives: understanding the expected costs and benefits. *Internet Research*, *12*(4), 348–364. doi:10.1108/10662240210438416

Rask, M., & Kragh, H. (2004). Motives for e-marketplace participation: Differences and similarities between buyers and suppliers. *Electronic Markets*, *14*(4), 270–283. doi:10.1080/10196780412331311720

Rowlands, P. (2003 January). Freight exchanges. *E-logistics Magazine* [Online], 25. Retrieved May 30, 2008, from http://www.elogmag.com//magazine/25/xchanges.shtml

Wang, Y. (2008) *Electronic marketplaces for tailored logistics.* Doctoral dissertation, Cardiff University, UK.

Wang, Y., Potter, A., & Naim, M. M. (2007a). Electronic marketplaces for tailored logistics. *Industrial Management & Data Systems*, *107*(8), 1170–1187. doi:10.1108/02635570710822804

Wang, Y., Potter, A., & Naim, M. M. (2007b). *Freight Best Practice Guide: Electronic Logistics Marketplaces Research Report*. Freight Best Practice Programme. Retrieved from http://www.freightbestpractice.org.uk/default.aspx?appid=1960&cid=43.

## FURTHER INFORMATION

*Study on a regional ELM in Wales*. (n.d.). Retrieved from http://www.cuimrc.cf.ac.uk/Pan_Wales_ELM_Home

*UK Government Department for Transport Freight Best Practice*. (2008). Retrieved from http://www.freightbestpractice.org.uk/default.aspx?appid=1960&cid=43

## KEY TERMS AND DEFINITIONS

**4PL:** Fourth party logistics, a term coined by global consulting firm Accenture, "an integrator that assembles the resources, capabilities, and technology of its own organization and other organizations" (for example, carriers) to provide comprehensive supply chain solutions.

**B2B:** Business to business, an e-commerce model in which all of the participants are businesses or other organizations.

**EDI:** Electronic data interchange, the electronic transfer of specially formatted standard business documents such as bills, orders and confirmations, sent between business partners.

**ELM:** Electronic logistics marketplace, an online marketplace where shippers and carriers meet for either spot trading of transport services or for long-term collaboration.

**EM:** Electronic marketplace, an online marketplace where buyers and sellers meet to exchange goods, services, money, or information.

**PAYG:** Pay-as-you-go, a software pricing model sometimes also known as 'on-demand or Software as a Service (SaaS). Unlike traditional applications that are paid for with an up-front license fee and installed on a company's own premises, on-demand systems are hosted by the vendor and typically paid for on a subscription basis.

**Private ELM:** an ELM created and maintained by a dominant supply chain player purely for its own management of its carriers.

**Shared ELM:** an ELM usually hosted by an independent technology provider and within which individual sub-ELMs can be created for individual shippers' use. If they want to, shippers or carriers can work across these individual sub-ELM systems too.

**Collaborative ELM:** an ELM created by a consortium of industrial companies aiming to pursue network optimization across companies, which may be hosted by an independent technology provider.

# Chapter 23
# An Agent-Based B2C Electronic Market in the Next-Generation Internet

**Vedran Podobnik**
*University of Zagreb, Croatia*

**Krunoslav Trzec**
*Ericsson Nikola Tesla, Croatia*

**Gordan Jezic**
*University of Zagreb, Croatia*

## ABSTRACT

*In a global multi-service and multi-provider market, Internet Service Providers (ISPs) will increasingly need to base their operation on new consumer-centric business models. In this article, the authors present an agent-based framework for the Business-to-Consumer (B2C) electronic market, comprising User Agents, Broker Agents and Provider Agents, which enable Internet users to select an ISP in an automated manner.*

## INTRODUCTION

In the late 1980s, when Mark Weiser introduced the concept of ubiquitous computing (also referred to as pervasive computing), it was just a vision for the 21st century (Weiser & Brown, 1997). Meanwhile, continual advances in wireless technologies and telecommunication systems, in conjunction with rapid proliferation of various types of (portable) devices, have made Weiser's vision a technical and economic viability. Weiser's ideas are becoming a reality as the new generation of ICT-based (*Information and Communication technology*) systems evolve. The next-generation Internet, the most prominent example of such a system, creates heterogeneous environments populated with diverse types of ubiquitous communication-enabled devices in need of specific services. Consequently, such an environment requires efficient mechanisms which can match demands (requested services) to supplies (available services), anywhere and anytime. The focus of this article is on creating an agent-based framework for service provider selection in the next-generation Internet.

DOI: 10.4018/978-1-61520-611-7.ch023

# BACKGROUND

## The Evolution of the Internet

The Internet emerged in the early 1970s, as a small network interconnecting just a few computers. As the Internet grew through the 1970s and 1980s, many people started to realize its potential. Nevertheless, the Internet did not experience real proliferation until the invention of the World Wide Web (WWW or simply Web 1.0), a service provisioned through the Internet infrastructure. Web 1.0, as a global information medium enabling users to read and write via computers connected to the Internet, became the bearer of the digital revolution in the 1990s which was a major catalyst of globalization and an important driver of economic prosperity. Consequently, all further Internet evolution after the invention of Web 1.0, is characterized as Web X.0, in spite of the fact that the WWW is just one of many Internet services. Web 2.0, also called "the Social Web", is no longer simply about connecting information, but also about connecting people through various forms of social networks (e.g., Facebook (http://www.facebook.com), MySpace (http://www.myspace.com), or LinkedIn (http://www.linkedin.com)). The phrase "Web 2.0" was coined a couple years ago when the social networking phenomenon was recognized, having more than half a billion users world-wide in 2007, employing it on a daily basis for both personal and businesses uses (Reid & Gray, 2007). Web 3.0, also called "the Semantic Web", is the next stage in the evolution of the Internet in which it will become a platform for connecting knowledge. Web 3.0 is an evolutionary path which will enable people and machines to connect, evolve, share, and use knowledge on an unprecedented scale and in many new ways make our experience of the Internet better (Davis, 2007). One of the most promising Web 3.0 technologies, besides the Semantic Web, are intelligent software agents which can utilize semantically annotated information and reason in a quasi-human fashion.

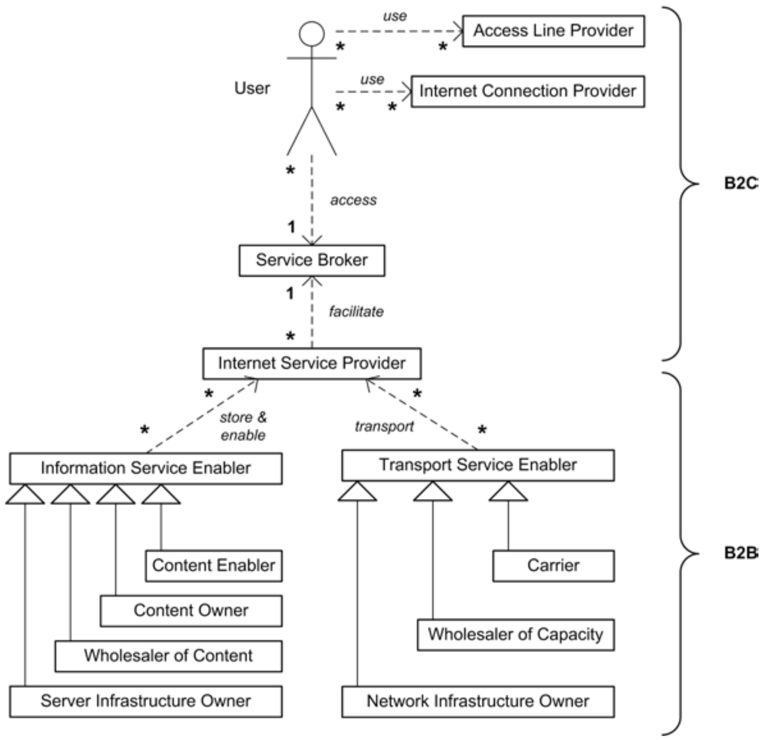
## Stakeholders in the Internet Domain

There are a number of different stakeholders present in the Internet domain (see Figure 1) who need to establish strategic partnerships in order to provide end-users with Internet services, integrate information and transport services. A stakeholder may take on a number of roles in a particular scenario, and a number of stakeholders can play the same role.

Examples of roles include the following (Fischer & Lorenz (European Telecommunications Consultants), 2000) (Podobnik & Lovrek, 2008):

- *User*: An Internet service user, having at his disposal one or more devices (e.g., mobile phone, laptop, digital TV receiver) attached/able to connect to the Internet.
- *Access Line Provider:* Provides telecommunication access to service consumers (e.g., an operator providing wireline access through a local loop or a mobile/wireless access operator).
- *Internet Connection Provider:* Provides network layer access to the Internet and its services (e.g., an operator with entry points to the Internet).
- *Internet Service Provider (ISP):* Facilitates integrated services for the consumers (e.g., a company offering IPTV service).
- *Service Broker:* Provides simplified filtering and access to a vast number of services available on the Internet (e.g., search engines).
- *Network Infrastructure Owner:* Provides transmission lines (e.g., telecoms or cable TV operators).
- *Carrier*: Provides a transport service for data traffic (e.g., companies which buy bandwidth from a Network Infrastructure Owner).

Figure 1. Roles and relationships of stakeholders in the Internet domain




- *Wholesaler of Capacity:* Provides lower-cost transmission and storage capacity (e.g., large ISPs selling capacity to smaller ISPs).
- *Server Infrastructure Owner:* Provides storage capacity and server functionality (e.g., companies owning "server farms").
- *Content Owner:* The owner of information or service in its original form (e.g., a movie producer).
- *Content Enabler:* Converts information to a format appropriate for Internet-based transmission.
- *Wholesaler of Content:* Provides low-cost content.

Figure 1 also differentiates relationships as being Business-to-Customer (B2C) or Business-to-Business (B2B).

## AN AGENT-BASED B2C ELECTRONIC MARKET IN THE NEXT-GENERATION INTERNET

### The Problem: How to Select "The Best" Internet Service Provider?

Internet service providers (ISPs) and IP-based telecom network operators are turning towards new business opportunities in a global multi-service and multi-provider market. With consumers typically having several multi-purpose end-user devices, the number and variety of personal, work, and home related services offered will also grow. As "plain broadband" wired/wireless Internet access is likely to become a commodity in the next 10 years or so (Anderson & Rainie, 2006), the ISPs will have to base their operation on new business models. Such models involve a number of stakeholders engaged in Internet service provisioning, from the user (i.e., consumer of the service) to the service provider. The selection of the service provider is not a trivial issue, assuming an (e-market) hosting a number of service providers offering the same or similar service. Our main challenge is the following: how to select "the best" ISP, given a set of user preferences.

## The Proposed Solution: An Agent-Based B2C Electronic Market

Prompt growth of the WWW and the rapid rise of e-commerce have provoked dynamic and extensive research aimed at developing efficient e-market models. Electronic commerce (e-commerce) comprises a broad range of issues including advertising, ontologies, on-line catalogs, intermediaries, security, trust, reputation, law and payment mechanisms (Guttman, Moukas, & Maes, 1998). Considering we aim to solve the problem of ISP selection given user preferences, in this article we are primarily concerned with B2C e-markets and the following stakeholders from the Figure 1: *users*, *service broker* and *ISPs*.

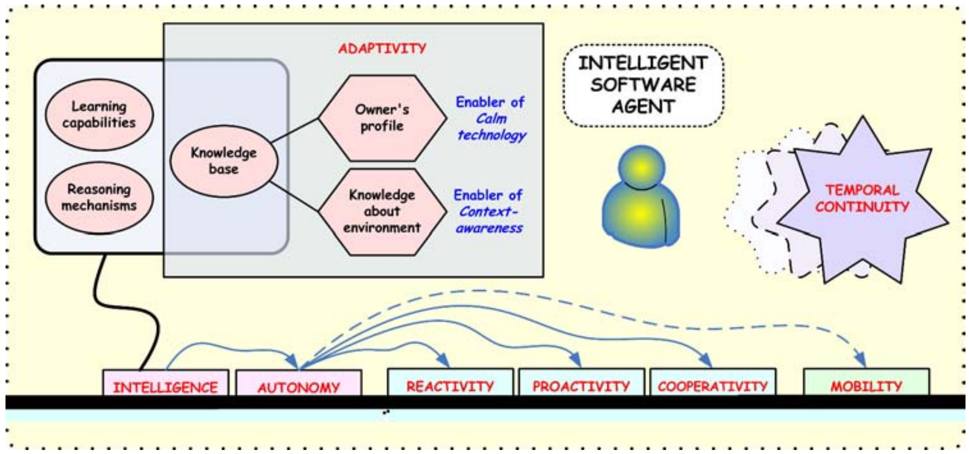
## Intelligent Software Agents

In a multi-agent system (MAS) implementing the proposed B2C e-market, intelligent software agents are used to impersonate *users*, *service broker* and *ISPs* in the next-generation Internet domain in order to enable automated interaction and business transactions.

An intelligent software agent is a program which autonomously acts on behalf of its human (or organizational) principal, while carrying out complex information and communication tasks which have been delegated to it. From the owner's point of view, agents improve their efficiency by reducing the time required to execute personal and/or business tasks. Figure 2 presents the relations between the main features of intelligent software agents:

- ***Intelligence*:** An agent must possess some intelligence grounded on its *knowledge base*, *reasoning mechanisms* and *learning capabilities*. The intelligence of an agent is a prerequisite for all its other characteristics. Depending on the assignment of a particular agent, different types of information will be maintained in its knowledge base. In general such information can be divided into two parts – the *owner's profile* and the agent's *knowledge about its environment*.
- ***Adaptivity*:** It is very important to notice that the agent's knowledge base does not contain static information. Adversely, the agent continuously updates its owner's profile according to the latest needs of the owner. This allows the agent to efficiently represent its principal in the pervasive environment of the next-generation Internet, thus realizing the calm technology concept. Additionally, the agent updates knowledge about its environment with the latest events from its ambience and with the current state of observed parameters intrinsic to its surroundings, thus realizing context-awareness. *Context-awareness* describes the ability of an agent to provide results depending on changing context information.
- ***Autonomy*:** An agent executes tasks autonomously without any interventions from its principal, what makes it an invisible servant, just as Weiser envisioned (Weiser & Brown, 1997). Autonomous execution presumes that an agent has the ability to control its actions and can ensure resources needed for execution of these actions.
- ***Reactivity*:** An agent must have the capability to react to impacts from the environment in which it operates.
- ***Proactivity*:** An agent does not just react to excitations from its environment, but also takes initiatives coherent to its tasks.

*Figure 2. A model of an intelligent software agent*




A well-defined objective is an inevitable prerequisite for proactivity.

- ***Cooperativity*:** An agent continually collaborates with other agents from its surroundings. On the basis of this cooperation, the agent takes actions which facilitate more efficient solutions for its delegated assignments.
- ***Mobility*:** An agent is capable of migrating between heterogeneous communication-enabled devices interconnected through the ubiquitous next-generation Internet network. Conventional programming systems do not allow migration of programs. Consequently, additional system preconditions must be ensured on all network nodes that are potential hosts for mobile software agents.
- ***Temporal continuity*:** An agent has a lifetime throughout which the persistency of its identity and its states should be retained.

## Agent-Enabled Internet Service Discovery

A description of the agent-mediated B2C e-market architecture shown in Figure 3 follows, along with a demonstration of how it operates.

## The Provider Agent

In the proposed B2C e-market, various types of Internet services $IS$ are offered:

$$IS=\{is_1,is_2,\ldots,is_{|IS|}\},\ is\subset IS,\ is_i\subset IS:|is_i|=1;$$

which are provided by different Internet service providers $ISP$:

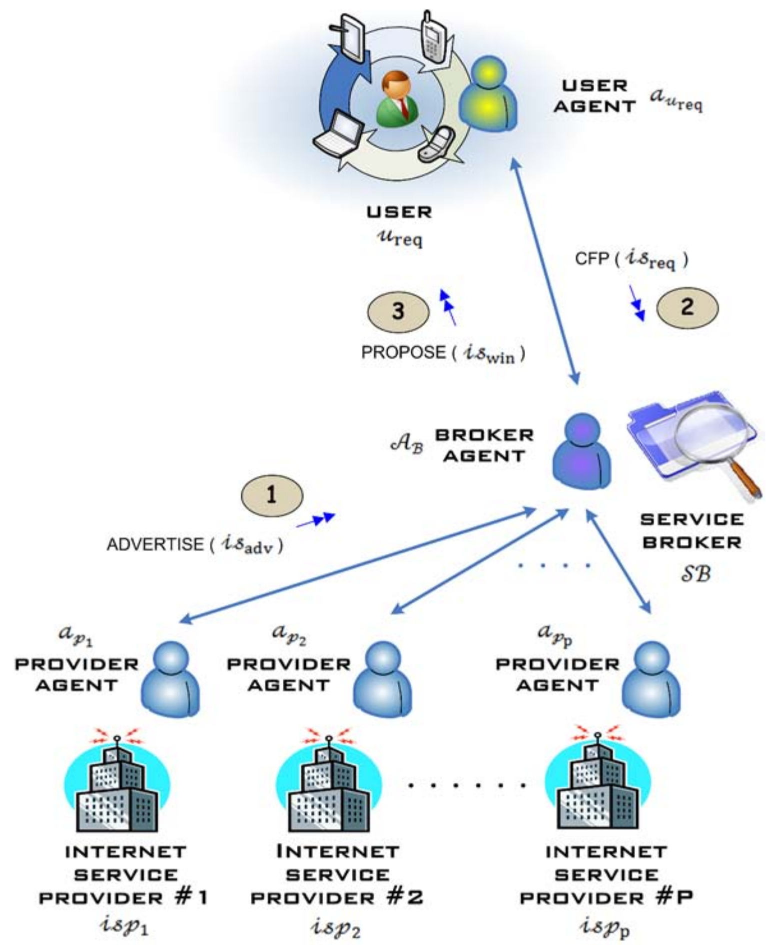
$$ISP=\{isp_1,isp_2,\ldots,isp_{|ISP|}\},\ isp\subset ISP,$$
$$isp_i\subset ISP:|isp_i|=1.$$

Internet service providers are represented in the e-market by Provider Agents $A_p$:

$$A_p=\{a_{p_1},a_{p_2},\ldots,a_{p|ISP|}\},\ a_p\subset A_p,$$
$$A_p=\{a_{p_1},a_{p_2},\ldots,a_{p|ISP|}\}\ a_{p_i}\subset A_p:\left|a_{p_i}\right|,\ a_p\subset A_p,$$
$$a_{p_i}\subset A_p:\left|a_{p_i}\right|=1.$$

An $a_{p_i}$ represents an $ISP$ which offers a certain service $is_1$. An $a_{p_i}$ advertises its service (advertised $is_i$ is denoted as $is_{adv}$) with a service broker (i.e., the Broker Agent) (interaction **1** in Figure 3).

Figure 3. An agent-mediated B2C e-market in the next-generation Internet




## The User Agent

$U=\{u_1,u_2,\ldots,u_{|U|}\}$, $u\subset U$, $u_i\subset U{:}|u_i|=1;$

are represented on the B2C e-market by User Agents $A_U$:

$$A_U=\{a_{u_1},a_{u_2},\ldots,a_{u|S|}\},\ a_u\subset A_U,$$
$$A_U=\{a_{u_1},a_{u_2},\ldots,a_{u|S|}\}\ a_{u_i}\subset A_U:\left|a_{u_i}\right|,\ a_u\subset A_U,$$
$$a_{u_i}\subset A_U:\left|a_{u_i}\right|=1.$$

An $a_{u_i}$ acts on behalf of its human owner (i.e., user) in the discovery process of a suitable service $is_i$. An $a_{u_{req}}$ wishes to get the best advertised Internet service from the set of all advertised Internet services ($\cup is_{adv}$) which can successfully fulfill its needs (the requested $is_i$ is denoted as $is_{req}$) (interaction **2** in Figure 3).

## The Broker Agent

Mediation between Internet service requesters (i.e., users) and providers (i.e., ISPs) is performed by service broker *SB*. There is one *SB* located on every B2C e-market and it is represented by the Broker Agent $A_B$:

$A_B{:}|A_B|=1.$

The $A_B$ mediates between $u$ (i.e., $a_u$) and all $isp$ (i.e., $a_p$) which advertise their services on this e-market. An $A_B$ enables $A_p$ to advertise its service descriptions and proposes the most eligible service to $a_u$ in response to its requests (the most eligible $is_i$ is denoted as $is_{\mathrm{win}}$) (interaction **3** in Figure 3). It is assumed that $A_B$ is a trusted party which fairly mediates between service requesters and service providers.

Figure 3 also depicts actions which enable service discovery in the proposed B2C e-market. Firstly (interaction **1**), $a_p$ advertises its services ($is_{\mathrm{adv}}$) with the Broker Agent $A_B$. Sometime after, user agent $a_{u_{\mathrm{req}}}$ requests an Internet service most similar to the its needs (i.e., most similar to $is_{\mathrm{req}}$) by sending CFP (*Call for Proposal*) to $A_B$ (interaction **2**). The $A_B$ then performs matchmaking ($m_{\mathrm{disc}}$) between the requested service requested service $is_{\mathrm{req}}$ and all advertised services ($\cup is_{\mathrm{adv}}$), where matchmaking is defined as:

$$m_{\mathrm{disc}}(is_{\mathrm{req}},is_{\mathrm{adv}}):ISP\times ISP\rightarrow[0,1],\forall is_{\mathrm{adv}}.$$

Following matchmaking, the most eligible service $is_{\mathrm{win}}$ ($is_{\mathrm{adv}}$ with the highest $m_{\mathrm{disc}}(is_{\mathrm{req}},is_{\mathrm{adv}})$ value) is chosen and proposed to the $a_{u_{\mathrm{req}}}$ in response to its request (interaction **3**).

## Service Matchmaking

Semantic Web languages, such as Resource Data Framework (RDF, http://www.w3.org/RDF/), RDF Schema (RDFS, http://www.w3.org/TR/rdf-schema/) and the Web Ontology Language (OWL, http://www.w3.org/TR/owl-features/), can be used to describe Internet services (Internet service descriptions are hereafter referred to as service profiles) With the help of various query languages, based on Structured Query Language (SQL) syntax, it is possible to perform very efficient semantic matchmaking, providing the service profiles have been created according to a certain standard.

In computer and information sciences, an ontology is a formal representation of a set of concepts within a domain and the relationships therein. It is used to reason the properties of that domain, as well as to define it For example, an ontology can contain knowledge regarding an Internet service. Part of such ontology is shown in Figure 4 (Frkovic, Podobnik, Trzec, & Jezic, 2008).

Common attributes used for describing objects can be classified as follows:

- *Interval*: An interval attribute is defined by a continuous linear scale divided into equal intervals (e.g., display resolution, available memory);
- *Ordinal* (or *rank*): An ordinal attribute has multiple states that can be ordered in a meaningful sequence. The distance between two states increases as they are further apart in the sequence Furthermore, intervals between consecutive states can differ. As an example, *Quality of Service (QoS)* in Figure 4 could be qualified as an ordinal attribute with values *Bronze, Silver,* and *Gold*);
- *Nominal* (or *categorical*): A nominal attribute takes on multiple states, but these states are not ordered in any way. In the ontology shown in Figure 4, *preferred content type* is an example of a nominal attribute.
- *Binary*: A binary attribute is a nominal attribute that has only two possible states (e.g., *data transfer type* can be *streaming* or *nonstreaming*).

Apart from the basic parts mentioned above, attributes can also contain references to other objects within the ontology.

Table 1 shows how service profile matchmaking is done. Each attribute in the service profile is asserted individually, while the end result is the arithmetic mean of the individual attribute scores. The details about the semantic matchmaking procedure follow:

Figure 4. Part of an Internet service ontology

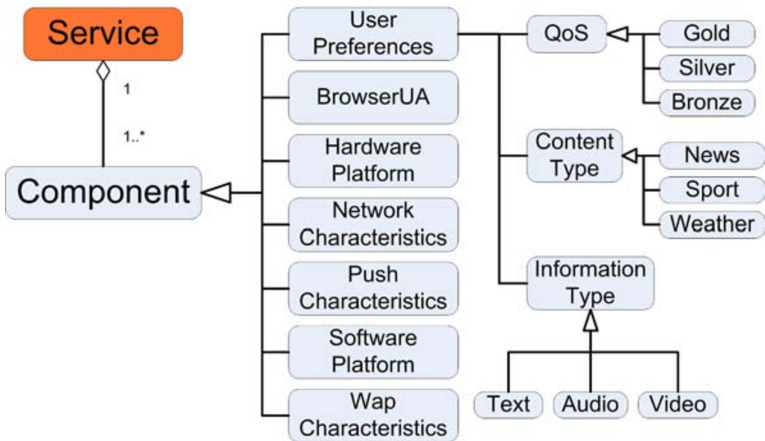
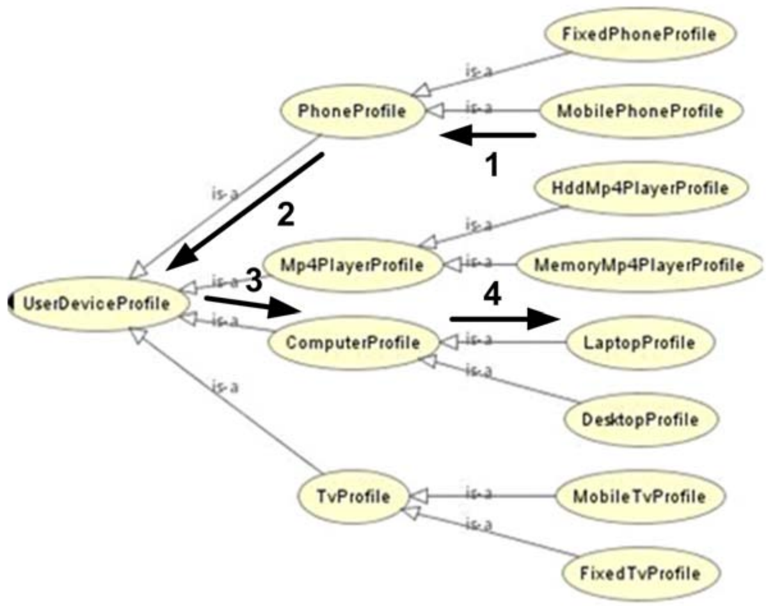



Table 1. Profile comparison results

| Attribute | Type | Value (service A) | Value (service B) | Score |
|---|---|---|---|---|
| | | | | |
| **ID** | abstract | Mobile 1 | Laptop 1 | none |
| **Class** | class | MobilePhoneProfile | LaptopProfile | 0,250 |
| **User preferences** | | | | |
| InformationType | instance | PlainText | Avi | 0,250 |
| InformationService | instance | CroatiaPoliticsInstance | MoviesInstance | 0,142 |
| Language | instance | English | Hrvatski | 0,500 |
| Genre | instance | RockMusic | ThrillerMovie | 0,250 |
| QoS | instance | Silver | Gold | 0,500 |
| DeliveryType | instance | NonStreaming | Streaming | 0,500 |
| **Hardware** | | | | |
| AvailableMemory | integer | 18000 | 1000000 | 0,018 |
| HorizontalResolution | integer | 180 | 1600 | 0,113 |
| VerticalResolution | integer | 230 | 1050 | 0,219 |
| BitsPerPixel | integer | 16 | 32 | 0,500 |
| **Software** | | | | |
| Os | instance | BasicOs | WindowsVista | 0,500 |
| Browser | instance | SonyEricssonBrowser | MozillaFirefox | 0,500 |
| JavaVersion | integer | 15 | 16 | 0,940 |
| | | | | |
| | | | **Profile similarity** | **0,370** |

- *Position within the class hierarchy*: Each service profile is an instance of a certain class from the ontology. Figure 5 shows how the class hierarchy position is transformed into a real number that reflects the similarity between two classes, or objects.

*Figure 5. Class hierarchy*




A greater distance between two classes should result in a decreasing similarity between class instances. For example, we can see that the *MobilePhoneProfile* and *LaptopProfile* classes are separated by four steps in the hierarchy. The similarity score is calculated as the inverse of the number steps (in this case 4), giving a similarity score of 0,25;

- *Common attribute types*: When comparing binary and nominal attributes, the result is either *0* (if the values are not the same), or *1* (if the values are identical). When comparing ordinal attributes, the result is a number between *0* and *1*, depending on the rank of each value. The result is calculated as the ratio between the smaller and the bigger number: e.g., when comparing the *Silver* and *Gold* levels of *QoS,* the similarity score is 0,5;
- *Attributes with object values*: Some attribute values contain references to other class instances. They can also be compared using the previously mentioned approach of class hierarchy positioning

## FUTURE RESEARCH DIRECTIONS

The future of provisioning emerging Internet services is directed towards creating an environment aware of user preferences, device capabilities, and communication context. In other words, it takes into account personalization, as well as collaboration issues, through dynamic user group formation defined by similar characteristics (user preferences, user device, context, etc.). Consequently, our research efforts will be aimed at extending the presented agent-mediated B2C e-market with group-oriented provisioning features. In particular, we will investigate different clustering techniques in order to identify groups of customers with homogeneous buying preferences, so-called market segments. Such an e-market will have large number of users that interact and form a complex trading (social) network. Consequently, we aim to implement broker agents capable of executing both scalable and computationally efficient graph clustering algorithms suitable for dealing with multidimensional data sets, such as service profiles.

In many respects, intelligent agents on the presented B2C e-market are likely to benefit from a closer interaction of both ontology-based knowledge representation and graph clustering techniques. Therefore, our future research will also be directed towards building agent architectures that enable synergistic usage of Semantic Web technologies with graph clustering techniques to provide sufficient incentives and motivation for users and providers to participate in B2C e-markets at large.

## CONCLUSION

In this article, we presented an agent-based framework for the B2C e-market where interactions between User Agents, Broker Agents and Provider Agents enable Internet users to select the most suitable Internet service provider (ISP) in an automated manner. The main benefit of the proposed approach is seen in situations when many ISPs offer the same or similar Internet service. Namely, in such cases, the user cannot search for the content manually or exhaustively.

## REFERENCES

Anderson, J., & Rainie, L. (2006). *The future of the Internet II*. Pew Internet and American Life Project.

Davis, M. (2007). *Semantic Wave 2008 Report: Industry Roadmap to Web 3.0 & Multibillion Dollar Market Opportunites.* Project10X.

Fischer & Lorenz (European Telecommunications Consultants). (2000). *Internet and the Future Policy Framework for Telecommunications.* Copenhagen: Fischer & Lorenz A/S.

Frkovic, F., Podobnik, V., Trzec, K., & Jezic, G. (2008). Agent-Based User Personalization Using Context-Aware Semantic Reasoning. *Lecture Notes in Artificial Intelligence*, *5177*, 166–173.

Guttman, R. H., Moukas, A. G., & Maes, P. (1998). Agent-Mediated Electronic Commerce: A Survey. *The Knowledge Engineering Review*, *13*(2), 147–159. doi:10.1017/S0269888998002082

Podobnik, V., & Lovrek, I. (2008). Multi-Agent System for Automation of B2C Processes in the Future Internet. In *Proceedings of IEEE Conference on Computer Communications (INFOCOM) Workshops 2008* (pp. 1-4). Phoenix, AZ: IEEE.

Reid, M., & Gray, C. (2007). Online Social Networks, Virtual Communities, Enterprises, and Information Professionals. *Searcher*, *15*(7), 32–51.

Weiser, M., & Brown, J. S. (1997). The Coming Age of Calm Technology. In P. J. Dening, R. M. Metcalfe, & J. Burke (Eds.), *Beyond Calculation: The Next Fifty Years of Computing* (pp. 75-86). New York: Springer-Verlag.

## ADDITIONAL READING

Ackoff, R. (1989). From Data to Wisdom. *Journal of Applied System Analysis*, *16*, 3–9.

Amin, M., & Ballard, D. (2000). Defining New Markets for Intelligent Agents. *IEEE IT Professional*, *2*(4), 29–35. doi:10.1109/6294.869380

Antoniou, G., & van Harmelen, F. A. (2004). *Semantic Web Primer.* Cambridge, MA: MIT Press.

Bellavista, P., Corradi, A., Montanari, R., & Tonin, A. (2006). Context-Aware Semantic Discovery for Next Generation Mobile Systems. *IEEE Communications*, *44*(9), 62–71. doi:10.1109/MCOM.2006.1705981

Berners-Lee, T. (2000). *Weaving the Web: The Original Design and Ultimate Destiny of the World Wide Web.* New York: HarperCollins Publishers.

Berners-Lee, T., Hendler, J., & Lassila, O. (2001). The Semantic Web. *Scientific American*, *284*(5), 34–43. doi:10.1038/scientificamerican0501-34

Bradshaw, J. M. (1997). *Software Agents.* Cambridge, MA: MIT Press.

Chorafas, D. N. (1998). *Agent Technology Handbook.* New York: McGraw-Hill.

Cockayne, W. T., & Zyda, M. (1998). *Mobile Agents.* Greenwich, CT: Manning Publications.

Fasli, M. (2007). *Agent Technology for E-Commerce.* Chichester, UK: Wiley & Sons.

Fensel, D. (2004). *Ontologies: A Silver Bullet for Knowledge Management and Electronic Commerce.* Berlin: Springer-Verlag.

He, M., Jennings, N. R., & Leung, H. (2003). On Agent-Mediated Electronic Commerce. *IEEE Transactions on Knowledge and Data Engineering*, *15*(4), 985–1003. doi:10.1109/TKDE.2003.1209014

Keller, U., Lara, R., Lausen, H., Polleres, A., & Fensel, D. (2005). Automatic Location of Services. *Lecture Notes in Computer Science*, *3532*, 1–16.

Leuf, B. (2006). *The Semantic Web: Crafting Infrastructure for Agency.* New York: Wiley.

Li, L., & Horrock, I. (2003). A Software Framework for Matchmaking Based on Semantic Web Technology. In *12th International World Wide Web Conference (WWW'03)* (pp. 331–339). Budapest: ACM.

Ljubi, I., Podobnik, V., & Jezic, G. (2007). Cooperative Mobile Agents for Automation of Service Provisioning: A Telecom Innovation. In *Proceedings of the Second IEEE International Conference on Digital Information Management* (pp. 817-822). Lyon, France: IEEE.

Podobnik, V., Jezic, G., & Trzec, K. (2007). A Multi-Agent System for Auction-Based Resource Discovery in Semantic-Aware B2C Mobile Commerce. *International Transactions on Systems Science and Applications*, *3*(2), 169–182.

Podobnik, V., Jezic, G., & Trzec, K. (2008). Towards New Generation of Mobile Communications: Discovery of Ubiquitous Resources. *Electrotechnical Review*, *75*(1-2), 31–36.

Podobnik, V., Petric, A., & Jezic, G. (2008). An Agent-Based Solution for Dynamic Supply Chain Management. *Journal of Universal Computer Science*, *14*(7), 1080–1104.

Podobnik, V., Petric, A., Trzec, K., & Jezic, G. (2009). Software Agents in New Generation Networks: Towards the Automation of Telecom Processes. In J. C. Lakhmi, & N. T. Nguyen (Eds.), *Knowledge Processing and Decision Making in Agent-Based Systems* (pp. 71-99). Berlin Heidelberg: Springer-Verlag.

Podobnik, V., Trzec, K., & Jezic, G. (2006). An Auction-Based Semantic Service Discovery Model for E-Commerce Applications. *Lecture Notes in Computer Science*, *4277*, 97–106. doi:10.1007/11915034_32

Podobnik, V., Trzec, K., & Jezic, G. (2007). Context-Aware Service Provisioning in Next-Generation Networks: An Agent Approach. *International Journal of Information Technology and Web Engineering*, *2*(4), 41–62.

Podobnik, V., Trzec, K., Jezic, G., & Lovrek, I. (2007). Agent-Based Discovery of Data Resources in Next-Generation Internet: An Auction Approach. In *Proceedings of the 2007 Networking and Electronic Commerce Research Conference (NAEC'07)* (pp. 28-51).

Saha, D., & Mukherjee, A. (2003). Pervasive Computing: A Paradigm for the 21st Century. *IEEE Computer*, *36*(3), 25–31.

Sycara, K., Paolucci, M., Soudry, J., & Srinivasan, N. (2004). Dynamic Discovery and Coordination of Agent-Based Semantic Web Services. *IEEE Internet Computing*, *8*(3), 66–73. doi:10.1109/MIC.2004.1297276

Trzec, K., Lovrek, I., & Mikac, B. (2006). Agent Behaviour in Double Auction Electronic Market for Communication Resources. *Lecture Notes in Artificial Intelligence* (LNCS Vol. 4251, pp. 318-325).

Weiser, M. (1991). The Computer for the 21st Century. *Scientific American*, *265*(3), 94–104.

Weiser, M. (1994). The World is not a Desktop. *Interactions (New York, N.Y.)*, *1*(1), 7–8. doi:10.1145/174800.174801

Wurman, P. R., Wellman, M. P., & Walsch, W. E. (2002). Specifying Rules for Electronic Auctions. *AI Magazine*, *23*(3), 15–24.

Yoon, J.-L. (2007). Telco 2.0: A New Role and Business Model. *IEEE Communications Magazine*, *45*(1), 10–12. doi:10.1109/MCOM.2007.284530

## KEY TERMS AND DEFINITIONS

**Next-Generation Internet:** An Internet which enables people and machines to connect, evolve, share, and use knowledge on an unprecedented scale.

**Internet Service:** Any service provided to the user through the Internet infrastructure.

**Intelligent Software Agent:** A program which autonomously acts on behalf of its human (or organizational) principal while carrying out complex information and communication tasks which have been delegated to it.

**Electronic Market:** An ICT-based system that creates value by bringing together stakeholders in the market to enable transactional immediacy and supply liquidity, by supporting the exchange of demand and supply information, and reducing transaction time and cost.

**Semantic Web:** An extension of the current Web in which information is given well-defined meaning, enabling people and machines to connect, evolve, share, and use knowledge in a better way.

**ontology:** A description of concepts and relationships between these concepts in an area of interest. Therefore, an ontology is the terminology used for a given domain of interest.

**Service Discovery:** The process of searching for possible matches between requested and available services.

# Chapter 24
# Concept of an Agent-Based Electronic Marketplace

**Norleyza Jailani**
*Universiti Kebangsaan Malaysia, Malaysia*

**Ahmed Patel**
*Universiti Kebangsaan Malaysia, Malaysia*

**Muriati Mukhtar**
*Universiti Kebangsaan Malaysia, Malaysia*

**Salha Abdullah**
*Universiti Kebangsaan Malaysia, Malaysia*

**Yazrina Yahya**
*Universiti Kebangsaan Malaysia, Malaysia*

## ABSTRACT

*This study explains the concepts of an electronic marketplace (e-marketplace) and the types of e-marketplaces in today's computing environment that is facilitated and driven by the Internet. The concept of software agent and the different types of agents which may exist in an e-marketplace application in the current setting of the global economy is also discussed. Specifically the idea of using mobile agents in the implementation of an e-marketplace is investigated. This article also introduces an example of a mobile agent-based e-marketplace which offers secure infrastructure services. The complex and challenging computing environment in which agents operate requires efforts in the standardization and management of agents.*

## INTRODUCTION

The concept of conducting business transactions via the electronic media has been an essential part of many businesses during the last few decades. Currently, the Internet which provides a set of interconnected networks has made it possible for individuals and businesses to conduct business transactions electronically. The process of buying, selling, transferring or exchanging products, services, payments and/or information via computer networks such as the extranet, intranet and

DOI: 10.4018/978-1-61520-611-7.ch024

the Internet is called electronic commerce (EC) (Turban et al, 2008).

EC can be commonly distinguished by the relationships or transactions between the participants. Business-to-business (B2B) transactions are transactions carried out by businesses with other businesses which might be their supply chain members, suppliers and intermediaries that share business information. Business-to-Customer (B2C) refers to cases where the transacting parties are businesses and their individual customers. These mainly focus on retail transactions.

EC can be conducted in an e-marketplace where buyers and sellers meet online to exchange products, services, and/or information. Traditionally, a market has been used as a place to match buyers and sellers. However, the current climate of fierce global competition requires sellers to develop their own opportunities winning criteria in order to attract buyers. Likewise, buyers are presented with so many choices of products from various merchants such that the process of making business decisions has become more complex and time-consuming. A seller's objective is to maximize his/her revenue and possibly find loyal customers. On the other hand, a buyer now has a choice of not purchasing a product/service at a posted price. Price and other product/service attributes can be negotiated through a market mechanism such as an auction, thereby creating a healthy and fair competition.

How do buyers continuously monitor the availability of a product/service that are of interest to them? Likewise, how does a seller find potential buyers for the product/service that they are offering? The solutions to these problems form parts of the features provided by an e-marketplace. According to Bakos (1998) an e-marketplace plays a central role in facilitating the exchange of information, product, services and payment. The function of an e-marketplace is similar to a physical market except that the computerized system is more inclined to create more efficient markets by providing updated information to participating sellers and buyers. In addition, an intermediary also plays a vital role in providing value-added activities and services to the buyers and sellers. The intermediary collects buyers' requests and sellers' offers. Besides matching buyers' requests with suppliers' offers, it can also send unsolicited messages updating the buyers and sellers with current information that may be of interest and importance to them.

To enable distributed buyers and sellers to conduct online business transactions, many new business models have been proposed. The Internet and agent technology have been regarded as the enabling technology to realize many new business models ranging from e-shops, e-procurement, e-auction and e-mall to virtual enterprises and e-marketplaces (Timmers, 1998). These services differ in terms of the technological requirements, the participants involved and the potential benefits that can be harvested by market participants. This chapter elaborates upon the fundamental concepts of e-marketplace trading and how mobile agent technologies help create it in e-business environments.

## BACKGROUND OF ELECTRONIC MARKETPLACE

A market is a meeting place for buyers and sellers where they are able to engage in trading and commerce. An e-marketplace is a virtual space that serves as a meeting place for buyers and sellers and at the same time serves also as a provider of integrated knowledge about all products and services. Transactions in an e-marketplace are carried out via various market mechanisms. Three main functions of a market, traditional or otherwise facilitate (Zwass, 2003):

1) matching buyers and sellers;
2) as a moderator in the exchange of information, products, services and payment related to the transactions; and

3) to provide the infrastructure that acts as a legal institution and local authorities that are able to control and assist in the smoothness of the market functions.

An e-marketplace using the Internet has shown that it can function more efficiently when the role of the middleman as agent which is a common feature in traditional marketplaces is replaced by a new mediator in the form of a computer system which is able to provide up-to-date information and services to buyers and sellers in a rapid manner.

An e-marketplace is managed by an authority who is responsible to guarantee smooth transactions between buyers and sellers by providing a complete technological infrastructure. An example of this infrastructure is the secure e-payment infrastructure that is provided by Escrow.com. Escrow.com serves as a mediator that protects the buyer by transferring money into the seller's account only after the buyer has received the goods or services. It also protects the seller against credit card frauds. Other types of infrastructure that is usually required in an e-marketplace are the certificate authority which performs the role of verifying the identity of the buyer and the seller, directory service, broker, search engine, safety and privacy negotiator, e-invoice and e-payment, logistics, delivery, etc. Based on the infrastructures offered, the e-marketplace operator will usually charge some membership fees or a percentage of the sales to the seller.

The electronic marketplace has emerged as a strong agent of change in the economy. The impact can be seen economically by its contribution to the competitive advantage. It has reshaped entire industries, improved marketing and sales, transformed business processes and organizations and redefined the organization (Turban et al, 2008; Jessup and Valaciah, 2008).

## Types of Electronic Marketplaces and Their Features

E-marketplaces can be categorized into four types, namely buy-side, sell-side, third party exchanges and vertical or horizontal marketplace. Each category is briefly explained here.

### Buy-Side

Buy-side e-marketplace applications represent organizations that use the EC facilities to procure products or services needed by their organizations via immediate buying methods and procurement. In the buy-side, there is one buyer and many sellers. An example of a buy-side e-marketplace is an organization that develops an e-procurement system to fulfill the buying and procurement needs of the organization from various registered suppliers. An organization that uses this solution is PETRONAS, Malaysia's national oil company. PETRONAS extended its purchasing ability by integrating a Supplier Portal to its legacy SAP system (MyBiz, 2009).

### Sell-Side

Sell-side e-marketplace is a platform for an organization to sell its products and services to other organizations via a transaction mechanism that is usually found in an e-business application. The seller can directly sells its products and services via a portal or a private e-catalogue or via connecting its e-catalogue to other bigger e-marketplaces. In the sell-side, there is one seller and many buyers. An example of an organization that uses this sell-side platform is the computer parts supplier Cisco at cisco.com and Dell at dell.com.

## Third Party Exchanges

Neutral e-marketplace that is operated by a third party is known as a third party e-marketplace. It can be in the form of a consortium of companies or an independent company that manages an e-marketplace computer server and the service infrastructures required by an e-marketplace. Among the service infrastructures offered include e-catalogues, e-shopping cart, e-payment etc. Via a third party e-marketplace, various organizations can sell products and services to other organizations. A third party e-marketplace can help businesses identify and conduct business with its suppliers and future buyers from a registered list of e-marketplace participants. This business model can help reduce the buyer's costs and it allows the seller to market its products and services to a wider group of potential customers.

### Vertical and Horizontal Marketplace

Vertical e-marketplace adds value by managing the interactions between buyers and sellers in a particular industry sector. It provides all inputs and strategies necessary to operate in the particular industry. It is usual to find that this type of e-marketplace concentrates only on a specific industry and only on special products and services such as the chemical industry, health industry, construction industry, automotive industry etc. An example of a vertical exchange is ChemConnect at chemconnect.com. The objective of this type of e-marketplace is to increase the efficiency of the supply chain by developing a virtual market and by increasing the coordination between buyers and sellers. Horizontal e-marketplaces are markets that are product focused. For example, there are e-marketplaces that are developed solely for the purpose of buying and selling products that are required in a production facility but are not part of the finished products produced by the facility. An example of a horizontal exchange is Ariba Supplier Network at ariba.com.

## Market-Making Mechanisms in E-Marketplaces

There are two popular market-making mechanisms that can be used in the e-marketplaces, namely aggregation and matching (Papazoglou and Ribbers, 2006; Kaplan and Sawhney, 2000). These mechanisms can be adapted to support e-business processes and applications.

### Types of Aggregation Mechanisms

There are several aggregation market-making mechanisms. Each of which is explained below.

**Portals and E-Catalogues**

An e-marketplace that uses aggregation acts as a virtual one-stop shop. The price of products or services is determined in advance. Examples of e-business applications that use the aggregation mechanism are portals and e-catalogues which sell goods and services from several suppliers at a posted price. A portal is a single point of access through a web browser to business information located inside and/or outside an organization. E-catalogues comprise of a products database, directory and search engines and a presentation function (Turban et al, 2008).

**E-Barter**

E-barter is where business is conducted through the exchange of products. The transactions are normally conducted through intermediaries such as barterdepot.com. A Canadian portal e-Barter.ca at ebarter.ca for example was conceived to offer exchange-style services to small businesses to provide services for one another. A manufacturer of white box PCs, for instance, could supply a marketing firm with desktops in exchange for some advertising help.

### Types of Matching Mechanisms

There are several matching mechanisms. Each of which is explained below.

**Auctions**

In a matching mechanism, buyers and sellers meet to confer on the price dynamically in real-time through a bargaining process using the electronic auction. There are two types of auction configurations. The first one is known as the forward auction. Here, there is one seller and many potential buyers. The seller submits a product or service for bidding and several buyers compete to offer the price they are willing to pay for the product or service. The seller can accept any bid or reject all. The popular forward auctions are the English auction, Japanese Auction, Quick-Win Auction, Yankee© auction and Dutch auction (Turban et al, 2008; Dans, 2002). In the English auction, the seller announces the initial low bid, which is progressively increased. The winner is the highest bidder and pays the price bid. The Japanese auction is where the bid price rises at set increments and the participants drop out until only the winning bidder remains. This auction is faster than the English auction. In the Quick-Win auction, a seller can enter his product into a quick win auction by specifying a minimum price that he or she will accept. When a buyer agrees to pay that amount, the item is immediately sold. The Yankee© auction is where the successful bidders pay what they bid as opposed to paying the price determined by the lowest qualified bidder. It starts at an acceptable minimum price and the bid increases according to time. The highest bidder wins. The Dutch auction works in the opposite way where the winning bid is the lowest acceptable price. The second type of configuration is where there is one buyer and many potential sellers. This type of auction is known as the reverse auction and Name-Your-Own-Price© (Turban et al, 2008). In the reverse auction or a buyer driven auction, it is the sellers rather than buyers that compete to offer the lowest price for products. The buyer can accept any bid or reject all. In Name-Your-Own-Price©, buyers make an offer to a seller or group of sellers for products based on their estimate of the sellers' lowest acceptable bid.

**E-Negotiation**

E-negotiation is an electronic bargaining process to obtain a mutual agreement. The basis of the agreement can also comprised of attributes other than price, such as time, payment and delivery method. It is normally used for specialized and expensive products or large quantity of products. E-negotiation can be easily conducted today due to three factors. Firstly, because products or services can be customized according to a buyer's requirements, secondly, the enabling computing and communication technology and thirdly, intelligent agent technology which is able to facilitate product/service searching and comparison efficiently.

## CONCEPT OF AN AGENT-BASED E-MARKETPLACE

A software agent is a computational entity which is able to function *autonomously* and with *flexibility* in an environment, usually also inhabited by other agents and processes (Jennings et al, 1998). These two criteria distinguish a software agent from other software. Autonomous here means that, it has control of its own tasks and is capable of accomplishing complex tasks designed for it without human or other agents' intervention. Flexibility is defined as its responsive, pro-active and sociable behavior to react towards changes it receives from the environment. In summary, a software agent is a computer system that is capable of flexible autonomous action in dynamic, unpredictable, typically multi-agent domains. The Internet has created an ideal operating environment for software agents, particularly in e-business and management applications. The main achievements of the software agent technology include frameworks and platforms based on standardized languages and architectures for agent systems development. Implemented software agents are claimed to have attractive features such as intelligence, adaptability, communicability and compatibility, autonomy and mobility. Some of these features are discussed next.

## Types of Agents in E-Business and Management Applications

A wide range of agent types can be deployed in e-business applications (Luck et al, 2003; Chen, 2000; Jennings et al, 1998; Nwana, 1996; Wooldridge and Jennings, 1995). There are described as below.

### Intelligent Agent

Intelligent agents have a certain degree of specific domain knowledge with which gives them the capability of reasoning and learning. This capability requires the agent to have access to a knowledge base and an inference engine for reasoning and iteratively contributing new information to the knowledge base. The capability of learning also determines the adaptive behavior of an agent to effectively handle new situations or contexts.

### Collaborative Agent

Collaborative agent has the capability to negotiate and communicate effectively with other agents, users and systems through a universally agreed nomenclature, communication language and interoperability norms. Inter-agent communication is carried out using, for instance, a knowledge query manipulation language that assumes specific domain ontology for specific agent applications. For example, an e-market buying auction agent will have to understand the concept of bidding a combined air-flight, hotel and car rental package in order to be able to negotiate deals with auction selling agents. It is a pre-requisite that agents will have some basic general ontology as a minimum requirement to be effective.

### Mobile Agent

Intelligent agents may have a certain degree of mobility operating as "free-roving" agents. Agents that can roam are called mobile agents. This means that the agent is not restricted to its home-base platform. It has the capability to migrate to other platforms where it can perform tasks remotely, thus reducing processing load on its home platform and reducing communication overheads. There is also the possibility of the agents to keep functioning after its home device has gone off-line. Mobile agent supports asynchronous computing and reduces the dependency on network availability and avoid network latency. A good example is a World Wide Web off-line search agent that is capable of retrieving desired e-marketplace information on behalf of the user according to his profile. The mobile agent is told what to look for, and then dispatched to carry out the search off-line. After a while, the agent will return with the desired information. The user can then decide what to do next. This level of intelligent knowledge operation implies that agents can be implemented to operate in a legal ("licensed") or illegal ("rogue/masquerading") manner, which needs effective and efficient management. Mobile devices with limited resources such as cellular phones can also benefit from mobile agent by transferring a task requiring complex computation to a host on a fixed network. Mobile agent provides a flexible distributed computing architecture; hence, management of these agents is crucial for a trusted e-business mobile environment.

### Interface Agent

Interface agents support and provide proactive assistance to a user learning to use e-business applications by observing and monitoring the actions taken by the user in the interface. The agents can learn new short cuts and recommend better ways of doing the tasks. They help to overcome the problem concerning user interaction, by finding a way to accommodate the end users so that interacting with the system becomes seamless and transparent.

## Mobile Agent Roles in an E-Marketplace as New Intermediaries

An e-marketplace is a flexible and efficient example of an e-business application which brings buyers and sellers together online, thereby playing the role of a digital intermediary. However, a typical e-marketplace consisting of a Web portal which only aggregates e-shops is not sufficient for today's challenging business environment. Within a value chain, anyone of the market participants might be the initiator or market maker of its electronic market. This means that the market maker can be the producer right down to the procurer, plus any intermediary, such as financial service providers, distributors, and the Internet and telecommunication service providers. E-marketplace participants expect more of these services to be available all the time not only from fixed desktop computers, but also preferably from their mobile devices.

An e-marketplace as one example of modern e-business applications pose difficult problems concerning cost reduction, profitability and efficiency improvement, interoperability and decision-making, thus making them a fertile and rich real-world environment for the application and experimentation of software agents. Some of the research challenges involve the adaptation of relevant software agent technologies, development methodologies and tools to meet the tight requirements of modern e-business. However, end-users are wary of using mobile software agents as they raise a number of security issues (Leavitt, 2000). Mobile agents can carry malicious codes which may perform passive or active attacks on any host they visited to gain access to confidential business information. On the other hand, they also need protection against other malicious hosts that might alter the information they carry when they visit the hosts in their itineraries.

A mobile agent-based system named *Shopping Consultant Agent System* (Kannammal et al, 2006) was developed using the Java Agent Development Environment (JADE, 2009). The system was used to collect the prices of a set of products specified by users from different seller hosts in an electronic market. The work analyzed the security attacks to mobile agents by malicious hosts and proposed solutions based on public key authentication technique and cryptography to address some of these problems. Another work (Chen et al, 2000) proposed a mobile agent-based e-commerce process. The work described the working flow for mobile agent-based e-commerce and then indicated the system should solve the relations between security, autonomy and open system issues with the combination of secure protocol in e-commerce. Song and Korba (2003) proposed the security communication architecture for mobile agents in e-commerce application. They analyzed the risk of active and passive attacks for mobile agent and e-commerce and proposed security protocol to provide a secure communication for the mobile agents when they move to different environments to deal with some e-commerce processing such as ordering and payment. Mobile Agents for Networked Electronic Trading (MAgNET) (Dasgupta et al, 2002) was a system developed on the Aglets platform (Aglets, 2009) which is designed for supply chain management where mobile agents deal with the procurement of several components needed to manufacture a complex product. In the system, the buyer site maintains a list of potential suppliers along with their lists of products. A buyer who is interested in acquiring a product creates a mobile agent, specifies criteria for the acquisition of the product, and dispatches the mobile agent to the potential suppliers. The mobile agent visits each supplier site, searches the product catalogs according to the buyer's criteria, and returns to the buyer with the best deal it can find. The buyer either confirms the deal and proceeds with the monetary transaction, or aborts the query and disposes the agent.

In summary, mobile agents play significant roles in e-marketplace from the initial stage where a user makes a request to participate in the e-marketplace until he completes his trans-

*Table 1. Agent roles in e-marketplace*

| Process | User Interface Agent Role | Associate Mobile Agent / Management Agent Role |
|---|---|---|
| Equipping users with security tools | -Acquire users' certificate and keys | Certification Authority |
| Entering e-marketplace | -Create buyer agent or seller agent<br>-Acquire authentication for user<br>-Register with the marketplace | Authentication Agent |
| Negotiating privacy conditions | -Receive privacy conditions<br>-Pass the information to buyer agent or seller agent for negotiation | Buyer Agent or Seller/Supplier Agent and Privacy Negotiation Agent |
| Selecting broker based on preferred market mechanism and searching desired product | -Receive request for broker and desired product<br>-Search for product and presents product information | Buyer Agent or Seller/Supplier Agent |
| Advertising a product (Supplier) | -Receive product information from user<br>-Wrap information into seller agent to forward user and product information to the broker agent | Seller/Supplier Agent |
| Negotiate product attributes (price, quality, delivery date, quantity, etc) using market mechanism implemented by broker and purchasing a product (Buyer) | -Receive personal, financial, other information required for product attributes negotiation from user<br>-Wrap information into buyer agent to be used for negotiation and purchasing | Buyer Agent, Broker Agent, Payment gateway and Delivery Agent |
| Acquiring details of product/service delivery information | -Receive information on delivery of products or services | Logistic Agent |
| Requesting forensic investigation on a transaction | -Receive request for digital forensic investigation on a specific transaction from user | Digital Forensic Agent |

actions. The processes include providing users with security tools such as certificate and keys, entering the e-marketplace, negotiating privacy conditions, selecting appropriate broker and searching for desired products or services, advertising products (for sellers), negotiating product attributes and purchasing of products (for buyers), processing payment, acquiring delivery information and requesting for a forensic investigation to be carried out on a specific transaction if a user suspects there is a security breach. An interface agent should be able to assist users such that user input is kept to a minimum. Table 1 shows the roles played by the interface agent and the associated agent/management agent involved in the abovementioned processes.

An e-marketplace may have several broker agents distributed in different hosts. Mobile buyer and seller agents can be easily transferred to their respective brokers. Therefore, it has become necessary to address the issues concerning security, privacy, trust and safety issues raised by mobile agents such as protecting personal confidential information, trust in all participating parties, legitimacy, authentication, communication, migration and payment processing. Figure 1 shows an example of a third party agent-based e-marketplace architecture which uses mobile agent technology for the buyer and seller agent, and infrastructure services as management agents which amongst others include certificate authority, secure electronic payment, logistic, trustworthy and digital forensic agent for tracing transactions, etc.

## Agent Standardization and Management

Agents, like humans, co-operate so that a society of agents can combine their abilities to solve problems and resolve conflicts. Due to the collaborative nature of multi mobile agent systems operating from different platforms, an agent standard represents a key requirement for successful interworking and interoperability. Mobile agent-based services will see a new generation of very complex Internet systems to support such e-activities. They will have a significant impact on the shape of the global information society in the next millennium. The management of these mobile agents in heterogeneous e-marketplace infrastructures is necessary for several vital reasons:

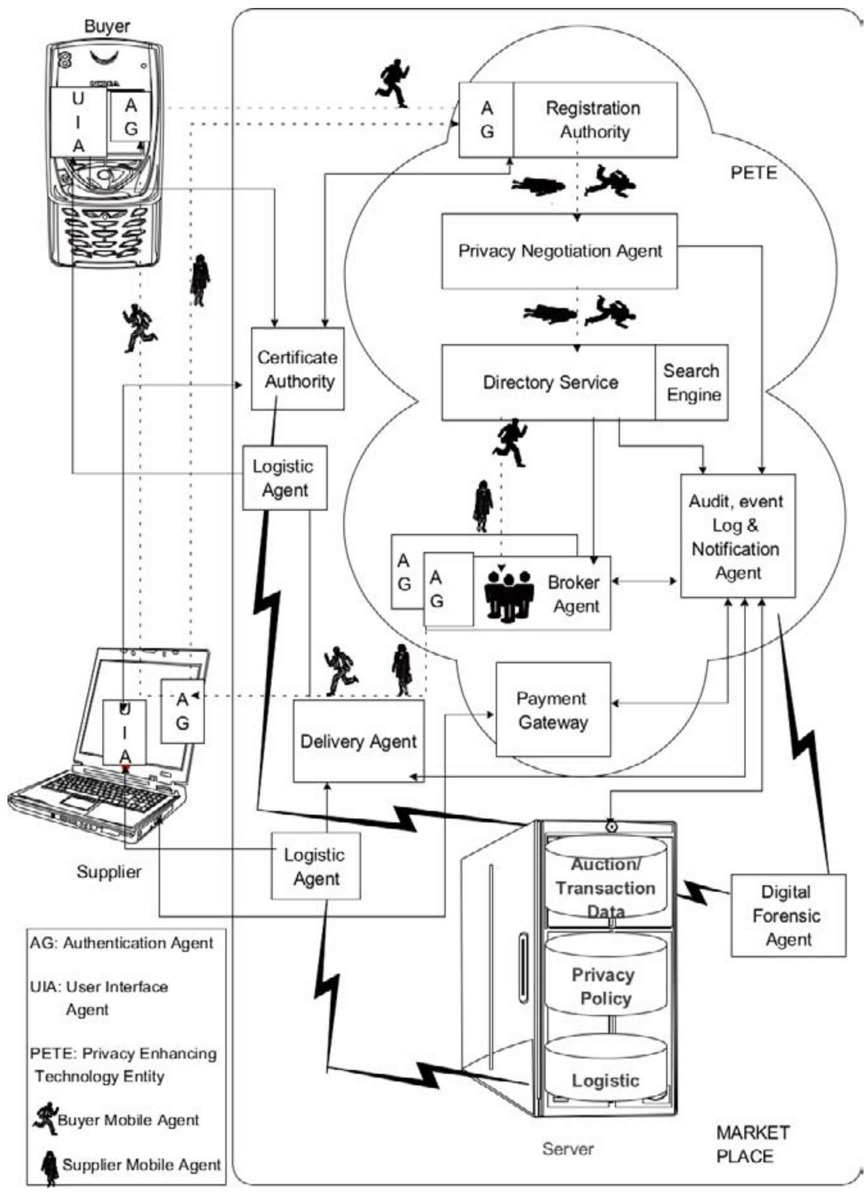
- To handle interoperability issues between various autonomous multi mobile agent systems.
- To aid in the discovery of service offerings and authorized usage of resources.
- To catch unauthorized agents masquerading to do damage, sniff vital personal and private information for subsequent illegal trading activities.
- To monitor the network resources, services and users via discovery agents.
- To handle issues regarding accountability and the monitoring of their overall behavior and performance.
- To track and analyze activities that affects critical services such as auctioning and e-payment in a secure and unobtrusive environment for forensic reasons.

There are already a number of mobile agent system implementations, such as AgentTcl, Aglets, Odyssey, Leap and Grasshopper which are incompatible with each other. To-date, two international organizations have proposed standards for mobile agent systems namely Foundation of Intelligent Physical Agents (FIPA) (http://www.fipa.org) and Mobile Agent System Interoperability Facility (MASIF) defined by the Object Management Group (OMG). Although MASIF and FIPA share many common properties, there are differences, particularly for interoperability in distributed agent platforms and computing systems which require conversion between them (Baumer et al, 1999; Zeghache et al, 2007). OMG MASIF aims at enabling mobile agents to migrate between agent systems of the same profile (language, agent system type, authentication type and serialization methods) via standardized CORBA IDL interfaces. FIPA works on enabling the intelligent agent's interoperability via standardized agent communication and content languages. However, in FIPA standards there is no specification about agent mobility.

## FUTURE RESEARCH DIRECTIONS

Previous works (Au et al, 2004; Wang et al, 2007; Zhang et al, 2005; Claessens et al, 2001) on agent-based e-marketplace have focused on issues of security, privacy, trustworthy and safety, and less attention has been paid to the requirements of digital forensics of transactions that happens in e-marketplaces. Many have proposed security protocols (Antoniou et al, 2007; Hao and Liu, 2006; Jailani et al, 2008) within a framework but we have yet to see a workable implementation. Future research should also focus on enabling e-marketplaces to support mobile-commerce where end-users can conduct complete transactions over Internet-enabled mobile devices. Research should also focus on the location of e-commerce whereby activities such as sending unsolicited advertisements to users based on current user location are carried out. Other issues that the standards bodies will have to address as part of the multi-agent management strategy are on the security measures for the non-mutilation of messages to avoid disturbance and miscommunication, privacy for non-disclosure of messages between agents, and non-repudiation to avoid denial of messages being sent for legal and forensic reasons. Another area is electronic payment whereby it is expected that in the future, agents will have to pay, especially when using resources on remote locations. This gives rise to issues related to security and the mechanisms for automated electronic payment.

*Figure 1. A secure third party agent-based e-marketplace framework (Adapted from Jailani et al, 2008)*




## CONCLUSION

This paper presented an overview of the fundamental concepts of an e-marketplace and it features. It also presents the potential of using agent technologies in e-marketplaces. The advantages and issues involved in using mobile agents for an e-marketplace implementation, and the requirements of standardization and agent management are discussed. This culminates in a proposed secure third party agent-based e-marketplace framework. Future research directions are also given.

## REFERENCES


Agent Management Specification, F. I. P. A. Foundation for Intelligent Physical Agents, FIPA TC Agent Management (2004/18/03), http://www.fipa.org/specs/fipa00023/SC00023K.html retrieved April 20, 2009.

*Aglets*. (n.d.). Retrieved May 28, 2009, from http://aglets.sourceforge.net

Antoniou, G., Sterling, L., Gritzalis, S., Udaya, P. (2007 October). Privacy and Forensics Investigation Process: The ERPINA Protocol. *Journal of Computer Science & Interface*.

Au, R., Vasanta, H., Choo, K. R., & Looi, M. (2004). A User-Centric Anonymous Authorisation Framework in E-Commerce Environments. In M. Janssen, H. G. Sol, & R. W. Wangenaar (Eds.), *Proceedings of the 6th International Conference in Electronic Commerce*, Delft, The Netherlands, October 25-27 (pp. 138-147).

Bakos, Y. (1998). The Emerging Role of Electronic Marketplaces on the Internet. *Communications of the ACM*, *41*(8), 35–42. doi:10.1145/280324.280330

Baumer, C., Breugst, M., Choy, S., & Magedanz, T. (1999). Grasshopper A Universal Agent Platform Based on OMG MASIF and FIPA Standards. In *First International Workshop on Mobile Agents for Telecommunication Applications (MATA'99)*, Ottawa, Canada (pp. 1-18).

Chen, N., Huang, S-Z., & Su, D-F. (2000). Research on Applied Technology of Mobile Agent in Electronic Business. *Journal Of Information Technology & Informatization*, (2).

Claessens, J., Preneel, B., & Vandewalle, J. (2001). Secure Communication for Secure Agent-Based Electronic Commerce Applications. In J. Liu & Y. Ye (Eds.), *E-Commerce Agents: Marketplace Solutions, Security Issues, and Supply and Demand* (LNAI 2033, pp. 180-190).

Dans, E. (2002). Existing Business Models for Auctions and Their Adaptation to Electronic Markets. *Journal of Electronic Commerce Research*, *3*(2), 23–31.

Dasgupta, P., Narasimhan, N., Moser, L. E., & Smith, P. M. (2002). MagNet: Mobile Agents for Parallel Processing. In *Proceedings of 3rd International Conference on Mobile Data Management (MDM 2002)* (pp. 61-68).

Hao, G.-Y., & Liu, F. (2006 October). Research on Computer Dynamic Forensic in E-marketplace Environment. *Market Modernization. JADE*. (n.d.). Retrieved May 28, 2009 from http://jade.tilab.com

Jailani, N., Yatim, N. F. M., Yahya, Y., Patel, A., & Othman, M. (2008). Secure and Auditable Agent-Based E-marketplace Framework for Mobile Users. *Computer Standards & Interfaces*, *30*(4), 237–252. doi:10.1016/j.csi.2007.10.009

Jennings, N., Sycara, K., & Wooldridge, M. (1998). A Roadmap of Agent Research and Development. *Journal of Autonomous Agents and Multi-Agent Systems*, *1*, 275–306.

Jessup, L., & Valaciah, J. (2008). *Information Systems Today: Managing in the Digital World* (3rd Ed.). Upper Saddle River, NJ: Prentice Hall.

Kannammal, A. Ramachandran, V., & Iyengar, N.Ch.S.N. (2006). Secure Mobile Agent System for E-Business Applications. *Computer Systems and Applications*, 326-329.

Kaplan, S., & Sawhney, M. (2000, May-June). E-Hubs: The New B2B Marketplaces. *Harvard Business Review*, 97–103.

Leavitt, N. (2000). Malicious Code Moves To Mobile Devices. *IEEE Computer*, *33*(12), 16–19.

Luck, M., McBurney, P., & Preist, C. (2003). *Agent Technology: Enabling Next Generation Computing-A Roadmap for Agent Based Computing*. AgentLink Community.

Marques, P. J., Silva, L. M., & Silva, J. G. (1999). Security Mechanisms For Using Mobile Agents In Electronic Commerce. In *Proceedings of the 18th IEEE Symposium on Reliable Distributed Systems* (pp. 378 – 383).

*MyBiz*. (n.d.). Retrieved June 5, 2009, from http://www.mybiz.net/index.php?option=com_content&view=article&id=99&Itemid=100

Nwana, H. S. (1996). Software Agents: An Overview. *The Knowledge Engineering Review*, *11*(3), 1–40. doi:10.1017/S026988890000789X

Papazoglou, M. P., & Ribbers, P. M. A. (2006). *E-Business: Organizational and Technical Foundations*. West Sussex, UK: John Wiley & Sons.

Song, R., & Korba, L. (2003 September). Security Communication Architecture for Mobile Agents and E-commerce. In *Proceedings of the 2003 International Work shop on Mobile Systems, E-Commerce and Agent Technology (MSEAT'2003),* Miami, Florida, USA.

Timmers, P. (1998). Business Models for Electronic Markets. *Electronic Markets*, *8*(2), 3–8. doi:10.1080/10196789800000016

Turban, E., King, D., McKay, J., Marshall, P., Lee, J., & Viehland, D. (2008). *Electronic Commerce: A Managerial Perspective 2008*. Upper Saddle River, NJ: Pearson/Prentice-Hall.

Wang, Y., Wang, Z., & Wei, L. (2007). A Migration Mechanism of Mobile Agent System Supporting Security and Fault-Tolerance. *Journal of Computer Technology And Development*, *17*(3).

Wooldridge, M., & Jennings, N. (1995). Intelligent agents: Theory and practice. *The Knowledge Engineering Review*, *2*(10).

Zeghache, L., Badache, N., & Elmaouhab, A. (2007). An Architectural Model for a Mobile Agents System Interoperability. In *New Technologies, Mobility and Security.* Amsterdam: Springer Netherlands. DOI10.1007/978-1-4020-6270-4

Zhang, D.-L., & Lin, C. (2005). Security Model of Mobile Agent in E-commerce. *China Academic Journal Electronic Publishing House*.

Zwass, V. (2003, Spring). Electronic Commerce and Organizational Innovation: Aspects and Opportunities . *International Journal of Electronic Commerce*, *7*(3), 7–37.

## ADDITIONAL READING

Luck, M., McBurney, P., & Preist, C. (2003). *Agent Technology: Enabling Next Generation Computing-A Roadmap for Agent Based Computing*. AgentLink Community.

Samaras, G. (2002). Mobile Commerce: Vision and Challenges (Location and its Management). In *Proceedings of the 2002 Symposium on Applications and the Internet (SAINT'02)* (pp. 43 – 45). Washington, DC: IEEE Computer Society.

Tarasewich, P., Nickerson, R. C., & Warkentin, M. (2002). Issues in Mobile e-Commerce. *Communications of the Association for Information Systems*, *8*, 41–64.

Turban, E., King, D., McKay, J., Marshall, P., Lee, J., & Viehland, D. (2008). *Electronic Commerce: A Managerial Perspective 2008*. Upper Saddle River, NJ: Pearson/Prentice-Hall.

## KEY TERMS AND DEFINITIONS

**Agent E-Marketplace:** An electronic market which uses software agents to represent buyers, sellers and other components of an electronic marketplace.

**Agent Management:** The activities of monitoring and handling agent communication, collaboration and resource usage between agents of the same and different agent platforms.

**Agent:** A software entity which can perform tasks autonomously, capable of making independent decisions, and taking actions to satisfy internal goals based upon its perceived environment.

**E-Marketplace:** A virtual space that provides infrastructure services for buyers and sellers to meet and conduct business transactions online.

**Intelligent Agent:** Software agent with the ability to acquire specific domain knowledge, learn and reason to make smart decision.

**Market-Making Mechanism:** A mode of business transactions which specifies the use of money or goods exchanged by buyers and sellers with an open and understood system of value and time trade-offs to produce the best distribution of goods and services.

**Mobile Agent:** Agent code that moves itself, including its execution state, on to another machine, to continue execution there. This is also referred to as mobile code.

# Chapter 25

# Concept of Mobile Agent–Based Electronic Marketplace Safety Measures

**Ahmed Patel**
*Universiti Kebangsaan Malaysia, Malaysia & Kingston University London, UK*

## ABSTRACT

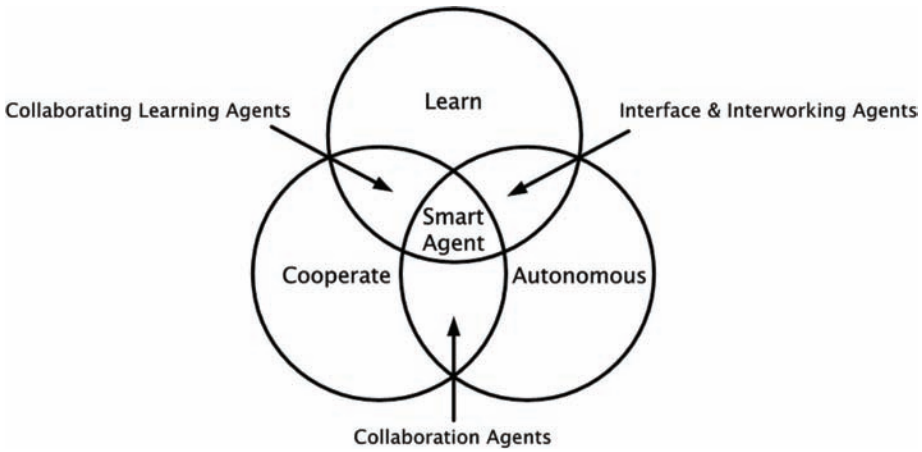
*In mobile agent-based systems, the use of mobile agents in pervasive ubiquitous electronic marketplace (e-marketplace) environment requires very well protected, secure and safe infrastructure and networking services, if they are to be trusted. The important issues and functions of security, privacy, trust and audit complement the basic requirements of mobile agent-based systems. These must support e-marketplace trading in today's computing arena facilitated and driven by the Web, Internet and ad hoc networks. In this chapter, the concept and application of security, privacy, trust, and audit for normal business and digital forensics purposes under the single term safety measures are presented. These measures are the key drivers and principles of secure mobile agents for mobile agent based environments.*

## INTRODUCTION

In this chapter, the basic concepts of Mobile Agent Systems (MAS) which support hosts, infrastructures and roving Mobile Agents (MAs) are extended to elaborate on the principles and address the key issues of security, privacy, trust, and audit for normal e-business and digital forensics purposes. The single term to encapsulate all of them is called *safety measures*. All of them have an impact in agent-based e-marketplace trading in the form of e-commerce or e-business. Many of these topics and the issues surrounding them are still in the Research & Development (R&D) domain. Some products from these efforts have become available for normal use. For those MASs having intrinsic value and affect business processes and individual's personal rights, these safety measures are vital, even in economic terms (Katos & Patel, 2008).

DOI: 10.4018/978-1-61520-611-7.ch025

*Figure 1. Primary dimensions of attributes for deriving smart intelligent agents*




## BASIC DEFINITIONS AND CONCEPTS OF MOBILE AGENTS

A *software agent* is a piece of software that executes on behalf of a program enacting the role of a process or end-user program. *Mobile code* is software downloaded from remote systems via a network and executed on a local system without explicit installation or execution by the recipient. MAs are specific incarnations of software agents and mobile code paradigms. They have great autonomy and different levels of intelligence as to what and how they can do their work. They are programs that can migrate from host to host across multiple platforms via networks when and where they choose. Their intermediate execution state is saved and transported to the new host where it is restored and the program continues running from the place where it paused.

Intelligent Agents (IAs) can handle dedicated but complex tasks on behalf of their users without repeatedly interacting with them to accomplish a task because they effectively communicate with other agents, users and service platforms against a given profile, which makes them highly intelligent and autonomous in the way they go about doing their work (Wooldridge & Jennings, 1995). A good example is a Web-based search agent that is capable of retrieving desired e-market information on behalf of the user according to his/her intended profile. The MA is instructed what to look for, and then dispatched to carry out the search and return with the information. This level of intelligent knowledge operation implies that agents can be implemented and managed to operate in any way one wants, albeit either legitimately or illegitimately. Those that operate illegally are a threat.

IAs derive their smartness by self-acquired learning through a combinations of interactions with other collaborating learning and/or collaborating agents with a common purpose, and interface and interworking agents (Nwana, 1996) as shown in Figure 1. These IAs are sometimes termed "Intelligent multi-Mobile Agents (IMAs), which effectively make them smart MAs. For the purpose of the material addressed in this chapter, MA, IA, IMA are the same things.

For such interworking and interoperability to be successful, there needs to be a minimum set of MA norms or guidelines that provide at least:

- A commonly agreed set of rules (protocols with their syntax and semantics and execution conditions) by which MAs can communicate with each other so that they can exchange information, negotiate services, or delegate responsibilities as tasks with given functions.

- A unique way to identify MAs through globally unique name assignments.
- Set of facilities for MAs to locate each other through directory and domain name services.
- A means for MAs to access and exchange information between standard and non-standard systems through translations and transformations, or legacy systems through backward compatibility.
- A set of rules for MAs migrating from one platform to another or from one host to another.
- A common means for MAs to interact with end-users through adaptable user-friendly human interaction interfaces.

From these scenarios it is obvious that the entire MAS is open to all kinds of risks, threats, abuses and damage since it is operating in an open heterogeneous environment. To overcome them an array of safety measures needs to be implemented for MAs in MAS to operate and exchange information accurately and safely.

## SAFETY MEASURES: SECURITY

MAS comprising of MAs, underlying platforms, host computers and infrastructures should be trusted, need to be protected from abuse, secure from threats, safe to use, protect the user and provide privacy support, and above all, be uniquely identifiable and auditable. All of these different aspects coming together as requirements are essential for a secure, trusted and safe mobile agent-base e-business environment to operate successfully (Borselius, 2002).

### Security Risks and Threats Issues

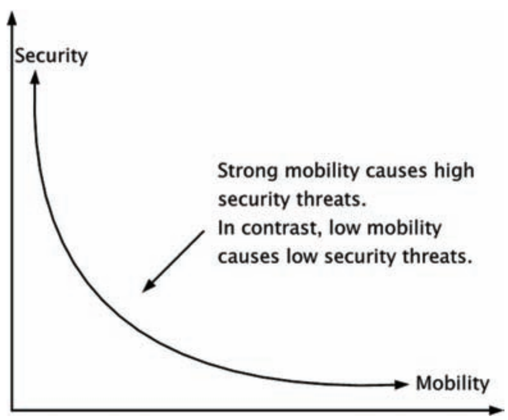
Regardless of the end-user application, all kinds of MAs raise a number of security issues but specifically the security problems concerning:

1) The protection of the platform or host that runs MAs against these kinds of attacks which can harm or use their resources without protection, guards, access rights or permission.
2) The essential protection necessary to guard MAs against malicious hosts that might alter or forge information it carries when it visits hosts in its applications' mobility itineraries.

Currently there are several proposed methods to provide protection such as access rights, sandboxing, authentication, authorization, proof-carrying code, e-payment check, etc (Alfalayleh & Brankovic, 2005; Jalani et al., 2008), but they are not sufficient to make the e-marketplace completely secure and auditable because of illegitimate side channel operations.

The mobility characteristic of MAs permits all the required operations to perform locally in the host without maintaining reliable connections with remote hosts and without pre-allocation of bandwidth and resources. MAs may perform this mobility function in a single hop or multi-hop manner. While single hop is more secure because it can be controlled "end-to-end", multi-hop is the more obvious choice since it is more efficient and useful than the single hop because of the nature of the application requiring a number of actions to complete a transaction. For instance, a MA can search for a product in the lowest price range more effectively through a multi-hop to obtain the message details from each visited site to satisfy the request as an atomic action. However, the major weakness of this method is that every visited site may steal or copy sensitive information (e-cash account number, credit card

*Figure 2. Mobility vs. Security*




details, personal information, etc) or change the results to favor a competitor. Also much easier for hackers to penetrate the systems along the route as opposed to the source and sink points. MAs with high levels of mobility have high security risks and threats. Conversely, low mobility cause low security threats as shown in Figure 2.

To minimize the security risks of MAs, Zhang and Lin (2005) proposed a framework for e-commerce that uses both single hop and multi-hop to reduce the threat. The first operation uses multi-hop to collect information as messages. MA does not take any sensitive information when performing information processing of the collected message. The second operation uses single hop to transfer the sensitive information in order to minimize the security risks. It is obvious that regardless of the number of hops, so long as traffic is passing in an open systems networking environment, like the Internet, there will always be security threats in one form or another. They have to be overcome using a combination of safety measures.

In general, safety measures in the broad sense are difficult to provide and is not always important for some mobile applications. Many if not most applications do not need these problems solved. For example, many simple applications like surfing the Internet by normal users for leisure holiday packages which do not impeach on the user's rights or system's behavior do not need any major safety measures other than simple malware and spam control. While those applications requiring it, need to protect the host from malicious MAs such as viruses and Trojan horses that covertly visit it and consume its resources in either a natural or clone form. Some of the security, privacy and trust challenges here are much more limited and of little impact. Nevertheless, when security and privacy is needed then MAS have to (Borking, 2009):

- Protect computing devices without limiting legitimate MA's rights.
- Protect the underlying supporting platform, host systems and network infrastructures from malicious or masquerading MAs.
- Protect MAs from malicious hosts.
- Protect groups of machines, MAs and their underlying platforms in a multi domain environment through cooperative and collaborative system policing and management.

## Security Functions and Mechanisms

MAs can be devised with or without security functions and mechanisms to suit non-sensitive to highly sensitive applications. In the absence of these functions and mechanisms, MASs are potentially open to abuse and misuse. This problem becomes even more serious when unsecure MAs run e-payment systems for e-business (Bellavista et al, 2004), particularly MAs moving to remote locations and masquerading to either pickup or deliver their cargo. While the network might be very open for any MA to tap into and sniff or listen to communication exchanges, safety measures at the application, platform and infrastructure levels have to be provided to include security mechanisms for authentication, authorization, message integrity, confidentiality and other operational defense facilities and mechanisms.

For MAS based e-business applications to be effective and strongly protective of their assets and customers' rights, then privacy, anonymity, non-repudiation, certification, trust, backup and audit that are largely interrelated essential functions must be provided to reinforce trust. Trust is perceived as a relationship between MAs (for example buyers and sellers) affecting a trade, learning each others behavior patterns and building levels of confidence between them on behalf of the target user against a given set of profile factors.

The use of MAs in e-business applications impose other security threats as well, such as eavesdropping, malicious interception, spoofing, uncontrolled cloning, double spending or deceptively taking funds, other fraudulent activities and alterations. Security and privacy mechanisms taken together with all the other supporting mechanisms should be implemented to ensure that MAs do not sacrifice overall safety measures for e-commerce and e-business applications as indicated and summarized in Table 1.

## Mobile Agent System (Mas) Related Specific Security Issues

Based on the safety measures of Table 1, MAS must overcome the following security problems (Poggi et al, 2003):

- Masquerading: MA poses as another agent to gain access to services or data at a host.
- False Identity: Host assumes false identity in order to lure MAs, or MAs use false identity to defraud the host and infrastructure services.
- Denial of Service: MAs may attempt to consume or corrupt resources of a host to preclude other MAs from accessing the host's services.
- Lack of Capacity and Credentials: Host can ignore an MA's request for services or access to resources due to overload or inappropriate supply of credential information.
- Unauthorized Access: MAs can obtain access to sensitive data by exploiting security weaknesses.
- Interference: An MA interferes with another to gain access to data, corrupt it, disable it or force it to rerun in overt or covert operations.
- Eavesdropping: Host can inspect MAs that are interpretive to obtain their internal algorithms and data, such as the maximum price the MA's owner is willing to pay for an item in an e-marketplace trade.
- Alteration: Hosts can change an MA's internal data, results or profile from previous processing to influence the MA's behavior or decision in an e-marketplace trade.
- Repudiation: After agreeing to some contract, an MA can subsequently deny that any agreement ever existed or modify the conditions of the contract to undermine legitimate e-marketplace trading.

It can also be observed from the features and functions in Table 1 that MAS perform a variety of security, trust, privacy and digital forensic functions, such as:

- MA Security – the ability to authenticate the identity of the owner (who holds authority) of an MA.
- MA Privacy – the ability to ensure anonymity, unobservability, pseudonymity and reputation of an owner of an MA.
- MA Tracking – the ability to track or trace and locate MAs that have migrated to other computers or masquerading in either a fraudulent or an accidental manner.
- MA Management – the ability to manage a collection of MAs in a multi-agent mobile system across autonomous operational boundaries.

*Table 1. Applicable safety measures for e-commerce & e-business mobile agent systems*

| Features | Functions |
|---|---|
| *Payment* | Secure verifiable and auditable mechanisms for automated electronic payment transactions. |
| *Security* | Authentication to avoid malicious agents from executing in MAS.<br>Authorization, message integrity, confidentiality, encryption, and other operational defense facilities and mechanisms. |
| *Trust* | Certification authority, payment managers, secure electronic payment, authentication, audit and verification callback/playback.<br>Trusted computing base and support for MAS execution environment. |
| *Privacy* | Privacy for non-disclosure of messages between agents.<br>Authorization & verification to collect and store and display personal data.<br>Anonymity, unobservability, pseudonyms, identity management, linkability and reputation.<br>Anonymity via implicit addressing on broadcast ad hoc networks.<br>Use of Privacy Enhancing Technologies (PETs) to defend privacy rights. |
| *Auditing* | Complete auditing system for buyer-seller and all the linked transaction services.<br>Non-repudiation to avoid denial of messages sent for accounting, legal and forensic reasons.<br>Alert law enforcement agents to investigate further. |
| *Digital forensics* | Traceability, accountability, pre-active, re-active and post-active investigation system.<br>Journalizing of events in MAS operational environment in background real-time mode.<br>Enticement systems to attract fraudulent and illegitimate agents into a honeypot in order to trace, immobilize and prosecute them. |
| *General System Safety* | Roll back transaction in case of failure, or playback as defined by law enforcement.<br>Non-mutilation or copying of software agents.<br>Define privilege levels and access rights to resources.<br>System safety, fault tolerance (backup system) and payment safety limits of transactions to ensure availability and reliability of MAS. |
| *Malicious Agent* | Non-mutilation of messages to avoid disturbance and garbled communication.<br>Control malicious agents, servers, communications, migration and information. |

To perform most of these functions, MAS need:

- MAs to:
  - Use resources available on their host machine.
  - Communicate with other MAs and their supporting objects.
  - Move about freely and easily in a heterogeneous network.
  - Protect themselves against malicious MAs, infrastructure platform services and hosts.
- MA Server to:
  - Provide an execution environment, such as virtual machines, for the MAs.
  - Provide the following services:
    - Registering and authentication of incoming MAs.
    - MA dispatching and receiving services.
    - MA communication services through brokerage for safety reasons.
    - Controlled access to local resources against inordinate usage.
    - Record and monitor all events for audit and verification purposes.
    - Customize MA Servers to provide additional security, trust, privacy and digital forensic services other than all other types

of services (e.g. lookup services, e-payment transactions services, etc) that a visiting agent can utilize.

In principle, MAS and MAs in particular may use a number of security mechanisms, schemes and techniques (Bidgoli, 2006) to adequately protect a machine against malicious agents. For example, digital signatures, public key infrastructures, trusted third party and trust management approaches might help identify such MAs and calculate by some means how much each MA should be trusted or avoided. It is beyond the scope of this chapter but an important aspect in designing and implementing MAS and MAs.

## SAFETY MEASURES: PRIVACY

Privacy is an expression of self-determination and dignity perceived as a fundamental human right by most constitutions of so called democratic societies. Personal privacy is largely based on data protection legislations, directives and guidelines to protect, collect, store and process personal data in order to guarantee privacy. Both legal and technical means have come together to protect privacy and ensure that the individual or the MAs performing on behalf of the individual have explicit controls to guarantee that right to privacy.

### Tapping Mobile Communication Information

MAs must have the capabilities to support these functions, particularly considering the use of various types of mobile devices and gadgets with enormous computing power running sophisticated applications. All of them (notebooks, mobile phones, Personal Digital Assistants (PDAs), etc.) have become commonplace and can be linked through the Internet in a variety of ways. Since services such as online e-banking, e-shopping etc are distributed and accessible via network-centric platforms, all confidential information may become visible to third parties by intercepting the messages at different levels of MAS architecture and the supporting underlying communication networks. Even if the services are secure and if the data exchanged between the MAs encrypted, the endpoints of the communication can be observed/intercepted at the point where the encryption/decryption function is performed. Having access to such information, makes it possible to determine, for instance, who is communicating with whom, or using which service, for what purposes, for how long and from which location. For example, if proper security and privacy measures are lacking within the MAs, the supporting platforms on which they run and the target hosts on which they execute could be misused. Similarly, mobile Location Based Services (LBS) and Radio Frequency IDentification (RFID) applications could be misused since they can capture a variety of user information on-the-fly that can be subsequently uploaded by service providers for a variety of uses (Treytl et al, 2008). Major threats caused by LBS and RFID to the user's privacy rights of informational self-determination are unsolicited profiling, location tracking and the disclosure of the user's social interactions and context of access.

Personal data such as location data, the user's preferences, business activities and the kind of information that a user requested as part of a transaction could be compiled and stored by service providers (or for that matter hackers) for detailed user profiling, subsequent analysis and usage without the user ever knowing. Examples of potential misuse could be unwanted marketing, blackmailing, virtual stalking, etc.

### Implicit Addressing on Ad Hoc Broadcast Networks

Receiving a message can be made completely anonymous to observers on the network by delivering the same message to all stations via multicast transmission, possibly using end-to-end-encryption (Kesdogan & Palmer, 2006). If the message has a specific intended recipient, an addressee, the message must contain some attribute by which the addressee alone can recognize the message as being addressed to him/her. This message attribute is termed an *implicit* (or indirect) address. It is only meaningful to a recipient who can determine whether he is the intended addressee. In contrast, an explicit address describes the specific place in the network to which the message should be delivered and therefore, cannot provide anonymity. However, public addresses should not be assigned using visible implicit addresses in order to avoid the *linkability* of the visible public address of a message and the addressee. Private addresses can be realized from visible addresses but then each of them should be used only once. Legitimate MAs need to obey the rules and use of implicit addressing to protect privacy in order to ensure legitimate anonymity and at the same time block illegitimate MAs from masquerading in anonymous ways.

## Privacy Enhancing Technologies (Pets)

Privacy cannot be protected solely by legislation. In practice, often privacy laws are not properly enforceable in ICT systems. Besides, the Internet has no national boundaries to govern it, and it is proving to be infeasible to harmonize privacy legislation and guidelines for implementing at an international level due to cultural, political and socio-economic differences. Nevertheless, PETs as a set of tools, mechanisms, protocols and anonymity services can be invoke to protect privacy and prohibit unwarranted behavior like spamming and unsolicited emails. As Clark, (2008) has suggested that one target would be to protect against and stop their counterparts, Privacy-Invasive Technologies (PITs) from doing sinister things in all kinds of guises in all types of e-business activities. Applying this principle to MAS, PETs can overcome PITs to reverse their alarmingly growing trend by directly assisting in the protection of the privacy interest of MAs on behalf of their legitimate clients through:

- Countermeasures: which are designed to defeat or neutralize PITs.
- Savage PETs: which combat privacy-intrusive behavior patterns by strictly denying identity and to provide genuine untraceable anonymity.
- Gentle PETs: this must balance the interests of privacy versus accountability and provide protected pseudonymity rather than anonymity.
- Tracking/tracing/trailing: data trail generation and intensification by means of denial of anonymity and traffic analysis.

One of the big problem and challenge is how to translate from privacy directives, guidelines and legislations frameworks to a technical solution? One possible solution is to use IBM's (2003) Enterprise Privacy Authorization Language (EPAL), which was submitted to the World Wide Web Consortium (W3C) as a possible norm. It is a formal language for writing enterprise privacy policies to govern data handling practices in ICT systems according to fine-grained positive and negative authorization rights.

Another solution to privacy is to use Platform for Privacy Preferences (P3P) from W3C. Some Web sites try to collect more information than is necessary about the people who purchased their merchandise. Others use controversial schemes such as tracker cookies to determine users' demographic information, buying habits, etc and then using this information to provide specifically targeted advertisements on behalf of their paymasters. P3P is designed to offer users more control of the kind of information that they allow to release, specifically through MAs. One of the prime goals of P3P "is to increase user trust and confidence in the Web through technical empowerment." (W3C, 2009).

PETs supposedly guarantees that only necessary identifying data is recorded by using blind digital signatures, partial blind signatures, blinded credentials systems and pseudo-identities mechanisms. They can be deployed in MAS by analyzing the threats and determining the security needs to achieve the desired levels of privacy. In general, the threats MAs encounter are:

- Altering the agent's functionality
- Duplication of the agent
- Masquerading
- Fraud with user's identity
- Inappropriate or devious networking and storage hosting and access
- Incorrect execution of functions

Some of these threats can be overcome by security implemented in MAs, hosts and infrastructure systems and trust through privacy can be achieved by MAs implementing control and reputation of what is allowed or not allowed using a third party such as PKI (Public Key Infrastructures) or TTP (Trusted Third Party). They facilitate MAs and hosts in MAS to authenticate each other by giving minimal but sophisticated identification information.

Anonymity has to comprise an attacker model as a protection goal. Such an attacker model defines how far a potential attacker can access or derive relevant information and what resources he can use. Therefore, anonymity (Pfitzmann & Hansen, 2009) of communication depends on how far an attacker can control or observe MAs, host computers and the underlying infrastructures and supporting platforms.

In summary, the use of PETs by MAs, on the one hand, should result in making breaches of certain data protection rules more difficult to achieve and, on the other hand, helping to detect and prevent such breaches for maintaining privacy and invoking digital forensic functions to do the rest.

## SAFETY MEASURES: DIGITAL FORENSICS

Auditing, accounting and overall system management are important in MAS for e-business operation. Even more important is digital forensics as an activity of investigation to trace and analyze illegal and fraudulent events to produce evidence for the purpose of prosecution and law enforcement. Digital forensics has four modes of operation:

1) Post-active: to catch and prosecute the culprit (which is performed after the event has taken place).
2) Pre-active: to provide defense mechanisms to prevent illegal events taking place (which is to have tools implemented to block such events taking place).
3) Re-active: to take appropriate course of actions to prevent illegal or unauthorized events from taking place during real-time live operations (which is an on-the-fly condition to stop such event taking place before any damage can be done).
4) Trap-active: to actively entice/attract illegal or fraudulent culprits to fall into a trap like a honeypot so as to immobilize, prevent, penalize and prosecute them (which is a controlled action to pre-empt and catch the culprit at the same time).

Auditing can be a part of digital forensics or vice versa in a MAS management framework. It does matter because events in MAS across all the executing components in the environments related to mobile transactions have to be journalized or recorded in background mode for subsequent use in accounting, auditing or digital forensics investigation. More precisely, in MAS, digital forensics includes event data collection, event data analyzing, employ various protocols to trace and block illegal events or allow controlled actions to take place to follow the illegal pattern without the culprit making any damage and formulate reports to prosecute or defend under law enforcement legislations. In digital forensics both *static agents* for monitoring and control by watching culprit MAs at a resident host machine, and *mobile agents* shadowing and following the culprit MAs are deployed. These agents carry out the component functions to add a sense of improved intelligence gathering and analysis, confidence and trust, reliability and fault-tolerance not only in MAS operational environment but also in all aspect of the digital forensics activities themselves. However, using MAS in digital forensics can cause a few problems. For example, the legitimate right of a MA user acting anonymously conflicts with the rights of a server victim identifying the malicious user (Antoniou et al, 2008). The goal of digital forensic is to collect evidence and reveal the identity of the attacker to the server, as either normal user or real attacker.

It summary, to make the audit and forensic services secure and meaningful to trace normal (non-audit/forensic) MAs, authenticated certificate authority, e-payments, cryptography techniques and secure protocols have to be implemented. Thus, the authenticity of the audited evidence for the e-business activities depends on the security, reliability and accuracy of the entire system.

## FUTURE RESEARCH DIRECTIONS

As already indicated in some parts of this chapter, there are a number of opportunities to do R&D from fundamental research to highly applied/strategic research converging towards pre-competitive development. Amongst the many topics, concepts and issues presented, there are several areas that both de facto and non-de facto regulatory and standards' bodies, governments and industry will have to address as part of a comprehensive MAS deployment strategy. The important ones are:

- Safety measures policy management defining a framework to synthesize legislations, directives and guideline in a formal design language is deemed essential to have provable technical solutions. Can automatic rule-based policy management tools be used to generate and select a set of prescribed safety measures against a mandate for MAs? Yes. Such a language should feed into the MAS/MA software development life-cycle to engineer rapid products. IBM's EPAL (IBM, 2003) is an example in that direction. A comprehensive language is needed to build fully-fledged MASs.
- Privacy needs to be simplified for end-users to understand. The selection from given profiles is not easy even for those persons having ICT background, so how should a novice understand it? New "aiding and abetting" models and supporting techniques are needed that can "perceive" end-user's requirement for privacy through usage and profile building automatically. Besides this, privacy functions have to be tied to digital forensics and audit on the one side for law enforcement and infringement prevention purposes and on the other side if it is to achieve better levels of privacy for its end-users.
- Security issues that need to be resolved for the deployment of advanced intelligent MAs should include measures for non-mutilation of messages to avoid disturbance and miscommunication across a range of technologies, network types and applications. Privacy for non-disclosure of personal data in messages between MAs will have to encrypt/decrypt without the knowledge of end- users to ensure ambient access and seamless Web access and Internet surfing. Many advanced non-repudiation techniques will have to be derived to avoid denial of messages being sent

when exercising legal rights and for digital forensic purposes. The understanding of MAs to perform in this mode will be very challenging.

- E-payment will have to go further to avoid the kinds of fraud that are prevalent today on the Internet. Integrated e-payment schemes will have to be defined and MAS made to operate with complete audit trails facilities. It is expected that in the future MAs will also have to pay for services consumed and resources used at remote locations on a metered unit basis. This becomes a new requirement on accounting management to ensure that taxes, duties and other dues will be paid to the relevant authorities in a global economy context. It needs new MAS paradigms to facilitate this.
- The issues of managing MAS are very complex indeed. They bring together many techniques and technologies together and offering new forms of e-businesses that span many enterprise processes and business models which require new management policies, strategies, methods and models. MAS management should be automated against a variety of profiles defining *e-everything*. The MAS area has matured and is ripe for taking onboard autonomic computing principles for management functions to become collaborative, cooperative self-determining, self-opportunistic, self-diagnosing, self-monitoring and self-healing against profiles generating rule-based policy models and structures.

These topics together with those presented elsewhere in this chapter regarding MAS and their MAs in the area of mobile technology for e-business present very challenging R&D opportunities and pay-offs.

## CONCLUSION

In this chapter, the conceptual key issues and core principles of secure mobility, auditing, security, privacy, implicit addressing, digital forensics and trust grouped together and encapsulated as "safety measures" were presented. MAS security differs from conventional security in the sense that a MA is not located nor executing on a trusted host will reduce its security rating and/or affect its operation. The MA might encounter problems associated in handling retrieved data with integrity since computing private data using private mechanisms may not be available at the executing host. While several solutions exist in solving some of the safety measures for mobile agent systems, many of these functions are not yet defined, while others are still in the R&D phase, undergoing trials, pilot use and beta version testing.

There are some applications already out there that have become commercially and shareware available in the use of mobile agent technology in the e-marketplace trading area. Hampering their use is the unsafe trading conditions in e-business over the Web and the Internet. The key success to the use of mobile agent technology will largely depend on how effectively and cheaply the safety measures espoused in this chapter can be implemented in MAS. They will have a significant impact on the next generation of multi-agent based system in all areas of not just e-marketplace trading but in *e-everything*. Their integration and advancement of new functions, processes, models and paradigms presents very challenging R&D opportunities and pay-offs in mobile agent technology in creating MAS with very smart MAs.

## REFERENCES

W3C. (2007). *Platform for Privacy Preferences (P3P) Project*. Retrieved June 15, 2009 from http://www.w3.org/P3P/

Alfalayleh, M., & Brankovic, L. (2005). An Overview of Security Issues and Techniques in Mobile Agents. In edited book by IFIP (International Federation for Information Processing), *Communications and Multimedia Security*, Springer Boston, 1571-5736 (Print) 1861-2288, October 2005.

Antoniou, G., Sterling, L., Gritzalis, S., & Udaya, P. (2008). Privacy and forensics investigation process: The ERPINA Protocol. *Computer Standards & Interfaces*, *30*(4), 229–236. doi:10.1016/j.csi.2007.10.008

Bellavista, P., Corradi, A., Federici, C., Montanari, R., & Tibaldi, D. (2004). Security for Mobile Agents: Issues and Challenges. In I. Mahgoub & M. Ilyas (Eds.), *Handbook of Mobile Computing*. Boca Raton, FL: CRC Press.

Bidgoli, H. (2006). *Handbook of information security*. New York: John Wiley and Sons.

Borking, J. J. (2009). Privacy Incorporated Software Agent (PISA), Proposal for Building a Privacy Guardian for the Electronic Age. *Lecture Notes in Computer Science*, *2009*, 130. doi:10.1007/3-540-44702-4_8

Borselius, N. (2002). Mobile agent security. *Electronics & Communication Engineering Journal*, *14*(5), 211–218. doi:10.1049/ecej:20020504

Clarke, R. (2008). Computer Security, Privacy and Politics: Current Issues, Challenges and Solutions. In I. Lee (Ed.), *Electronic Business: Concepts, Methodologies, Tools, and Applications* (Vol. 4). Hershey, PA: IGI.

IBM. (2003). *Enterprise Privacy Authorization Language (EPAL), Version 1.2*. Retrieved June 15, 2009, from http://www.w3.org/Submission/2003/SUBM-EPAL-20031110/

Jailani, N., Yatim, N. F. M., Yahya, Y., Patel, A., & Othman, M. (2008). Secure and Auditable Agent-Based E-marketplace Framework for Mobile Users. *Computer Standards & Interfaces*, *30*(4), 237–252. doi:10.1016/j.csi.2007.10.009

Katos, V., & Patel, A. (2008). A Partial Equilibrium View on Security and Privacy, *Information Management and Computer Security, 16*(1), 74-83. Retrieved from http://www.emeraldinsight.com/0968-5227.htm

Kesdogan, D., & Palmer, C. (2006). Technical challenges of network anonymity. *Computer Communications*, *29*(3), 306–324. doi:10.1016/j.comcom.2004.12.011

Nwana, H. S. (1996). Software Agents: An Overview. *The Knowledge Engineering Review*, *11*(3), 1–40. doi:10.1017/S026988890000789X

Pfitzmann, A., & Hansen, M. (2009). *Anonymity, Unlinkability, Unobservability, Pseudonymity, and Identity Management - A Consolidated Proposal for Terminology. Version 0.28.* Retrieved May 2009, from http://dud.inf.tu-dresden.de/Anon_Terminology.shtml

Poggi, A., Tomaiuolo, M., & Vitaglione, G. (2003, January). Security and Trust in Agent-Oriented Middleware . *Lecture Notes in Computer Science*, *2889*, 989.

Treytl, A., Spenger, W., & Riaz, B. (2008). A secure agent platform for active RFID. In *Emerging Technologies and Factory Automation, 2008. ETFA 2008* (pp.492-495).

Wooldridge, M., & Jennings, N. R. (1995). Intelligent agents: Theory and practice. *The Knowledge Engineering Review*, *10*(2), 115–152. doi:10.1017/S0269888900008122

Zhang, D.-L., & Lin, C. (2005). Security Model of Mobile Agent in E-commerce. *China Academic Journal Electronic Publishing House*, *25*(6), 1271–1273.

## KEY TERMS AND DEFINITIONS

**Agent Management:** The activities of configuring, monitoring, administering and handling agent communications, interactions, collaborations and resource usage in a heterogeneous mobile agent system.

**Agent:** A software entity which can perform tasks on behalf of an end-user autonomously, capable of making independent decisions, and taking actions to satisfy a set of internally defined goals based upon its perception and interactions within the mobile agent environment.

**Auditing:** The function of keeping a complete trail of actions, events, data and information flows for the purpose of ensuring legitimacy, examination or investigation.

**Digital Forensics:** The capability of performing post-activity investigation analysis and audit trails for the purpose of prosecuting illegitimate or criminal users, as well as providing the necessary mechanisms to curtail illegal activities by agents and users in pre-emptive mode.

**E-Marketplace:** A virtual space which provides the infrastructure services for buyers and sellers to meet and conduct business transactions using mobile agent systems.

**E-Payment:** Making payments electronically through any available means like digi-cash, credit card and other forms of electronic fund transfers.

**Intelligent Agent:** Software agent with the ability to infer, acquires a specific domain knowledge and able to learn and reason to make smart decision.

**Mobile Agent:** is a software agent referred to as mobile code with the ability to move itself from one computing environment to another, including its execution state and data set, to continue executing there from where it last left off.

**Privacy:** To provide the necessary services, mechanisms and protocols for making legitimate agents and users anonymous, whilst ensuring that illegitimate agents and users are eliminated and/or exposed.

**Safety Measures:** comprising of all the functions of security, privacy, trust, secure e-payment schemes, audit and digital forensics couched in a single term called *safety measures*.

**Security:** To safe guard all asserts and provide the necessary function and features to make security services and mechanisms available for use by agents and users.

# Chapter 26
# Time Constraints for Sellers in Electronic Markets

**Kostas Kolomvatsos**
*University of Athens, Greece*

**Stathes Hadjiefthymiades**
*University of Athens, Greece*

## ABSTRACT

*Electronic markets provide virtual places for negotiation over the exchange of products. In such places entities representing buyers and sellers can interact and agree upon a product price. Both parties try to maximize their profit. The authors model such an interaction as a finite horizon bargaining game and try to quantify the maximum time of seller participation in the game. The estimated deadline indicates until when the interaction is profitable for the seller. The authors' model defines the appropriate value for a patience factor which finally results in the seller deadline fully adapted in each product characteristics.*

## INTRODUCTION

With the rapid development of the Web new business models have emerged. A huge number of commodities are available to users including pieces of information. Due to the vast number of resources, finding the appropriate product is a demanding procedure and sometimes is beyond of the human capabilities. Hence, users need an automatic mechanism to find products while providers need a mechanism to efficiently promote and negotiate their products.

DOI: 10.4018/978-1-61520-611-7.ch026

The combination of Electronic Markets (EMs) (Bakos, 1998) with an enhanced scheme such as intelligent agents could be the solution to this problem. EMs are virtual places where entities, not known in advance, can negotiate and agree upon the exchange of products. In these markets, products could be electronics, books, clothes or even more information. In cases where information pieces (stock prices, videos, etc) are the exchanged products, we can define the concept of Information Markets (IM) (Ge at al., 2007; Lauffman, 1994). Autonomous entities offer many advantages w.r.t. the representation of users (buyers) searching for products and providers (sellers). One example is intelligent agents. Agents (Nwana, 1996) are software components acting on behalf of their owners. In EMs, agents try to find and buy the appropriate product according to user needs. While representing sellers, agents try to sell each product in the most profitable price.

One important issue in such negotiations is the deadline determination for both parties. Especially in the seller side the deadline is very crucial because sellers try to service a lot of clients. The determination of the appropriate deadline is very important and difficult task. In this article, we describe a model for the seller behaviour and through this model we present a methodology for the deadline calculation. This model is extended using Fuzzy Logic (FL) theory (Zadeh, 1965) in order to provide an efficient mechanism for the decision process, especially, under conditions of uncertainty. The deadline calculation affects the behaviour of the seller in the interaction procedure concerning the proposed prices.

## MARKETPLACE BUSINESS MODEL

EMs are virtual places where entities present, negotiate and agree upon the purchase of specific products. When the negotiated products are pieces of information such markets are termed Information Markets (IMs). Information has a number of specific characteristics which differentiates it from the classical products such electronics, books, etc. First of all, the economics of information production indicate that the information production costs more when the first copy is produced and less for the additional pieces. Furthermore, information can be characterized as out-of-date more easily than classical products. For example, a stock price has greater value for limited time duration. Hence, sellers want to sell such products as soon as possible. Finally, information is always available to buyers. A seller negotiating DVD players has limited capabilities of delivery which can have negative result when they run out of products.

In general, EMs involve two main groups of entities: the buyers and the sellers. Buyers try to buy products at the lowest possible price while sellers try to sell products at the highest possible price. It is obvious, that there is a conflict of interests between these two groups. Hence, we can focus on their direct interaction and model this interaction as a Bargaining Game (BG) with incomplete information (Fudenberg & Tirole, 1991). Game theory (Rubinstein & Osborne, 1994) has been extensively studied by the research community. BGs have been thoroughly reviewed in Rubinstein's study (1985a; 1985b). Rubinstein has studied a BG with alternating offers and has defined the equilibrium for such games. Fudenberg and Tirole (1983) studied a simple two person two-period BG and presented a solution using the perfect Bayesian equilibrium approach. However, there is a difficulty when studying BGs under incomplete knowledge.

In such cases, players do not know any of the characteristics of the opponent and consequently at every round of the game are not sure for the opponent reaction. An important characteristic is the players' deadline. For example, players can make offers, however, they are not sure when the opponent deadline expires increasing the probability of a conflict. Moreover, in the seller side a deadline is mandatory because the seller has to deal with a number of buyers and it cannot propose prices for ever. For example, the seller, due to an increased number of clients waiting to buy a specific product, may want to sell it in smaller price and, thus, aiming at higher profits through this large number of buyers.

In this article, using the model of a BG, we try to define an automatic negotiation mechanism between players and combining it with FL we try to provide an additional level of intelligence describing a reasoning mechanism for them. The BG lasts for a finite period of time (horizon) and

*Table 1. The seller behaviour process*

```
Seller_Behaviour()
Begin
   Calculate Seller_Deadline
   Current_Round=0
   While Current_Round <= Seller_Dealline do
 Calculate and Propose the Seller_Price
 Read the Buyer_Answer
If Buyer_Answer == 'ACCEPT' Then
          Agreement = Seller_Price
          Stop the BG
      Else
          Read the Buyer_Price
          Estimate the Buyer_Deadline
          Calculate the profit based on the Buyer_Price
          If (Buyer_Price is profitable AND (Buyer_Deadline expires OR Seller_Deadline
            expires)) OR Buyer_Price >= upcoming Seller_Price Then
             Accept the Buyer_Price
             Agreement = Buyer_Price
             Stop the BG
          Else
             Send rejection message
             Current_Round++
          Endif
      Endif
   Endwhile
End
```

involves a number of alternating offers. At every round, entities propose a specific price for the product. If this price is accepted by the opponent then the BG ends with an agreement and specific profit for both entities. The seller starts first and the buyer follows if the proposed offer is rejected. The seller proposes at odd rounds (1, 3, 5, …) and the buyer proposes at even rounds (2, 4, 6, …). If a player is not satisfied with the proposed offer, it has the right to reject it and issue a counter-proposal. If an agreement is reached then the BG ends with profit for both or else a conflict leads to zero profit.

## SELLER BEHAVIOUR

Every seller at every round of the BG issues an offer to the buyer. Its aim is to challenge the buyer to accept the proposal in order to obtain some profit. The seller acts as a caching server because it can deliver products to interested parties more than once. Its profit is depended on a utility function which implies the product price and the production cost. The utility function is defined as follows:

$$U_s = \sqrt{p - c} \tag{1}$$

In (1), p is the product price and c is the production cost. This utility function indicates that the seller is risk aware (Hargraeaves & Varoufakis, 2004). The main reason is that the seller spends time and resources in order to serve each client. The utility function also shows that the seller profit mainly depends on the product price. The greater the price is the greater the profit becomes. However, there is the possibility of rejection of its proposal. In such cases, the seller should take an offer and it should decide if it will accept or reject the current proposal. The algorithm used by the seller is depicted in Table 1.

The algorithm in Table 1 deals with the behaviour of the seller at every round of the game. The seller wants to sell as many products as it can, however, it cannot propose prices for ever. This means that it is not profitable for a seller to engage in an infinite BG. Hence, through the presented algorithm, we try to model its behaviour and provide an efficient method for the purchase process. The main rationale of the seller is: "wait till your deadline expires or the buyer accepts your price or the buyer proposes a price better than your own". In the last two cases, it is obvious that every time: (a) the seller receives a better price than its upcoming proposal, or (b) the buyer accepts the current proposal, it concludes the BG with profit given by (1). In the rest of the cases, the seller should propose specific prices for a predefined time limit. Hence, the most important issue is the determination of the appropriate deadline for this interaction. The deadline calculation is discussed in the following section.

The proposals that the seller addresses to buyers are based on a pricing function. This pricing function takes into account the product characteristics as well as the number of the current round. The seller can sell popular products in smaller prices because it gains from the increased number of clients interested in such products. For example, if a product has a production cost equal to 5 monetary units (mu) then it is more convenient to sell it with a profit of 2 mu to 100 clients than to sell it with a profit of 20 mu to 10 clients. In the first case the product price is 7 mu and it is more challenging than in the second case where the price is 25 mu. A high price in the majority of cases repulses buyers. Hence, we define a pricing function as follows:

$$p^{s}(x) = \frac{\mu}{x^{q+1}} + c, \qquad x = 1, 2, \ldots \tag{2}$$

where ε is the profit, c is the production cost, x indexes the seller round (i.e. x=2 implies the second proposal at the third round of the BG) and q is the popularity measure (non normalized probability of reference) (Kolomvatsos & Hadjiefthymiades, 2008) based on Zipf's law (Zipf, 1949). A large value for q indicates that the product is very popular and can be sold in smaller prices according to seller policy.

## DEADLINE DETERMINATION

Based on the pricing policy of the seller and by analyzing its pricing function, we understand that the pricing function tends to the line of the cost without intersecting it. The reason is that the seller does want to sell its products in prices below the production cost. Hence, we can define a time point from which all subsequent proposals change marginally. If the buyer has not accepted the seller proposals up to this point, probably its policy is to wait for better offers or its offers acceptance> Moreover, its valuation may be very small compared to seller cost. In the last case, the possibility of an agreement is very small, while in the first two cases, the seller cannot propose prices for ever and it should define the appropriate time for the BG. The main reason is, as mentioned before, that the seller tries to service a lot of clients consuming resources and time and has the potential to reject clients that aim to very small prices, probably below its production cost.

### Simple Mathematical Model

The seller's pricing function tends asymptotically to the line of the cost. The time $T_s$ shows the seller deadline and represents from which time point it is not profitable for the seller to continue proposing prices. In order to have such time point the following relation should stand:

$$\lim_{t \to \infty} \left[ \frac{-\mu \cdot (q+1)}{T_s^{\,q+2}} \right] = 0 \tag{3}$$

and consequently:

$$T_s^{q+2} \approx \alpha \cdot \mu \cdot (q+1) \rightarrow T_s \approx (\alpha \cdot \mu \cdot (q+1))^{\frac{1}{q+2}} \tag{4}$$

where $\alpha$ shows how much closer to the zero the (3) could be. Factor $\alpha$ shows the patience of the seller. When $\alpha$ is large means that the seller is a very patient player who can wait for its offers acceptance and when $\alpha$ is small means that the seller wants to conclude the game as soon as possible. Equation (4) shows from which time instant the seller reaches to a price with which all the upcoming proposals have a very small divergence. Specifically, the offers are close enough to the seller cost and it is meaningless to continue the game if the buyer to this point has rejected all the preceding prices. For more details the interested reader should refer in (Kolomvatsos & Hadjiefthymiades, 2008).

## Fuzzy Approach

Using patience factor $\alpha$, the seller could define its deadline for a specific product. However, this is a difficult task because a crisp number should be defined. Fuzzy Logic (FL) can provide means for the decision of the value of factor $\alpha$. FL seems to be the appropriate tool for real-time decision making under incomplete and uncertain information. Human knowledge about the described scenario can be expressed through FL rule base. This rule base indicates the appropriate value for factor $\alpha$ and respectively the appropriate deadline for the specific product. FL rule base implicates the product characteristics which are the profit ε and the popularity measure q. Hence, at every BG the system has the capability to adapt on the different product characteristics.

We define a Mamdani FL system (Mamdani & Assilian, 1975) and we follow a MISO (Multiple Input Single Output) approach for each FL rule. The rule-based approach that we have incorporated implicates a set of rules in the form: '*if* premise *then* consequent' and, thus, for each rule we take:

$R_j$: If $q$ is $A_{1(j)}$ AND/OR $\varepsilon$ is $A_{2(j)}$ Then $a$ is $B_{(j)}$

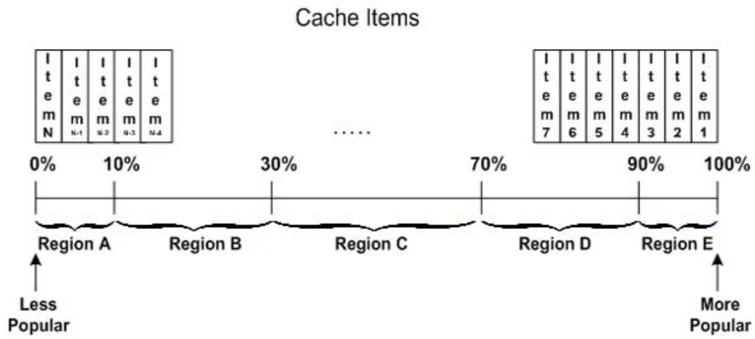
where $A_{1(j)}$, $A_{2(j)}$ and $B_{(j)}$ are the j$^{th}$ fuzzy set linguistic value. These linguistic values are defined for the two product parameters (profit and popularity measure) and the output parameter $\alpha$. The linguistic descriptions that we are using in this model are *low*, *medium* and *high*. Especially, for the parameter q, we use the linguistic modifier *very* and define two more linguistic descriptions: *very low* and *very high*. Moreover, for each parameter, we define the corresponding membership functions which map the linguistic values to [0,1]. These functions are trapezoidal functions with centers $c_{ij}$ and width $s_{ij}$.

Figure 1 depicts the regions in which every linguistic value for q corresponds. *Very low* q (region A) means that the product is at the last places in seller cache while *Very high* value (region E) means that the specific product is a very popular product for which a lot of clients waiting to buy it. The same meaning stands for the rest of linguistic values. *Low* value corresponds to region B, *Medium* value to B and *High* value to D.

Concerning the profit ε, *Low* value means that the seller aims to a small amount of profit, *Medium* that the profit is a medium number and *High* that the seller aims to a large amount of profit. It should be noted that in order to have profit values in the [0,1], we use a sigmoid (exponential) function to normalize these values. Hence, we define a maximum profit value (for example three times as the production cost) and then we take the final result.

For the output, factor $\alpha$, we also define three basic linguistic values (*low*, *medium*, *high*). Using the linguistic modifier we take two more values: *Very low* and *Very high*. The described values correspond to five levels of patience. Trapezoidal membership functions define the region that each linguistic term corresponds. A maximum value is

*Figure 1. Cache popularity rank regions*




used for $\alpha$. For example, the maximum value could be equal to 2000. Hence, the seller acts under the following rationale:

a) When the product is not popular it stays as long as it can in order to secure its profit. In such cases there are not a lot of clients interested in these products. Consequently, the output value for $\alpha$ will be large enough close to the top value.
b) When the product is very popular the seller can reduce more quickly its prices and this way to challenge the buyer to accept the proposals. In such cases the factor $\alpha$ is a small number close to 0.

In this point of our article, we describe only two rules of the FL rule base. For more details, the interested reader should refer in (Kolomvatsos et al., 2008).

$R_1$: If ($q$ is *very low* AND ($\varepsilon$ is *low* OR $\varepsilon$ is *medium*)) Then $a$ is *very High*

*Explanation:* The $R_1$ rule means that, if the product's popularity rank is very low (the product is located at the 10% lower places of the cache – Region A) and the pursued profit is low or medium then the value of $a$ should be very high because the seller has to stay as much as possible in the BG in order to secure its profit. This stands because there is a decreased number of buyers interested in the specific product and the seller targets to a small initial profit.

$R_2$: If ($q$ is *very high* AND ($\varepsilon$ is *medium* OR $\varepsilon$ is *high*)) Then $a$ is *very low*

*Explanation:* The rule $R_2$ refers to a product located at the most popular places of the cache (Region E). The seller does not have to stay for long in the BG because there might be an increased number of buyers for the specific product. Hence, its higher profits could be derived through this large number of buyers selling the specific product with smaller profit.

## DISCUSSION

The seller participating in a BG aims to sell its products at the highest possible price because this way will gain the highest possible profit. Defining the behaviour of the seller, it is imperative to define a deadline for which the BG is profitable. As we saw, this deadline can be calculated and adapted in the product characteristics. Our study indicates that using the simple mathematical model, we can define a deadline adjusted to the described model without the need to be defined by humans. FL usage provides a reasoning mechanism at the beginning of each BG and, thus, the seller can decide the maximum BG participation time. The most important is that through FL reasoning the deadline can be grater or smaller than the deadline calculated by the simple model. For example, for a popular product with q=1 and profit ε=20 the deadline through simple model is equal to 13 (the value of $\alpha$ is defined as a crisp value equal to 50) and through the FL model is equal to 9. For a popular product with q=1 and profit ε=5 the deadline is calculated equal to 6 and 10 respectively. Finally, we should note that the most important advantage of our FL model is that it can be adapted even more in cases where we have the same product but the seller indents to different profit.

In order to understand the importance of the deadline calculation let us think of a product which is very popular. This means that it draws the interest of a very large number of buyers. Accordingly, let us consider a product which is not popular. For the first product, 100 buyers have shown interest in it and only a single buyer has shown interest for the second one. In the first case the seller should stay less in the interaction process and challenge each buyer proposing small prices while in the second case the seller should stay longer trying to achieve an agreement. The profit for the first product is large due to the increased number of buyers (irrelatively if the seller earns small profit at every transaction) while the profit in the second case depends only on the profit provided by the buyer.

## CONCLUSION

In this article, we present an interaction model between buyer s and sellers participating in EMs or more specifically in IMs. This interaction is modelled as a BG where the two parties try to agree upon the price of products. We describe the characteristics of players and basic parameters of the BG. We focus on the seller side and we present its behaviour. It proposes prices based on a pricing function which can be used to define the appropriate deadline for its participation in the BG. The seller can sell popular products in smaller prices because it aims at higher profits through the increased number of buyers interested in such products. On the other hand, when negotiate over non popular products it tries to secure its profit staying more in the interaction procedure. Moreover, we describe a FL approach defining a reasoning mechanism for the decision of the appropriate value of the patience factor. FL model leads to deadlines adjusted to the products characteristics which are the popularity measure and the profit that the seller aims to.

## REFERENCES


Bakos, Y. (1998). The Emerging Role of Electronic Marketplaces on the Internet. *Communications of the ACM*, *41*(8), 35–42. doi:10.1145/280324.280330

Fudenberg, D., & Tirole, J. (1983). Sequential Bargaining with Incomplete Information. *The Review of Economic Studies*, *50*(2), 221–247. doi:10.2307/2297414

Fudenberg, D., & Tirole, J. (1991). *Game Theory*. Cambridge, MA: MIT Press.

Ge, W., Rothenberger M., & Chen E. (2007). A Model for an Electronic Information Marketplace. *Australasian Journal Of Information Systems, 13*(1).

Hargraeaves, S. P., & Varoufakis, Y. (2004). *Game Theory: A Critical Text*. London: Routledge.

Kolomvatsos, K., Anagnostopoulos, C., & Hadjiefthymiades, S. (2008). On the Use of Fuzzy logic in a Seller Bargaining Game. In *Proc. of the 32nd Annual IEEE International Computer Software and Applications Conference (COMPSAC 2008),* July 28th - August 1st, Turku, Finland (pp. 184-191).

Kolomvatsos, K., & Hadjiefthymiades, S. (2008). Implicit Deadline Calculation for Seller Agent Bargaining in Information Marketplaces. In *Proceedings of the 2nd International Conference on Complex, Intelligent and Software Intensive Systems (CISIS 2008),* March 4th-7th, Barcelona, Spain (pp. 184-190).

Laufmann, S. (1994). The Information Marketplace: The Challenge of Information Commerce. In *Proceedings of the 2nd International Conference on Cooperative Information Systems* (pp. 147-157).

Mamdani, E. H., & Assilian, S. (1975). An experiment in linguistic synthesis with a fuzzy logic controller. *International Journal of Man-Machine Studies*, *7*, 1–13. doi:10.1016/S0020-7373(75)80002-2

Nwana, H. S. (1996). Software Agents: An Overview. *The Knowledge Engineering Review*, *11*(2), 205–244. doi:10.1017/S026988890000789X

Rubinstein, A. (1985a). Perfect Equilibrium in a Bargaining Model. *Econometrica*, *50*, 97–109. doi:10.2307/1912531

Rubinstein, A., & Osborne, M. J. (1994). *A Course in Game Theory*. Cambridge, MA: MIT Press.

Rubistein, A. (1985b). A Bargaining Model With incomplete Information About Time Preferences. *Econometrica*, *53*(5), 1151–1172. doi:10.2307/1911016

Zadeh, L. A. (1965). Fuzzy Sets. *Information and Control*, *8*(3), 338–353. doi:10.1016/S0019-9958(65)90241-X

Zipf, G. K. (1949). *Human Behaviour and the Principle of Least Effort*. Cambridge, MA: Addison-Wesley.

## KEY TERMS AND DEFINITIONS

**Electronic Market:** A place where entities can negotiate and agree upon the exchange of products.

**Information Market:** Electronic market where the negotiated product is information.

**Intelligent Agent:** Autonomous software component acting on behalf of its owner. It can learn its owner characteristics and preferences.

**Fuzzy Logic:** Mathematical technique for dealing with imprecise or incomplete information in a specified scenario.

**Fuzzy Rule Base:** A set of If-then rules which consists of the main reasoning component of a fuzzy system.

**Pricing Function:** A function which results the price that an entity proposes when negotiating in an electronic market.

**Seller Deadline:** The time limit for which the seller stays in an interaction procedure with potential buyers.

# Chapter 27
# Towards Efficient Trust Aware E-Marketplace Frameworks

**Malamati Louta**
*Harokopio University of Athens, Greece*

**Angelos Michalas**
*Technological Educational Institute of Western Macedonia, Greece*

## INTRODUCTION

In the liberalized and deregulated e-marketplace some key factors for service providers' success are the following. First, the efficiency with which services will be developed. Second, the quality level, in relation with the corresponding cost, of new services. Third, service providers' reliability with respect to service provisioning. Fourth, the efficiency with which the services will be operated (controlled, maintained, administered, etc.). The aim of this paper is, in accordance with efficient service operation objectives, to propose enhancements to the sophistication of the negotiation functionality that can be offered by e-commerce systems in open competitive communications environments.

DOI: 10.4018/978-1-61520-611-7.ch027

In the highly competitive and dynamic e-marketplaces, Service/Product Requestors (*SPRs*) should be provided with mechanisms that enable them to find and associate with the most appropriate Service/Product Providers (*SPPs*), i.e., those offering the desirable quality of service / product at a certain time period, in a cost efficient manner. Such mechanisms may entail a wide variety of negotiation mechanisms, including auctions, bilateral (*1* to *1*) and/or multilateral (*M* to *N*) negotiation models and strategies, as well as posted offer schemes (i.e., a nonnegotiable, take-it-or-leave-it offer) in order to establish the 'best' possible contract terms and conditions with respect to service / product access and provision.

Efficient e-marketplace operation requires for a cooperation of high degree among the various entities (SPRs and SPPs). However, seeking for the maximization of their welfare, while achieving their own goals and aims, entities may misbehave (intentionally-acting selfishly or unintentionally-due to faults), thus, leading to a significant deterioration of system's performance. Therefore, trust mechanisms should be exploited in order to build the necessary trust relationships among the e-marketplace entities, enabling them to automatically adapt their strategies to different levels of cooperation and trust.

In related research literature, reputation mechanisms are employed to provide a "soft" security layer, sustaining rational cooperation and serving as an incentive for good behaviour, as good players are rewarded by the society, whereas bad players are penalized by spreading in the market their bad reputation. In general, reputation mechanisms establish trust by exploiting learning from experience concepts in order to obtain a reliability value of system participants in the form of rating based on other entities' view/opinion. Reputation related information may be disseminated to a large number of system participants in order to adjust their strategies and behaviour, multiplying thus the expected future gains of honest parties which bear the loss incurred by cooperating and acting for the maximization of the social welfare. Current reputation system implementations consider feedback given by Buyers in the form of ratings in order to capture information on Seller's past behavior, while the reputation value is computed as the sum (or the mean) of those ratings, either incorporating all ratings or considering only a period of time (e.g., six months) (eBay), (OnSale).

In the context of this study, our focus is laid upon the evaluation of the reliability of SPPs. To this respect, a collaborative reputation mechanism is presented and evaluated, which takes into account the SPPs' past performance in consistently satisfying the SPRs' expectations. Specifically, the reputation mechanism rates the SPPs with respect to whether they honoured or not the agreements established with the SPRs, thus, introducing the concept of trust among the involved parties. The reputation mechanism considers both first-hand information (acquired from the evaluator SPR's past experiences with the target SPP) and second-hand information (disseminated from other SPRs), is decentralized and exhibits robust behaviour against inaccurate reputation ratings intentionally and/or unintentionally provided.

The rest of the paper is structured as follows. After briefly revisiting the related research literature, the authors discuss on the fundamental concepts lying behind the design of the trust-aware framework. The problem of cheating witnesses is described and the solution introduced is experimentally evaluated.

## BACKGROUND

The issue of trust has been gaining an increasing amount of attention in a number of research communities. In (Wang, 2008) the authors review the reputation-based trust evaluation mechanisms in literature and outline some trust issues that are particularly important in e-commerce environments. In (Josang, 2005) an overview on existing and proposed systems that can be used to derive measures of trust and reputation for Internet based transactions is given, while current trends and developments are analyzed. A general observation is that commercial systems so far utilize simple schemes, while academic community proposes systems with advanced features, which however lack coherence, as there is no consolidated set of well recognized principles for building trust and reputation systems.

In (Mui, 2003) a typology is proposed summarizing existing works on reputation across diverse disciplines (i.e., economical studies, scientometrics, computer science, evolutionary biology, sociology). Specifically, reputation is assumed to be context dependent, it can be viewed as global or personalized, can be used to describe an individual or group of individuals. Individual reputation can be derived either from direct encounters or/and observations made about other agent's encounters with others (direct reputation) or from inferences based on information gathered indirectly (indirect reputation) comprising prior beliefs an agent has about strangers, reputation estimates of the group an agent belongs to and information gathered according to a mechanism similar to the "word of mouth" propagation of information for human. Based on this typology, the authors have studied the relative strengths of different notions of reputation in a set of evolutionary games.

In (Sabater, 2001), reputation is considered to be a multi-faceted concept. Thus, it is built taking into account individual, social and ontological dimensions. Specifically, an agent's reputation is formed considering previous direct interactions with the specific agent (individual reputation formation), the interactions with the other members of the group to which the agent under evaluation belongs, the opinion the group of the requesting agent has about the agent being evaluated, the opinion the group of the requesting agent has about the group the agent being evaluated belongs (social reputation formation) and reputation values on different aspects (ontological reputation formation).

In (Yu, 2000), the authors base the decision concerning the trustworthiness of a party on a combination of local information acquired from direct interactions with the specific party (if available) and information acquired from witnesses (trusted third parties that have interacted with the specific party in the past). In order to obtain testimonies from witnesses, a trust net is built by seeking and following referrals from its neighbours, which may be adaptively chosen. Their approach relies upon the assumption that the vast majority of agents provide honest ratings, in order to override the effect of spurious ratings generated by malicious agents. In (Yu, 2003), some models of deception are introduced and it is studied how to efficiently detect deceptive agents following these models based on a variant of the weighted majority algorithm applied to belief functions. In (Zhang, 2008), the authors present a model for evaluating trustworthiness of advisor and seller agents aiming to handle effectively unfair ratings (both high and low). Advisor and seller agent trustworthiness can be calculated exploiting both private and public knowledge. Experimental results are provided demonstrating the performance of the proposed scheme under diverse conditions with respect to the percentages of unfair ratings provided.

Bachrach (2009) presents a decentralized data management scheme grounded in gossip-based algorithms. The proposed scheme motivates agents to maintain a high reputation value as its theoretical and empirical (through simulation experiments) analysis shows that the higher an agent's reputation is above a threshold set by its peers, the more transactions it would be able to complete within a certain time unit.

In (Yolum, 2005), the authors study the guidelines for building self-organizing referral networks, consisting of autonomous agents that model others in term of their trustworthiness and disseminate information on others' trustworthiness via simulation experiments for the e-commerce application domain. The simulation findings yield interesting guidelines with respect to the selectivity of referrals exchange.

Xiong (2005) introduces PeerTrust, an adaptive and dynamic reputation based trust model that helps participants/peers to evaluate the trustworthiness of each other based on the community feedback about participants' past behavior. Regarding the credibility of the feedback source, the authors first used a function of the trust value as its credibility value; that is feedback from trustworthy peers is considered more credible. However, it is possible for a peer to maintain a good reputation by performing high quality services but send malicious feedback to its competitors. In such a case the credibility factor is calculated as a personalized similarity measure between the experiences with other partners in the market.

In general, various systems for trust establishment have been proposed, a number of which utilize the opinion / view other system participants have on the entities under evaluation. Most of them aim to enable entities to make decisions on which parties to negotiate/cooperate with or exclude, after they have been informed about the reputation ratings of the parties of interest. The authors believe that the SPPs that are deemed misbehaving should not be directly excluded / isolated, but instead the SPRs' decision on the most appropriate SPP should be on a weighted combination of the evaluation of the quality of the SPPs' offer and of their reputation rating. Additionally, a number of related works do not clearly describe how the evaluator entities find in the system feedback sources used for the overall evaluation of the target entities. Furthermore, our mechanism in order to elicit true feedback considers intentional as well as unintentional inaccurate information provisioning, taking into account, in addition to witness trustworthiness, the number of transactions a witness SPR has performed with the target SPP and the sum of the respective transactional values. Finally, in our framework, time effect has been taken into account and more recent events weigh more in the evaluation of the overall reputation rating of the target entity, while untrustworthy SPPs are given a chance to re-enter the system and improve their reputation rating in case they abide by the established SLA terms and conditions.

## TRUST-AWARE E-MARKETPLACE FRAMEWORK FUNDAMENTALS

Let us assume the presence of *M* SPPs offering *n* services / products in the e-marketplace and *N* SPRs negotiating with SPPs at some points in time for the terms and conditions concerning the provisioning of a service / product. In general, the SPRs can decide on the most appropriate SPPs based on an evaluation of the SPPs' offers quality combined with an estimation of the SPPs' expected behaviour. The second factor constitutes the SPPs reliability, which is introduced in order to reflect whether the SPPs finally provide to the SPRs the service / product that corresponds to the established contract terms or not.

The study is based upon the notion of interacting intelligent agents which participate in trading activities on behalf of their owners, while exhibiting properties such as autonomy, reactiveness, and proactiveness, in order to achieve particular objectives and accomplish their goals. Thus, Service/ Product Requesting Agent (*SPRA*) may be introduced and assigned with the role of capturing the SPR preferences, requirements and constraints regarding the requested service / product, delivering them in a suitable form to the appropriate SPP entity, acquiring and evaluating the corresponding SPPs' offers, and ultimately, selecting the most appropriate SPP on the basis of the quality of its offer and its reputation rating. Service Product Provider Agents (*SPPAs*) are the entities acting on behalf of the SPPs. Their role would be to collect the SPR preferences, requirements and constraints and to make a corresponding offer, taking also into account certain environmental criteria. SPRAs and SPPAs are both considered to be rational and self-interested and are, in principle, in conflict, aiming to maximise their owners' profit.

A distributed collaborative reputation mechanism is exploited in order to assess SPPs reliability in an accurate and time-efficient manner. In essence, SPPs reputation ratings are formed by SPRs, reflecting whether in general SPPs abide by the agreement terms or not; the SPPs reliability is reduced whenever the SPPs during service / product provisioning do not honour the contract terms reached via the negotiation process. For the formation of SPPs reliability, the evaluator SPR agent utilises both locally stored information (acquired from SPRA's past experiences with SPPAs) as well as information retrieved from other agents (i.e., witness - based approach).

The designed reputation mechanism is based on the following focal assumptions and principles:

A) Each SPRA keeps a record of the reputation ratings of the SPPAs it has negotiated with and has been served in the past.
B) Each SPRA is willing to share its experiences and provide whenever asked for the reputation ratings of the SPPAs, formed on the basis of its past direct interactions.
C) The SPPAs reputation ratings are estimated by an evaluator SPRA as a weighted combination of two factors; the first factor constitutes the SPPAs reputation ratings as formed by the evaluator SPRA on the basis of its direct experiences in the e-market, while the second factor contributing to the overall reputation ratings estimation depends on information regarding SPPAs past behaviour gathered from a number of witnesses.
D) The evaluator SPRA obtains potential witness references by contacting a central component, hereafter noted as Reputation Broker. Specifically, in the current version of this study, the Reputation Broker maintains a list of the SPPAs providing a specific service / product as well as a list of SPRAs that have previously interacted with a specific SPPA.
E) The reliability of SPPs is treated as a behavioural aspect, independent of the services / products provided. Thus, the witnesses list may be composed by SPRAs which have had direct interactions with the specific SPPA in the past, without considering the service / product consumed, enabling this way the formation of SPPs' reliability in a time – efficient manner. Additionally, the SPRAs will serve as witnesses for the estimation of the overall reputation of SPPAs, only in case they have formed an accurate picture regarding SPPA's reliability related behavioural aspects (e.g., they have been involved with the target SPPA for at least a pre-defined number of transactions, in which case we assume that the learning period has been completed).
F) SPPAs have a solid interest in informing the Reputation Broker with respect to services / products they currently offer, while the SPRAs are authorized to access and obtain witness references only in case they send feedback concerning the preferred partner for their past interactions in the system. This policy based approach provides a solution to the inherent incentive based problem of reputation mechanisms in order for the Reputation Broker to keep accurate and up to date information.
G) SPPAs reputation ratings are updated by SPRAs, only after a transaction has taken place, exploiting learning from experiences techniques. Specifically, a reward/penalty function is introduced, reflecting whether the service / product quality is compliant with the picture established during the negotiation phase. The better /worse the SPPA behaves with respect to the agreed terms and conditions, the more positive /negative the influence of the reward / penalty function on the SPPA's rating.
H) Initial SPPAs' reliability rating values are taken equal to 0.1. A quite low reputation rating value has been assumed (that is all SPPAs initially are considered to be dishonest entities) in order to avoid the bad consequences of changing identities so as to wipe out possible misbehaviour in the past.
I) A learning period is required in order for the SPRAs to obtain fundamental information for the SPPAs. During the learning period and in case reputation specific information is not available to the SPRA (both through its own experiences and through the witnesses) or it highly possible to be outdated, the reliability related factor is not considered for the SPPA selection. Thus, the SPP's will

be selected only on the basis of the quality of their offers (or even in a random or in a round-robin basis).

J) Considering that the SPRAs have initially acquired the fundamental reliability related information for the SPPAs (that is after the learning period), only the reputation rating of the "best" SPPA (i.e., the one selected on the basis of the quality of the offers proposed to the SPRA and the SPPAs' reliability related values) will be updated, after the user finally accesses the service. Thus, the system can only verify the behaviour of the "most" appropriate SPPA and has no means to identify potential changes to other SPPAs' behaviour with respect to their compliance to the established contract terms and conditions.

K) In order to take into account new SPPAs that enter the system and/or not to exclude SPPAs that initially did not honour the terms and conditions of the contracts established, thus being attributed with a small reliability related value after the learning period, and give them a chance to re-enter to the system and improve their reputation rating in case they abide by the contract terms and conditions, the simplest possible approach that could be adopted is to base the SPRAs' decision concerning the most appropriate SPPA (after a specific time period, or after the completion of a specific number of transactions) on the SPPAs' performance and omit the SPPAs' reputation rating values until possible outdated information the system possesses is updated

L) The reputation mechanism comes at the cost of keeping reputation related information at each SPRA and updating it after service provision / resource consumption has taken place.

M) The reliability rating value of the SPPAs requires in some cases (e.g., when consumption of network or computational resources are entailed in the service provisioning process) a mechanism for evaluating whether the service quality was compliant with the picture promised during the negotiation phase.

For details, please refer to (Louta, 2008-A) and (Louta, 2009).

## Witness Cheating Behaviour: Challenges & Solutions

True feedback cannot be automatically assumed. Second-hand information can be spurious (e.g., parties may choose to misreport their experience due to jealousy in order to discredit trustworthy providers or in contrast to add credits to untrustworthy providers). In general, a mechanism for eliciting true feedback in the absence of Trusted Third Parties or intermediaries is necessitated. According to the simplest possible approach that may be adopted in order to account for possible inaccuracies to the information provided by the witnesses SPRAs (both intentional and unintentional), the evaluator SPRA can mostly rely on its own experiences rather on the target SPPA's reputation ratings provided after contacting the SPRAs. To this respect, SPPA's reputation ratings provided by the witness SPRAs may be attributed with a relatively low significance factor.

In the context of this study, we consider that in the eyes of the evaluator agent, each witness SPRA is associated with a weighting factor dynamically updated, which reflects whether the SPRA provides feedback with respect to its experiences with the SPPAs truthfully and in an accurate manner. In essence, this weighting factor is a measure of the credibility of the witness information. To be more specific, in order to handle intentional inaccurate information, an honesty probability is attributed to each SPRA, i.e., a measure of the likelihood that a SPRA gives feedback compliant to the real picture concerning service provisioning. Trustworthiness of witnesses initially assumes a high value. That is all witnesses are considered to report their experiences to the evaluator agent honestly. Potential dissemination of misinformation on behalf of a witness is identified in case the overall SPPAs reputation rating as estimated by the evaluator is beyond a given distance from the rating provided by the witness, in which case its honesty probability is accordingly decreased. Second-hand information obtained from trustworthy SPRAs (associated with a high honesty probability), are given a higher significance factor, whereas reports (positive or negative) coming from untrustworthy sources have a small impact on the formation of the SPPAs' reputation ratings.

Concerning the provision of inaccurate information unintentionally, the authors take into account the number of transactions a witness SPRA has performed with the target SPPA, the sum of the respective transaction values and the time the last transaction has occurred. Specifically, it is quite safe to assume that SPRAs that have been involved with the target SPPA only for a few times will not have formed an accurate picture regarding its behaviour. Additionally, if the reputation rating is formed on the basis of low-valued transactions, there is a possibility that it does not reflect the real picture (e.g., an SPPA may strategically exhibit good behaviour in case its potential profits in a context of a transaction are low and cheat when the expected earnings are high). In order to further improve the correctness of the reputation ratings assessment, time effects have been introduced in our mechanism, modeling the fact that more recent events should weigh more in the evaluation of the target SRPs overall reputation rating by the evaluator. Thus, potential modifications of the SPPs behaviour in recent past are addressed.

## EXPERIMENTAL RESULTS

The reputation framework with the assumption of honest feedback provision from the vast majority of the witnesses has been evaluated by simulating interactions among self-interested SPRAs and SPPAs and has performed well (Louta, 2008-B) and (Louta, 2009). In this study, our aim is to extensively test our framework and provide indicative evidence of the efficiency of our proposed scheme, incorporating various degrees of witnesses' misbehaviour.

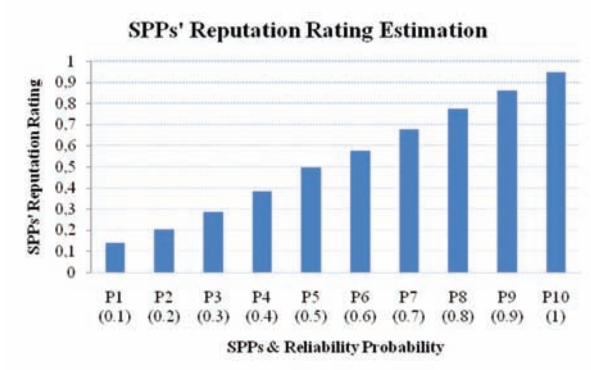
We hereafter assume the existence of an area that falls into the domain of $M=10$ candidate Service / Product Providers $P=\{P_1,P_2,\ldots,P_M\}$ (that is a specific request may be handled by any of the candidate SPPs belonging to the set $P$). Furthermore, it is assumed that $N=1000$ different Service/Product Requestors access the area.

In order to evaluate SPPs' reliability, each SPP has been associated with a reliability probability, i.e., a measure of the likelihood that the SPP delivers the service in accordance with the agreement established. This probability has been set to the following values: *0.1* for SPPA $P_1$, *0.2* for SPPA $P_2$ (i.e.,), *0.3* for SPPA $P_3$, *0.4* for SPPA $P_4$, *0.5* for SPPA $P_5$, *0.6* for SPPA $P_6$, *0.7* for SPPA $P_7$, *0.8* for SPPA $P_8$and *0.9* for SPPA $P_9$ and *1* for SPPA $P_{10}$. A mixture of extreme and moderate values has been chosen in order to test the schemes under diverse conditions. In essence, with probability *0.1* SPPA $P_1$ complies with its promises, while $P_9$ maintains its promises with probability *0.9*.

Figure 1 illustrates the reputation ratings of each SPPA, as estimated after 100 transactions have taken place between the evaluator SPRA & each witness SPRA and the SPPA under evaluation. The number of witnesses is taken equal to 100 and all witnesses are assumed to behave honestly (that is, they provide the evaluator SPRA with the actual reputation rating).

In the sequel, we incorporated witness cheating behaviour in our framework, gradually increasing the portion of misbehaving witnesses (that is the witnesses returning false feedback to the evaluator agent) as well as the distance of the false feedback from the actual rating as formed by each witness SPRA on the basis of its direct experiences with the SPPAs. Specifically, we have considered 10%, 30% and 50% of the witnesses providing

*Figure 1. SPPs' reputation rating estimation, considering honest feedback provisioning from 100 witnesses*




inaccurate reputation related information to the evaluator agent, varying in each case the distance of the inaccurate rating from the actual rating to 10%, 30% and 50% (both incrementally and decrementally).

Figure 2 presents the mean deviation for all SPPAs of the estimated SPPAs' rating with respect to the actual one for each of the aforementioned cases (blue line series). For the SPPAs' reputation rating estimation, as a first step witness trustworthiness assumes its initial value and is not dynamically modified (that is all witnesses are in the eyes of the evaluator agent behaving honestly, even if this is not the case). As a next step, the evaluator agent identifies the misbehaving witnesses and dynamically updates the respective weighting factor taken into account in the SPPA's rating estimation. The deviation of the estimated SPPAs' rating with respect to the actual one for the cases of 30% and 50% misbehaving witnesses each with 30% and 50% feedback modification (distance of the inaccurate rating from the actual rating) with respect to the actual one is presented in the red line series.

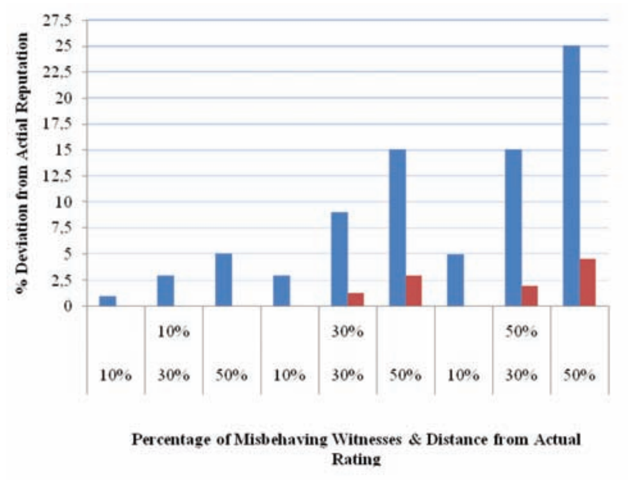
As may be observed, the mean deviation of the SPPAs' reputation rating estimation from the actual rating from 15% (in the case of 50% misbehaving witnesses with feedback modification 30% without dynamic modification of witness trustworthiness) drops to approximately 3%, when adjusting their honesty probability. The same stands for the case of 50% misbehaving witnesses with feedback modification 50% where the mean deviation drops from 25% to 4,55%.

## CONCLUSION

E-marketplaces are highly dynamic and variable environments characterized by at any time and no cost associated emergence and disappearance of various actors, players' anonymity, participation in only a few transactions that may be of relatively low value, and difficulty of legal contract enforcement as potential contracts may cross jurisdictional boundaries. In general, parties' misbehaviour due to selfish or malicious reasons can significantly degrade the performance of the e-market. To cope with misbehaviour the parties should be able to automatically adapt their strategies to different levels of cooperation and trust. Reputation mechanisms are employed to provide a "soft" security layer, introducing incentives for good behaviour.

In this study, a reputation mechanism is proposed which helps estimating Service Product Providers (SPPs) trustworthiness and predicting their future behaviour, taking into account their

*Figure 2. SPPs' reputation rating Estimation, considering honest feedback provisioning from 100 witnesses*




past performance in consistently satisfying Service Product Requestors (SPRs) expectations in e-marketplace environments. Specifically, SPPs are rated with respect to whether they honoured or not the agreements they have established with the SPRs. The reputation mechanism is distributed, considers both first-hand information and second-hand information, while it exhibits a robust behaviour against inaccurate reputation ratings. Our aim is to provide indicative evidence of the efficiency of our proposed reputation framework, especially in case of unfair ratings (witnesses cheating behaviour), simulating interactions among self-interested autonomous intelligent agents. Future plans involve our frameworks' extensive empirical evaluation against existent reputation models and trust frameworks.

## REFERENCES


Bachrach, Y., Parnes, A., Procaccia, A., & Rosenschein, J. (2009). Gossip-based aggregation of trust in decentralized reputation systems. *Autonomous Agents and Multi-Agent Systems*, *19*, 153–172. doi:10.1007/s10458-008-9073-6

*eBay*. (n.d.). Retrieved from http://www.ebay.com

Josang, A., Ismail, R., & Boyd, C. (2005). A survey of trust and reputation systems for online service provision. *Decision Support Systems*, *43*, 618–644. doi:10.1016/j.dss.2005.05.019

Louta, M. (2008). Towards a Collaborative Reputation Based Service Provider Selection in Ubiquitous Computing Environments. In F.E. Sandnes et al. (Eds.), *UIC 2008* (LNCS 5061, pp. 520-534). Berlin Heidelberg: Springer-Verlag.

Louta, M., & Michalas, A. (2008). Trust Management Framework for Efficient Service Provisioning in Dynamic Distributed Computing Environments. In *Proc. of the 3rd International Conference on Internet and Web Applications and Services*, Athens, Greece (pp. 518-523).

Louta, M., Michalas, A., Anagnostoupoulos, I., & Vergados, D. (2009). Trust management framework for intelligent agent negotiations in ubiquitous computing environments. *Telecommunication Systems Journal*, *41*, 141–157. doi:10.1007/s11235-009-9155-z

Mui, L., Halberstadt, A., & Mohtashemi, M. (2003). Evaluating Reputation in Multi-Agent Systems. In R. Falcone et al. (Eds.), *Trust, Reputation, and Security: Theories and Practice* (LNAI 2631, pp. 123-137). Berlin Heidelberg: Springer-Verlag.

OnSale. (n.d.). Retrieved from http://www.onsale.com/exchange.htm

Sabater, J., & Sierra, C. (2001). REGRET: Reputation in gregarious societies. In *Proc. of the 5th International Conference on Autonomous Agents,* Montreal, Quebec, Canada (pp. 194-195).

Wang, Y., & Lin, K.-J. (2008). Reputation-Oriented Trustworthy Computing in E-Commerce Environments. *IEEE Internet Computing*, *12*(4), 55–59. doi:10.1109/MIC.2008.84

Xiong, L., & Liu, L. (2005). Reputation and Trust. In W.-C. Hu et al. (Eds.), *Advances in Security and Payment Methods for Mobile Commerce* (pp. 19-35). Hershey, PA: Idea Group Inc.

Yolum, P., & Singh, M. (2005). Engineering Self-Organizing Referral Networks for Trustworthy Service Selection. *IEEE Transactions on Systems, Man, and Cybernetics. Part A, Systems and Humans*, *35*(3), 396–407. doi:10.1109/TSMCA.2005.846401

Yu, B., & Singh, M. (2000). A social mechanism of reputation management in electronic communities. In M. Klusch & L. Kerschberg (Eds.), *Cooperative Information Agents IV - The Future of Information Agents in Cyberspace* (LNCS 1860, pp. 154-165). Berlin Heidelberg: Springer-Verlag.

Yu, B., & Singh, M. (2003). Detecting Deception in Reputation Management. In *Proc. of the 2nd International Joint Conference on Autonomous Agents and Multi-Agent Systems*, Melbourne, Australia (pp. 73-80).

Zhang, J., & Cohen, R. (2008). Evaluating the trustworthiness of advice about seller agents in e-marketplaces: A personalized approach. *Electronic Commerce Research and Applications*, *7*, 330–340. doi:10.1016/j.elerap.2008.03.001

## KEY TERMS AND DEFINITIONS

**Distributed & Collaborative Reputation Mechanisms:** Reputation mechanisms establish trust by exploiting learning from experience concepts in order to obtain a reliability value of system participants in the form of ratings. Collaborative algorithms attempt to determine ratings for a collection of entities, given a collection of opinions that those entities hold about each other.

**E-Marketplace Frameworks:** The entities and processes enabling buying and selling of products or services over electronic systems, such as the Internet and other computer networks.

**Mobile Intelligent Agent Technology:** Intelligent mobile agents are software components incorporating intelligent functionality that can at a certain point in time migrate in order to perform a specific task.

**Reliability Evaluation:** The process of determining whether an existing system / entity has achieved a specified level of operational reliability (desired, agreed upon or contracted behaviour).

**Trust Management:** Trust management can be conceptualized in two ways. First, as a process according to which an entity becomes trustworthy for other entities. Second, as a process that enables the assessment of the reliability of other entities, which in turn is exploited in order to automatically adapt its strategy and behaviour to different levels of cooperation and trust.

# Section 4
# E-Business Strategies

# Chapter 28
# Assessing Relational E-Strategy Supporting Business Relationships

**Anne-Marie Croteau**
*Concordia University, Canada*

**Anne Beaudry**
*Concordia University, Canada*

**Justin Holm**
*Concordia University, Canada*

## INTRODUCTION

As per the Census Bureau of the Department of Commerce, the estimate of U.S. retail e-commerce sales for the first quarter of 2009 was $31.7 billion. For the same period, e-commerce accounted for 3.5 percent of total sales with a value of $30.2 billion sales. As electronic business (e-business) has become essential in our economy, organizations have begun to demand a return on their investment in such endeavors (Damanpour and Damanpour, 2001). More recently, research indicates that web-based technologies enhance performance when the environmental pressures are high, the technical capabilities within the organization are well integrated, and the management team highly supports and sees value in e-business initiatives (Sanders, 2007).

DOI: 10.4018/978-1-61520-611-7.ch028

An extensive and diverse body of literature has been produced regarding e-business. One research angle that lacked over the years is the definition and assessment of an e-business strategy (e-strategy). Some efforts were made in evaluating e-strategy through an electronic simulation (Ha and Forgianne, 2006). Another recent research observed that human, technological and business capabilities and e-business implementation influence the business performance at various levels (Coltman, Devinney, and Midgley, 2007). However, both studies did not develop an e-strategy construct empirically tested with managers.

The main objective of this paper is thus to develop an integrative construct of e-strategy, mainly focusing on the relationships built between and within companies. Various e-strategies related to the relationships built between a company and its business partners (B2B), consumers (B2C), and employees (B2E) are incorporated into a unified construct called relational e-strategy, which is measured as a second-order factor composed of these three different dimensions. Structural equation modeling using EQS is used to provide a preliminary test of the new model. Results obtained from 220 respondents suggest that the relational e-strategy construct and its three sub-constructs meet all the criteria for construct validation. To provide some indication of its predictive validity, the relational e-strategy is tested against business performance where positive and significant results are obtained.

The paper is organized as follows. The first section offers a brief literature review of the relational e-strategy. The methodology used to develop the relational e-strategy measurement tool and collect data is presented next. The findings are then depicted and discussed. The last section provides a discussion and addresses the limitations and implications of this study as well as future directions for research.

## RELATIONAL E-STRATEGY

Chandler (1962) defines strategy as the "determination of the basic long-term goals of an enterprise, and the adoption of courses of action and the allocation of resources necessary for carrying out these goals" (1962, p. 13). Strategy is also defined as "either the plans made, or the actions taken, in an effort to help an organization fulfill its intended purposes" (Miller and Dess, 1996, p. 38). Therefore, a business strategy is the outcome of decisions made to guide an organization with respect to its environment, structure and processes that influence its organizational performance (Croteau and Bergeron, 2001).

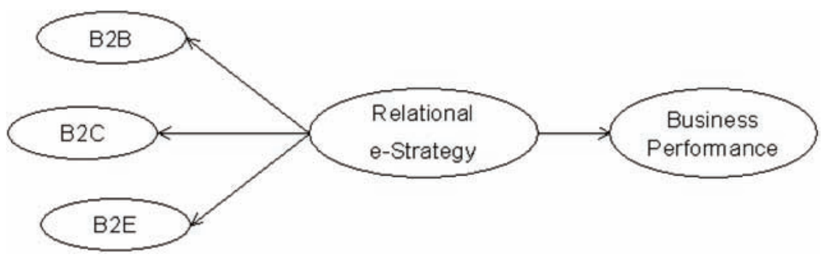
In the e-business context, the concept of e-strategy refers to how the web-based technologies can restructure organizations by providing them with a new competitive edge (Cagliano, Caniato, and Spina, 2003). The term "relational" is defined as the way web-based technologies are being used to facilitate relationships (Murillo, 2001). Therefore, borrowing from previous definitions, we define *"relational e-strategy" as the way organizations use electronic means to facilitate their business relationships.*

Hooft and Stegwee (2001) attach supplier and customer life cycles to Porter's (1985) value chain. The value chain views a company as an entity, which transforms raw materials, through a value adding process, into a finished product or service. The supplier and customer life cycles outline the process of interactions with suppliers and customers to buy raw materials and to sell finished goods. Both processes have been revolutionized by IT. Hooft and Stegewee's model also suggests that a company's relations with employees are within the company's value chain.

Inspired by their model, the relational e-strategy construct reflects most of the relationships encountered by a company and comprises three dimensions: B2B, B2C, and B2E. This instrument captures how web-based technologies can support business relationships. Explanations for each of the three e-strategy dimensions follow.

***Business-to-Business e-Strategy*** refers to the electronic means used to facilitate an organization's relationships with other businesses. Inter-organizational cooperation can assist companies in deriving a competitive advantage. The e-commerce procurement life cycle outlines how technology is important in facilitating relationships between businesses (Archer and Yuan, 2000), which is an important aspect of successful B2B initiatives (O'Keefe, 2001; Galbraith and Merril, 2001). The perceived value of the relationship, inter-firm trust, and relationship commitment are indications of healthy business interactions (Hausman, 2001). Communication and collaboration are crucial parts of developing relationships between businesses (Olesen and Myers, 1999; Olkkonen et al, 2000) and can even enable supplier collaboration in developing products and specifications (Parker, 2000; Burgess et al., 1997).

*Figure 1. Research model*




***Business-to-Consumer e-Strategy*** refers to the electronic means used to facilitate relationships and transactions with the consumers of products or services. Easing the purchasing process for consumers with the use of technology can lead to increased sales and is thus a valuable asset to businesses (Lee, 2001; Bontis, 1998). B2C is also facilitating the process of building relationships with consumers who shop over the Internet (Wang et al., 2000). It can be used to customize communication and content for specific consumers, increasing the ability of companies to enhance consumer relations (Jiang, 2000). The analysis of consumer purchasing and browsing patterns can lead to a greater understanding of consumers (Phau and Poon, 2000). Software agents and decision support systems can be employed to learn about and to serve consumers better (Sproule and Archer, 2000).

***Business-to-Employee e-Strategy*** refers to the electronic means used to facilitate communication among employees as well as between employees and management. B2E can be used to enable employee development, innovation, and training (Adeoti Adekeye, 1997; Udo, 1998; Bontis, 1998; Kuei et al., 2001; Maier and Remus, 2001). It can also allow employees to access an increased amount of information (Ang et al., 2000).

This review reveals that each dimension of the relational e-strategy has been studied separately. Although this groundwork is important, organizations tend to implement all of them (Turban et al., 2008). Therefore, there is a need to provide both researchers and practitioners with an integrative understanding of what a relational e-strategy is and how it can be measured using these three dimensions.

## METHODOLOGY

This section describes the research model, the operationalization of the constructs, the data collection, and analysis. Measurement tools have been developed to validate the relational e-strategy construct, which is assessed as a second-order factor. B2B, B2C, and B2E e-strategies are measured as first-order constructs and are consequently components of e-strategy. To verify the predictive validity of this proposed construct, the link between the relational e-strategy and the business performance has also been tested using the approach suggested by Venkatraman (1985) when he developed a new measurement of business strategy (STOBE, STrategic Orientation of Business Enterprises). The research model is illustrated in Figure 1.

To respond to the plea made for better MIS research instrument validation (Boudreau et al., 2001), particular attention was devoted to the process of developing and validating the relational e-strategy instrument. Following Churchill's (1979) recommendations, a large number of items were generated and an iterative purification procedure was followed in order to uncover the most relevant items to e-strategy.

Clear constructs for e-strategy were lacking at the beginning of the survey development.

Because there were no instruments previously developed on relational e-strategy, the construct development process was conducted following guidelines proposed by Venkatraman and Grant (1986). Items from business strategy or IT strategy were derived or adapted.

The card-sorting technique was then used to ensure the validity of all dimensions of the relational e-strategy construct. Following guidelines provided by Moore and Benbasat (1991) who originally conducted with paper and envelopes, respondents are asked to consider each survey item and place it in the appropriate category or construct. An on-line adaptation was created to assess the present research instrument. The definitions of the constructs were given in the top frame of the webpage while each item was listed in the lower frame with a selection box for the respondent to choose the construct that they deemed appropriate. Emails were sent to 150 professors at North American universities; 31 were returned to the sender and 12 replied with automated out-of-the-office responses, giving a total sample size of 107. Of the 21 respondents who completed the card sorting exercise, two had not completed the survey completely and four had not selected categorizations for a sufficient number of items. The remaining 15 completed answers were used in the card sorting analysis. This exercise helped in validating the appropriate items; 6 out of 9 items proposed for the B2B e-strategy were kept; 8 out of 11 potential B2C e-strategy items were retained, and 7 out of 11 B2E e-strategy were used for the final instrument.

The web-based survey instrument was then pre-tested three times. The items, as well as the web-design, were modified after each pre-test. The first two pretests were conducted with MIS professors who did not participate to the card-sorting exercise, and the last one was completed by IS practitioners. A five-point Likert scale was used with "totally disagree" and "totally agree" as anchors. A "not applicable" option was also made available. Each page of the final web-based survey provided the definition of each corresponding dimension of the relational e-strategy followed by its corresponding items.

## DATA COLLECTION AND ANALYSIS

A web-based survey was considered appropriate for this study. Since no suitable database existed, the process of gathering email addresses was automated using software agent technology. The agent was programmed to collect email addresses from stock market data providers using company ticker symbols to avoid duplication. Addresses were collected from the American Stock Exchange, Dow Jones, Nasdaq, and Toronto Stock Exchange. Email addresses were obtained for a total of 4538 companies in the US and 1593 companies in Canada. As the head of IT/IS strategy was targeted, recipients who did not hold such a position were asked to forward the email to that person.

Of the 6131 email invitations to participate in the study, 1059 were undeliverable, leaving 5072 delivered emails (3827 in the US and 1245 in Canada). 220 respondents completed the survey, resulting in an overall response rate of 4.34% (3.21% in the US and 7.95% in Canada). Of the 220 respondents, 33% were from the manufacturing industry, 14% from services, and 9% from communications with the remaining respondents being from various industries (finance, health, mining, etc.). The organization size was measured in number of employees where 19% of the organizations in our sample have less than 100 employees, 26% have between 100 and 500 employees, and 55% more than 500 employees. The top four job titles were IT/IS Manager (20%), Director IT/IS (16%), CIO (14%), and VP IT/IS (11%). The remaining respondents occupied other various management positions (manager, director, CEO, CTO). Respondents had an average of 4.7 years of experience in their current position and 7.9 years with their company.

Three sets of t-tests were performed to determine any significant differences among respondents. The first set compared respondents at an executive level to respondents at a managerial level. The second series of tests examined answers from respondents holding an IT/IS related position and those occupying a non-IT/IS related one. Finally, the third set of t-tests was conducted between Canadian and US respondents. None of these revealed any significant differences on any constructs under study. Skewness values ranging from -0.019 to -0.806 and a normalized Mardia coefficient of 9.69 indicated that the data followed a normal distribution. On average, there were only two missing values (0.91%) per respondent.

## RESULTS

EQS, a Structural Equation Modeling (SEM) tool, requires complete data for all cases on all measured variables. Mean replacement was thus performed on missing values as suggested by Bentler (1995). SEM also necessitates that the data set comprises 10 times as many cases than the number of measured variables in the model (Bentler, 1995; Byrne, 1994). The minimum required here is 210 cases. Therefore, a sample of 220 respondents is sufficient.

The first step in SEM consists of performing the measurement model depicting the links between the latent variables and their observed measures. Three indices are used to assess the goodness of fit of the models assessed with the EQS. First, the ratio of chi-square on the number of degrees of freedom provides a good index of fit of the model and is preferred over the chi-square alone which is too sensitive to sample size (Bentler, 1995; Hartwick and Barki, 1994). A ratio value smaller than 3 indicates a good fit of the model (Hartwick and Barki, 1994). Second, the Comparative Fit Index (CFI) is known as a stable goodness of fit index for the structural model. A CFI greater than 0.90 indicates a good fit of the model (Bentler, 1995; Byrne, 1994). Finally, the Average Absolute Standardized Residual (AASR) provides an indication of the proportion of the variance not explained by the model. An AASR smaller than 0.05 is considered appropriate (Bentler, 1995; Byrne, 1994). The resulting measurement models assessing the relational e-strategy and the business performance constructs are respectively presented in Figures 2 and 3. All indices for both constructs meet the goodness of fit criteria, except for the business performance $\chi^2$/df ratio, which is higher than 3.00. This, however, is overcome by a CFI of 0.95 and an AASR of 0.003, both values being better than the recommended threshold.

The second step in SEM is the evaluation of the relationships among the latent factors. The final model is presented in Figure 4. A very good overall fit of the model was achieved with the CFI reaching a more than acceptable level at 0.92, the $\chi^2$/df ratio of 2.12 below the threshold of 3.00, and an AASR index of 0.045 also below the recommended level. The size and significance level of the paths provide strong support to the relationship between the relational e-strategy and the performance.

## DISCUSSION

The overall model was tested with a sample of 220 managers, using a two-step structural equation modeling approach. Collecting email addresses with the software agent technology and conducting a web-based survey turned out to be an efficient way of reaching relevant respondents. One limitation associated with this approach is that private organizations are not represented in our sample. All respondents were from public organizations hence inducing a sample bias even though companies of different sizes and from various industries were included.

The main contribution of this research is the development and validation of an integrative construct of a relational e-strategy that encompasses three dimensions: B2B, B2C, and B2E. The measurement models provided a good fit for

*Figure 2. Relational e-strategy measurement model*

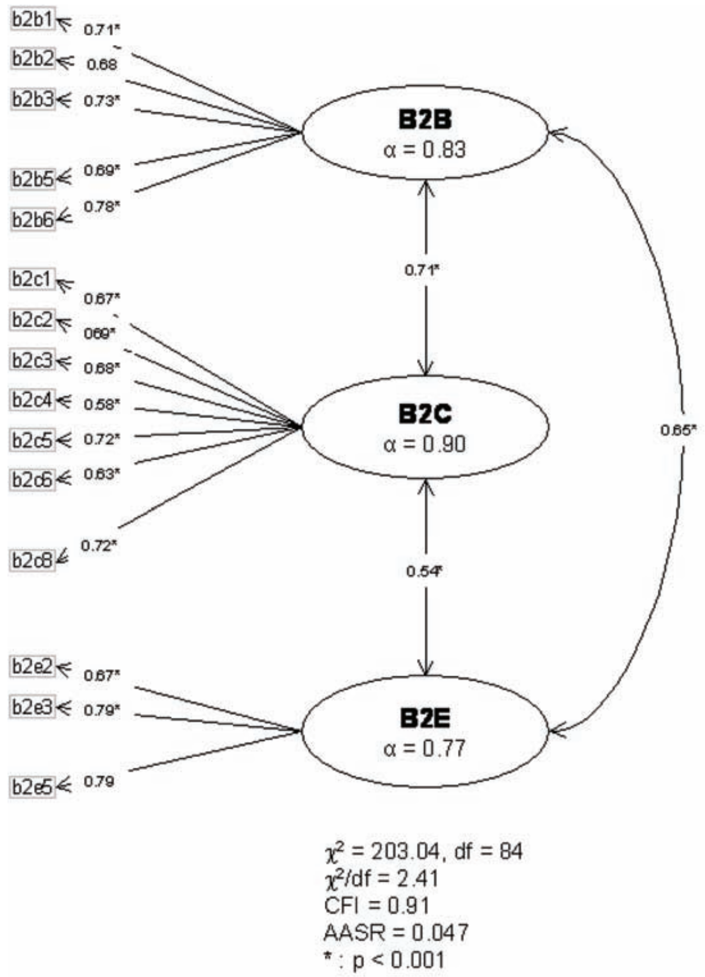



*Figure 3. Business performance measurement model*

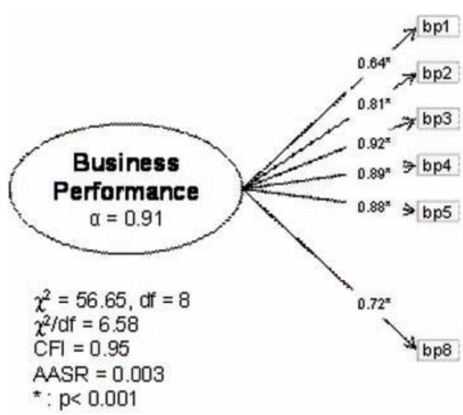
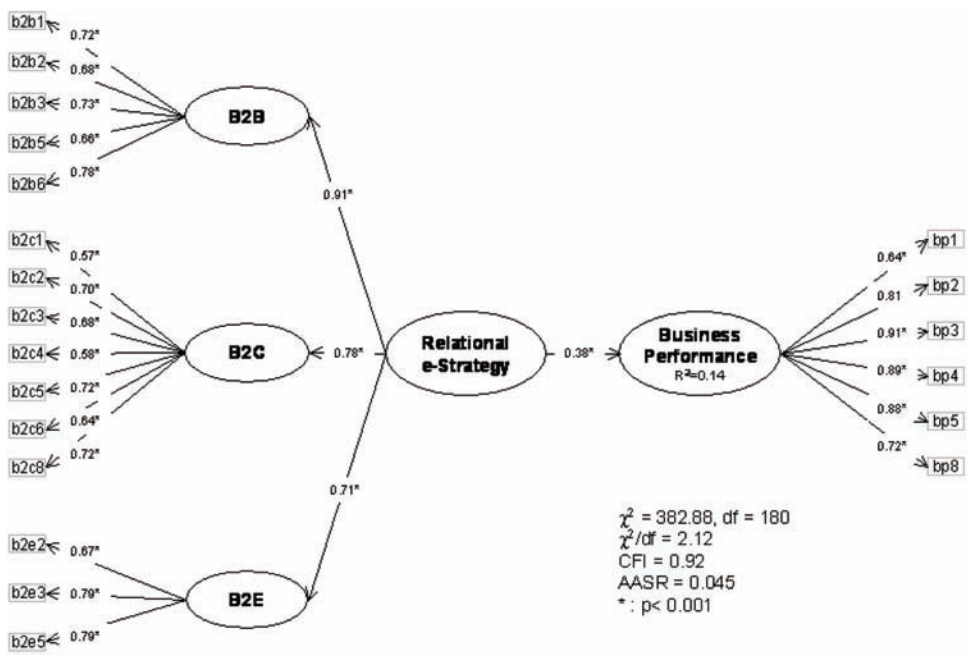


Figure 4. Structural model




the data, furthering the support for the constructs. Overall, the structural model had very acceptable fit. When looking at the links between the relational e-strategy construct and its respective dimensions, results indicate that B2B has the highest path value, followed by B2C and B2E respectively. This reflects the market evolution of deploying electronic means in fostering electronic relationships. Indeed, the level of B2B activities is estimated to be higher than the one for B2C (Surmacz, 2001; Greenberg, 2004).

Our results provide preliminary evidence that these three e-strategies are complementary and significant when defining e-strategy. This instrument turned out to be successful in measuring how web-based technologies can support business relationships. The relationship between the relational e-strategy and the business performance is highly significant, indicating the potential predictive validity of this new measurement tool. Further validation of the relational e-strategy construct and its measurement capability are needed. This instrument could also be used when investigating the strategic impact of e-business applications within organizations.

Based on our sample, results indicate that the relational e-strategy is significantly and positively related to business performance, which is mainly measured from a perceived financial angle. E-strategy helps in increasing net profits, return on sales and return on investment, sales growth rate and market share. When it comes to the components of the relational e-strategy, B2B e-strategy is the most important one, followed by B2C and B2E respectively. B2B e-strategy stresses the importance of sharing information with business partners, building closer relationship with them and increasing their trust through e-business. It also indicates how web-technologies can support better collaboration and negotiation with business partners when developing products and specifications. B2C e-strategy is designed to allow consumers to make online transactions and reduce the service response time. Such e-strategy uses web-technologies to provide consumers with better information on products and services. It helps in better understanding their needs and building their loyalty. It fosters a sense of closeness between them and the company. B2E e-strategy is set to enable training of employees, help them to find other employees with specific expertise and document their knowledge. Respondents were not asked to rank the importance of each e-strategy compared to the other two but it seems that the B2B e-strategy is the most prominent one. This could be due to our sample mainly composed of large companies in the manufacturing and services industries that depend a lot on their business partners to manufacture products and offer services.

Our instrument catches the contributions of web-technologies applied to the three main relationships that a company needs to build to remain viable and profitable: one with its partners, another with its consumers and finally, one with its employees. As per our findings, all three e-strategies are necessary and complementary.

## REFERENCES


Adeoti-Adekeye, W. B. (1997). The importance of management information systems. *Library Review*, *46*(5), 318–327. doi:10.1108/00242539710178452

Aldridge, A., Forcht, K., & Pierson, J. (1997). Get linked or get lost: Marketing strategy for the internet. *Internet Research: Electronic Networking Applications and Policy*, *7*(3), 161–169. doi:10.1108/10662249710171805

Ang, C.-L., Davies, M., & Finlay, P. N. (2000). Measures to assess the impact of information technology on quality management. *International Journal of Quality & Reliability Management*, *17*(1), 42–66. doi:10.1108/02656710010300135

Archer, N., & Yuan, Y. (2000). Managing business-to-business relationships throughout the e-commerce procurement life cycle. *Internet Research: Electronic Networking Applications and Policy*, *10*(5), 385–395. doi:10.1108/10662240010349390

Bentler, P. M. (1995). *EQS Structural Equations Program Manual.* Encino, CA: Multivariate Software Inc.

Bontis, N. (1998). Intellectual capital: An exploratory study that develops measures and models. *Management Decision*, *36*(2), 63–76. doi:10.1108/00251749810204142

Boudreau, M.-C., Gefen, D., & Straub, D. W. (2001). Validation in information systems research: A state-of-the-art assessment. *MIS Quarterly*, *25*(1), 1–16. doi:10.2307/3250956

Burgess, T. F., Gules, H. K., & Tekin, M. (1997). Supply-chain collaboration and success in technology implementation. *Integrated Manufacturing Systems*, *8*(5), 323–332. doi:10.1108/09576069710179779

Byrne, B. M. (1994). *Structural Equation Modeling with EQS and EQS/Windows: Basic Concepts, Applications, and Programming*. Thousand Oaks, CA: Sage Publications Inc.

Chandler, A. D., Jr. (1962). *Strategy and structure*. Cambridge, MA: MIT Press.

Cheng, E. W. L., Li, H., Love, P. E. D., & Irani, Z. (2001). An e-business model to support supply chain activities in construction. *Logistics Information Management*, *14*(1/2), 68–77. doi:10.1108/09576050110363239

Churchill, G. A. (1979). A paradigm for developing better measures of marketing constructs. *JMR, Journal of Marketing Research*, *16*, 64–73. doi:10.2307/3150876

Coltman, T. R., Devinney, T. J., & Midgley, D. F. (2007). E-Business strategy and firm performance: a latent class assessment of the drivers and impediments to success. *Journal of Information Technology*, *22*, 87–101. doi:10.1057/palgrave.jit.2000073

Croteau, A.-M., & Bergeron, F. (2001). An information technology trilogy: Business strategy, technological deployment and organizational performance. *The Journal of Strategic Information Systems*, *10*(2), 77–99. doi:10.1016/S0963-8687(01)00044-0

Galbraith, C. S., & Merrill, G. B. (2001). IPO performance in business-to-business B2B e-commerce firms: Effects of strategy and industry. *Managerial Finance*, *27*(7), 1–15. doi:10.1108/03074350110767259

Greenberg, P. A. (2004). B2B E-Commerce: The Quiet Giant. *e-Commerce Times.* Retrieved from http://www.ecommercetimes.com/story/ 2130.html

Gunnigle, P., Turner, T., & Morley, M. (1998). Strategic integration and employee relations: The impact of managerial styles. *Employee Relations*, *20*(2), 115–131. doi:10.1108/01425459810211296

Ha, L., & Forgionne, G. (2006). Econometric Simulation for e-business strategy evaluation. *International . Journal of Business Research*, *2*(2), 38–53.

Hartwick, J., & Barki, H. (1994). Explaining the role of user participation in information system use. *Management Science*, *40*(4), 440–465. doi:10.1287/mnsc.40.4.440

Hausman, A. (2001). Variations in relationship strength and its impact on performance and satisfaction in business relationships. *Journal of Business and Industrial Marketing*, *16*(7), 600–616. doi:10.1108/EUM0000000006194

Hooft, F. P. C., & Stegwee, R. A. (2001). e-Business strategy: How to benefit from a hype. *Logistics Information Management*, *14*(1-2), 44–54. doi:10.1108/09576050110360223

Jiang, P. (2000). Segment-based mass customization: An exploration of a new conceptual marketing framework. *Internet Research: Electronic Networking Applications and Policy*, *10*(3), 215–226. doi:10.1108/10662240010331975

Kuei, C.-H., Madu, C. N., & Lin, C. (2001). The relationship between supply chain quality management practices and organizational performance. *International Journal of Quality & Reliability Management*, *18*(8), 864–872. doi:10.1108/EUM0000000006031

Lee, C.-S. (2001). An analytical framework for evaluating e-commerce business models and strategies. *Internet Research: Electronic Networking Applications and Policy*, *11*(4), 349–359. doi:10.1108/10662240110402803

Maier, R., & Remus, U. (2001). Towards a framework for knowledge management strategies: process orientation as strategic starting point. In *Proceedings of the 34th Annual Hawaii International Conference on System Sciences*, Maui, Hawaii.

Miller, A., & Dess, G. G. (1996). *Strategic Management* (2nd Ed.). New York: McGraw Hill.

O'Keeffe, M. (2001). Myths and realities of e-commerce in the perishable foods industries: Unleashing the power of reputation and relationship assets. *Supply Chain Management: An International Journal*, *6*(1), 12–15. doi:10.1108/13598540110694644

Olesen, K., & Myers, M. D. (1999). Trying to improve communication and collaboration with information technology. *Information Technology & People*, *12*(4), 317–332. doi:10.1108/09593849910301621

Olkkonen, R., Tikkanen, H., & Alajoutsijarvi, K. (2000). The role of communication in business relationships and networks. *Management Decision*, *38*(6), 403–409. doi:10.1108/EUM0000000005365

Parker, H. (2000). Interfirm collaboration and the new product development process. *Industrial Management & Data Systems*, *100*(6), 255–260. doi:10.1108/02635570010301179

Perry, M., & Bodkin, C. (2000). Content analysis of fortune 100 company web sites. *Corporate Communications: An International Journal*, *5*(2), 87–96. doi:10.1108/13563280010338331

Phau, I., & Poon, S. M. (2000). Factors influencing the types of products and services purchased over the internet. *Internet Research: Electronic Networking Applications and Policy*, *10*(2), 102–113. doi:10.1108/10662240010322894

Sandars, N. A. (2007). An empirical study of the impact of e-business technologies on organizational collaboration and performance. *Journal of Operations Management*, *25*(6), 1332–1347. doi:10.1016/j.jom.2007.01.008

Simeon, R. (1999). Evaluating domestic and international web-site strategies. *Internet Research: Electronic Networking Applications and Policy*, *9*(4), 297–308. doi:10.1108/10662249910286842

Sohal, A.S., Moss, S., & Ng, L. (2001). Comparing IT success in manufacturing and service industries. *International Journal of Operations & Production Management, 21*(1,2), 30-45.

Sproule, S., & Archer, N. (2000). A buyer behavior framework for the development and design of software agents in e-commerce. *Internet Research: Electronic Networking Applications and Policy*, *10*(5), 396–405. doi:10.1108/10662240010349408

Surmacz, J. (2001). B2B: It's Alive, It's Alive. *CIO Metrics*. Retrieved from http://www3.cio.com/metrics/2001/metric205.html

Turban, E., Lee, J., King, D., McKay, J., & Marshall, P. (2008). *Electronic commerce 2008: A managerial perspective*. Upper Saddle River, NJ: Prentice Hall.

Udo, G. J. (1998). The status of information systems department: Te effects of downsizing. *Industrial Management & Data Systems*, *98*(1), 23–32. doi:10.1108/02635579810199672

Venkatraman, N. (1985). *Strategic orientation of business enterprises: The construct and its measurement business*. Ph.D. Dissertation, University of Pittsburgh.

Venkatraman, N., & Grant, J. H. (1986). Construct measurement in organizational strategy research: A critique and proposal. *Academy of Management Review*, (111): 71–87. doi:10.2307/258332

Wang, F., Head, M., & Archer, N. (2000). A relationship-building model for the web retail marketplace. *Internet Research: Electronic Networking Applications and Policy*, *10*(5), 374–384. doi:10.1108/10662240010349381

Warkentin, M., Bapna, R., & Sugumaran, V. (2001). E-Knowledge networks for interorganizational collaborative e-business. *Logistics Information Management, 14*(1,2), 149-160.

Wen, H. J., Chen, H.-G., & Hwang, H.-G. (2001). e-Commerce web site design: strategies and models. *Information Management & Computer Security*, *9*(1), 5–12. doi:10.1108/09685220110366713

## KEY TERMS AND DEFINITIONS

**Web-Based Technologies:** Electronic tools and applications used to support and facilitate exchanges between organizations and individuals

**Electronic Commerce (E-Commerce):** The process of buying and selling products, services and information via computer networks

**Electronic Business (E-Business):** The process of using web-based technologies to improve and transform key business processes

**Electronic Strategy (E-Strategy):** The way web-based technologies restructure organizations by providing them with a new competitive edge

**Relational E-Strategy:** The way organizations use electronic means to facilitate their business relationships

**Business-to-Business (B2B) E-Strategy:** Electronic means used to facilitate relationships between your business and other businesses

**Business-to-Consumer (B2C) E-Strategy:** Electronic means used to facilitate relationships and transactions with the consumers of your products or services

**Business-to-Employee (B2E) E-Strategy:** Electronic means used to facilitate communication between your employees and to help them in carrying out their jobs

**Business Performance:** Measure used to position a company against its competitors and/or to evaluate how it financially operates

## APPENDIX: QUESTIONNAIRE

Table 1 shows the list of all items used during the survey, along with the average and standard deviation of each retained item.

*Table 1. Items and descriptive data per construct*

| *Respondents were asked to indicate on a Likert scale if they totally disagreed(1) or totally agreed (5) with the following items:* | | **Item Avg** | **Item Std** |
|---|---|---|---|
| **Business-to-Business e-strategy** | | | |
| B2B1 | Develop closer relationships with business partners | 3.36 | 0.90 |
| B2B2 | Enable inter-organizational collaboration in developing products and specifications | 3.30 | 0.92 |
| B2B3 | Enable information sharing with business partners | 3.42 | 1.03 |
| B2B4 | Assist the procurement of goods and services from suppliers | - | - |
| B2B5 | Enable negotiation | 3.11 | 0.85 |
| B2B6 | Increase business partner trust | 3.23 | 0.82 |
| **Business-to-Consumer e-strategy** | | | |
| B2C1 | Gain a better understanding of consumers | 3.35 | 0.96 |
| B2C2 | Reduce consumer service response time | 3.61 | 0.94 |
| B2C3 | Provide consumers with product and service information | 3.80 | 0.87 |
| B2C4 | Allow consumers to make online transactions | 3.14 | 1.04 |
| B2C5 | Achieve a closer relationship with individual consumers | 3.22 | 0.88 |
| B2C6 | Provide consumers with company specific information | 3.82 | 0.81 |
| B2C7 | Measure consumer satisfaction | - | - |
| B2C8 | Build consumer loyalty | 3.20 | 0.87 |
| **Business-to-Employee e-strategy** | | | |
| B2E1 | Enable collaboration between employees | - | - |
| B2E2 | Enable training of employees | 3.26 | 1.07 |
| B2E3 | Enable employees to find other employees with specific expertise | 2.88 | 1.06 |
| B2E4 | Improve communications between employees and management | - | - |
| B2E5 | Document knowledge of employees | 2.81 | 1.04 |
| B2E6 | Provide universal access to information | - | - |
| B2E7 | Increase employees' productivity | - | - |
| **Business performance** | | | |
| BP1 | Market share | 3.32 | 0.98 |
| BP2 | Sales growth rate | 3.06 | 1.02 |
| BP3 | Net profits | 3.06 | 1.10 |
| BP4 | Return on sales | 3.05 | 1.08 |
| BP5 | Return on investment | 3.10 | 1.06 |
| BP6 | Revenue growth relative to the competition | - | - |
| BP7 | Market share gains relative to the competition | - | - |
| BP8 | Net profits relative to the competition | 3.35 | 0.99 |
| BP9 | Return on investment relative to the competition | - | - |

# Chapter 29
# Leading the Organizational Dynamics of E-Business Firms

**Esin Can Mutlu**
*Yıldız Technical University, Turkey*

**Yasemin Bal**
*Yıldız Technical University, Turkey*

**Pınar Büyükbalci**
*Yıldız Technical University, Turkey*

## ABSTRACT

*As a result of globalization and continuously changing environmental conditions, new business models emerge in the new era of management. E-business firms also have been formed during this era and took attention of management scholars as they show a wide variety of new organizational dynamics in terms of certain structural characteristics. Leading these dynamics requires special leadership traits that constitute a base for the harmonic functioning of e-business firms. In this context, the main aim of this study is to conceptually discuss the important organizational aspects in e-business firms and support them with the needed leadership traits.*

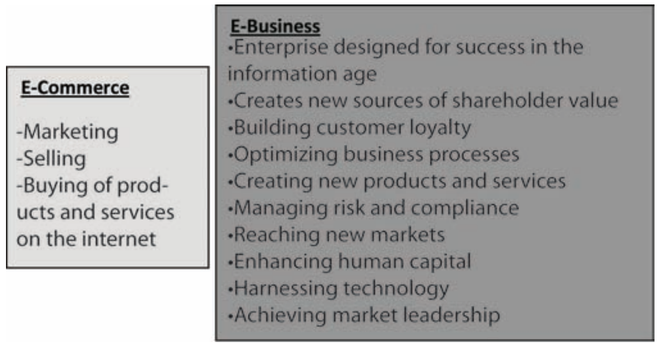
## INTRODUCTION

With the launch of internet and wide usage of technology in our daily and business lives, the way of doing business has dramatically changed. In accordance with this, one of the most important dimensions that made globalization so effective in business life turned out to be; with Thomas Friedman's (2000) words; the "democratization of technology", which represent the above mentioned easy and wide-usage of technological opportunities. This change in daily life made it inevitable for companies to change themselves in a way to meet new expectations of customers living in a strongly connected global village.

Consistent with these, companies developed new ways of doing business by taking advantage of technology in the business world. As we enter the twenty-first century, business conducted over the internet with its dynamic, rapidly growing and highly competitive characteristics promises new avenues for the creation of wealth. Established firms are creating new online businesses; while new ventures are exploiting the opportunities the

DOI: 10.4018/978-1-61520-611-7.ch029

*Figure 1. The concepts of e-commerce and e-business*




internet provides (Amit and Zott, 2001, 493). According to many authors, this new age of business characterized with the increasing globalization of hyper-competitive knowledge economies requires a new mindset necessary for creating self adaptive systems (Nadeem, 2006). The attempts to constitute such a mindset led to the emergence of the concept of "e-business" as a fresh new perspective to business models.

However, this "new business model" and its certain features have not been widely discussed in the management literature. Especially the issues of structural and managerial dimensions of e-business firms are still among the "to-be-explored areas in the contemporary management field.

With the intent of shedding light to this undiscovered area of literature, this article will attempt to discuss the change in the organization structures and organizational relations caused by transformation of businesses in the new e-business world. This change will be thought and discussed in an integrative way with the desired leadership skills in those e-business firms which aim to be proactive in their complex environment.

## BACKGROUND

When we look at the definition of e-business (or *e-commerce*), we see that there is no consensus in literature. To some, e-business is just commerce using computers while to others it is the more encompassing definition of business activities carried out over computer-mediated channels (Davis, 2003).

Basing on Turban et. al. (2002), Gottschalk (2006) differentiated between the terms "e-commerce" and "e-business" by claiming that e-business is a more comprehensive concept. According to him, "Electronic Commerce" is a concept that describes the process of buying, selling or exchanging, products, services and information, via computer networks, including the Internet; while, e-business refers to a broader definition of E-Commerce, not just buying and selling of goods and services, but also, servicing customers, collaborating with business partners, and conducting electronic transactions within an organization. Gottschalk (2006) further clarifies these conceptual definitions with the following illustration (p.16);

No matter what the definition is, it is for sure that, usage of web-based technology created important opportunities for companies. These companies make attempts to redefine traditional value chains and develop complex knowledge sharing systems that connect pricing, product and design information with suppliers and customers (Neilson et. al., 2000). For example, when effectively used, it helps the technological infrastructure of the company to evolve and certain business processes to get automated. As a consequence, the costs caused by traditional process methods decline as a result of widening of the operation field to a global scale, which is a factor that leads a company to take advantage of economies of scale on a global basis. In parallel with this, customer and supplier base of the companies is widened in a way that covers the whole globe, which creates a certain bargaining power for all sides and thus, dramatically changes relationships.

However, the changes brought by e-business implications are not limited to external factors and the relationships between them. Actually, what is more challenging for organizations turns out to be aligning themselves internally with the demands imposed by the dynamic environment in order to implement a successful e-business strategy, which requires a high degree of flexibility to create a competitive advantage (Phillips & Wright, 2008). Such flexibility requires a "re-design" of the organizational structure including the designation of organizational network, tasks, reward systems, and policy and regulation systems (Wang, 2000).

While discussing the nature of organizational structure, three kinds of relationships should especially be taken into consideration; namely the relationship between task-task, the relationship between task-people and the relationship between people-people (Koçel, 2007). The structure of the organization should be designed in a way to harmonize all these relationships, which in turn will cause certain differences in terms of formalization, centralization and complexity. To be able to better trace the differences between traditional organizations and e-business firms, organizational dynamics should be explored in terms of these concepts.

Formalization refers to the extent to which explicit rules, regulations, policies and procedures govern organizational activities (Hatch, 2006). When considered for e-business organizations, Geisler (2001) claimed that as a result of the high flexibility needed in the initial stages of e-business firms formalization is usually expected to be low. However as integration and standardization become necessary and routinization is encouraged as a result of the ongoing shared processes during mature life stages of the firm, the degree of formalization is expected to increase.

Another important concept, centralization, means that the decision authority is located near the top of the organization. If the company is "decentralized", decision authority is pushed downward to lower organizational levels (Daft, 2008). The turbulent and continuously changing environment of e-business firms requires rapid responses and proactive postures. To comply with this highly demanding environment, e-business firms choose to adopt flat decentralized structures to provide the speed of response and flexibility (Long & Schoenberg, 2002).

Finally, complexity refers to the number and diversity of the elements in an environment (Hatch, 2006). This concept can also be thought in terms of organizational structure; in that, as the number and diversity of the elements in an organization increases, this will cause the organizational structure to become more complex. When complexity of e-business firms is considered, it is seen that the degree of specialization plays an important role. Again Geisler (2001) emphasize that as a result of the high number of specialties employed, e-business firms inherits employees having different technical skills and thus show high degrees of horizontal differentiation, which in turn causes a high degree of horizontal complexity. As emphasized by Mintzberg (1979), use of certain "liaison devices" as task forces and integrating managers is required in horizontally specialized structures in order to ease the coordination between specialized small work groups by establishing a route for direct communication. Thus, leading such coordination mechanism to foster communication becomes one of the most important skills in managing e-business firms. On the other hand, the flatter and decentralized organizational structure of e-business firms hinders high degrees of vertical differentiation in order to ease the rapid flow of information and knowledge.

The changes in the above discussed structural dimensions should be thought in a related manner to the specific traits of employees in e-business firms. In addition to the previously mentioned special technical skills, these employees also show a certain degree of entrepreneurial mindset and prefer to work in an informal corporate culture which promotes knowledge sharing, networking and innovation (Long & Schoenberg, 2002).

As a result of these different characteristics, new dynamics emerge in the organizations in terms of previously stated task-task, task-people and people-people relationships. In accordance, these new relations require a "different mix of managerial competencies" (Allred & Snow & Miles, 1996, p.18). Management scholars emphasize the need to discuss the managerial aspect of any change attempt regarding the organizational dimensions (Lee & Lee & Lin, 2007). This notion is also valid for the discussions regarding e-business literature. As Cope & Waddell (2004) stated "the adoption of any new technology brings about change, but e-business is significantly different in that it completely shifts global business into a fast paced electronic environment" (p.20). This shift caused a parallel shift from traditional management models towards new management strategies, structures and systems that are used to redesign the organization in a complementary way with the needs emerged in new e-business models and made it a necessity to look at the issue from the managerial perspective (Wang, 2000; Phillips & Wright, 2008; Cope & Waddell, 2004).

This managerial perspective is far beyond the classical "manager" concept. As the main focus of new e-business firms is changing certain organizational dynamics, the leadership characteristics of managers have become more important. According to Yukl (2002), "Leadership is the process of influencing others to understand and agree about what needs to be done and how it can be done effectively, and the process of facilitating individual and collective efforts to accomplish the shared objectives" (p.7).

This capability of "influencing" is among the most crucial characteristics that a manager needs during dealing with a change process. Kotter (1996) states that it is the "leadership" that consists of "a set of processes that create organizations in the first place or adapt them to significantly changing circumstances" (p.25), not classical management. He further specifies these processes as *establishing direction*, *aligning people* and *motivating and inspiring*.

Within the framework of these processes, leading the continuously changing internal and external environmental dynamics of e-business firms force leaders to delegate responsibility, release control and empower the staff to proactively carry out the desired changes (Phillips &Wright, 2008). This environmental dynamics also makes it a challenge for leaders to find precise and timely information and to come up with a right strategic decision. Under such hard conditions e-business leaders are expected to be highly skilled in terms of collaboration and communication to become completely integrated with organizational functions and to meet the business objectives of the firm (Long & Schoenberg, 2002; Nadeem, 2006).

Following this notion, Kador (2001) proposed some important guidelines for e-business leaders;

- **Model e-business from top to bottom:** E-Business leaders should champion the usage of internet and web-based technologies at every level of the organization.
- **Take risks for reward:** Risk taking and "thinking out of the box" is key to be successful in the dynamic environment of e-business firms; and e-business leaders should behave strategically and try to see the whole picture and the relationships it inherits, while taking risks.

- **Tolerate ambiguity and chaos:** Unlike traditional managers, e-business leaders should capture the essence of newly emerged relationships in the continuously changing environment of their firms; and be always prepared to make decisions under chaotic and uncertain conditions.
- **Foster communication and develop a culture of information sharing:** With the introduction of web-based technologies, information flow has become more transparent, which enabled the creation of a more information- sharing culture in the organization. Accordingly, one of the most important responsibilities of e-business leaders turned out to be managing information flow between internal and external stakeholders of the firm.

Overall, it will not be wrong to claim that, with all these characteristics, the leadership style that e-business firms operating in a highly dynamic environment need is "transformational leadership", as it inherits the most motivating and stimulating traits. Basing on Bass (1996), Yukl (2002) states that the transformative leader transforms and motivates followers by (p.253);

- making them more aware of the importance of task outcomes,
- inducing them to transcend their own self-interest for the sake of the organization or team,
- activating their higher-order needs.

All these attempts accord with the needs of the highly qualified workforce in e-business to carry out a task and to conform to the needs of the fast moving and changing environmental conditions by developing an organizational identity and dedication. As Albert, Ashforth and Dutton(2000) points out, as the internal and external environment of organization becomes more dynamic and complex, "it becomes more important to have an internalized cognitive structure of what the organization stands for and where it intends to go", in other words a sense of "organizational identity" (p.13). However, this issue becomes problematic in e-business firms as a majority of the employees, employers and client meet only through web, and use home-offices in certain places. This makes the organization a "virtual" one in terms of relationships it inherits; and in such a virtual structure, leaders should facilitate communication of organizational objectives and make sure that every stakeholder of the organization behaves in accordance with these common objectives.

As a final point, the following table of Booz-Allen & Hamilton will be helpful to summarize the discussion in this study, as it clarifies the changes in terms of certain organizational dynamics and leadership with the emergence of e-business organizations (Neilson, Pasternack & Viscio, 2000);

## FUTURE RESEARCH DIRECTIONS

This study discussed the changes emerged in certain organizational dynamics of e-business firms and the leadership traits needed to successfully manage these changes in a conceptual framework. However, beyond the general perspective presented in this study, certain specific topics regarding the issue should be further explored in the future. Especially the globalization of markets brought about new research areas into the field of management. Researchers studying e-business firms should also adopt this perspective and take issues like the degree of internationalization and its effects on organizational dynamics of e-business firms into consideration. Also, certain demographic variables like age, size and sector will create difference in terms of these dynamics and leadership styles and thus should be used as important variables in future researches on e-business firms. Finally, the issue of "ethics" has

*Figure 2. E-Organization dimensions*

| | *1990s* | *E.org* |
|---|---|---|
| ***Organization Structure*** | • Hierarchical<br>• Command and control | • Centerless, networked<br>• Flexible structure that is easily modified |
| ***Leadership*** | • Selected "stars" step above<br>• Leaders set the agenda<br>• Leaders force change | • Everyone is a leader<br>• Leaders create environment for success<br>• Leaders create capacity for change |
| ***People&Culture*** | • Long-term rewards<br>• Vertical decision making<br>• Individuals and small teams are rewarded | • "Own your own career" mentality<br>• Delegated authority<br>• Collaboration expected and rewarded |
| ***Coherence*** | • Hard-wired into processes<br>• Internal relevance | • Embedded vision in individuals<br>• Impact projected externally |
| ***Knowledge*** | • Focused on internal processes<br>• Individualistic | • Focused on customers<br>• Institutional |
| ***Alliances*** | • Complement current gaps<br>• Ally with distant partners | • Create new value and outsource uncompetitive services<br>• Ally with competitors, customers and suppliers |
| ***Governance*** | • Internally focused<br>• Top-down | • Internal and external focus<br>• Distributed |

become especially important as a result of the high degrees of information sharing in e-business firms, and the role of leadership in managing such information flow is a promising topic for both ethics and e-business literatures.

## CONCLUSIONS

E-business concept caused a radical change, in other words "a paradigm shift", in management perspective; more specifically in understanding and implementing the way management functions are carried out. Therefore, to fully exploit the opportunities presented by this new perspective has become a challenge for many executives today. This challenge mainly stems from the nature of "change" as a whole. A change in a perspective never comes alone; it requires a lot of new practical implications to take place. In accordance, a change in the way of doing business requires a change in organizational structures and organizational relations along with it to work as expected. This, actually, implies a change in the organization as a whole, with its mentality, structure and the relations it inherits. This change mainly takes its source from the complexity of the environment in which the e-business firm operates. In this environment the employees are highly skilled, the consumers are highly informed about the alternatives, and the operation field of the company is highly dispersed throughout the whole globe. To operate effectively in such an environment, organization structures become more adaptable and flattened, in a way that leads to employee empowerment, team formation and support, free flow of information and transparency of data to all employees in the organization (Singh, 2004). By becoming more flexible than others, these organizations get the chance to be able to operate successfully in a rapidly changing environment and gain competitive advantage.

As a final point, it should be noted that, the discussion regarding this huge change process, made leadership skills inevitably important for today's e-business executives. Certain skills as being visionary, consultative, risk taking, forward thinking and so on will become dominant traits for new leader-managers (Cope&Waddell, 2004). Managing change in a complex world of new structures and relations can only be handled by implementing the skills that lead people harmonically to match them with the new structure and objectives of the firm.

## REFERENCES

Albert, S., Ashforth, B. E., & Dutton, J. E. (2000). Organizational Identity and Identification: Charging New Waters and Building from Bridges. *Academy of Management Review*, *25*(1), 13–17.

Allred, B. B., Snow, C. C., & Miles, R. E. (1996). Characteristics of Managerial Careers in the 21st Century. *The Academy of Management Executive*, *10*(4), 17–27.

Amit, R., & Zott, C. (2001). Value Creation in E-Business. *Strategic Management Journal*, *22*, 493–520. doi:10.1002/smj.187

Bass, B. M. (1996). *A New Paradigm of Leadership: An Inquiry into Transformational Leadership*. Alexandria, VA: US Army Research Institute for the Behavioural and Social Sciences.

Cope, O., & Waddell, D. (2004). Leadership in E-Business. In M. Singh & D. Waddell (Eds.), *E-Business Innovation and Change Management* (pp. 19-37). Hershey: IRM Press.

Daft, R. (2008). *New Era of Management*. Mason, OH: Thomson-Southwestern.

Davis, T. (2003). E-Commerce Measurements and Analysis. *Statistical Journal of the United Nations*, *20*, 289–301.

Friedman, T. (2000). *The Lexus and the Olive Tree: Understanding Globalization*. New York: Anchor Books.

Geisler, E. (2001, August). *Organizing For E-Business: The Implementation of Management Principles in Electronic Commerce*. Paper presented at the meeting of the PICMET 01, Portland, Oregon.

Gottschalk, P. (2006). *E-Business Strategy, Sourcing and Governance.* Hershey, PA: Idea Group Publishing.

Hatch, M. J. (2006), *Organization Theory*. Oxford, UK: Oxford University Press.

Kador, J. (2001). The Education of E-Business Leaders. *Infoworld*, 39-40. Retrieved March 5, 2001, from http://www.infoworld.com/articles/ca/xml/01/03/05/010305caleader.html

Koçel, T. (2007). *İşletme Yöneticiliği*. İstanbul: Arıkan Yayınevi.

Kotter, J. (1996). *Leading Change*. Boston: Harvard Business School Press.

Lee, C., Lee, G., & Lin, H. (2007). The Role of Organizational Capabilities in Successful E-Business Implementation. *Business Process Management Journal*, *13*(5), 677–693. doi:10.1108/14637150710823156

Long, P., & Schoenberg, R. (2002). Does E-Business Require Different Leadership Characteristics. *European Management Journal*, *20*(6), 611–619. doi:10.1016/S0263-2373(02)00112-3

Nadeem, M. M. (2006). Knowledge Management Leadership: Revolutionizing E-Business Excellence. *Business Renaissance Quarterly*, (Summer), 81-100.

Neilson, G.L., Pasternack, B.A., & Viscio, A.J. (2000 January). Up the (E) Organization! A Seven Dimensional Model for the Centerless Enterprise. *Strategy Business*.

Phillips, P. A., & Wright, C. (2008). E Business's Impact on Organizational Flexibility. *Journal of Business Research*, 1–10.

Singh, M. (2004). Innovation and Change Management. In M. Singh & D. Waddell (Eds.), *E-Business Innovation and Change Management* (pp. 1-18). Hershey, PA: IRM Press.

Turban, E., King, D., Lee, J., Warkentin, M., & Chung, H. M. (2002). *Electronic commerce: A Managerial Perspective*. Sidney, Australia: Pearson Education, Prentice Hall.

Wang, S. (2000). Managing the Organizational Aspects of Electronic Commerce. *Human Systems Management*, *19*, 49–59.

Yukl, G. (2002). *Leadership in Organizations*. Upper Saddle River, NJ: Prentice Hall.

## ADDITIONAL READING

Acosta, P. S., & Cerdan, A. L. (2008). Analyzing E-Business Value Creation From a Resource Based Perspective. *International Journal of Information Management*, *28*, 49–60. doi:10.1016/j.ijinfomgt.2007.05.001

Al-Qirim, N. (Ed.). (2003). *Electronic Commerce in Small to Medium Sized Enterprises*. Hershey, PA: Idea Group Publishing.

Brache, A., & Webb, J. (2000). E-Business: The Eight Deadly Assumptions of E-Business. *The Journal of Business Strategy*, *21*(3), 13–17. doi:10.1108/eb040084

Chaffey, D. (Ed.). (2003). *Business Information Systems: Technology, Development and Management For the E-Business* (2nd Ed.). London: Prentice Hall.

Chen, S. (2005). *Strategic Management of E-Business* (2nd Ed.). West Sussex, UK: John Wiley & Sons.

Combe, C. (2006). *Introduction to E-Business: Management and Strategy*. Oxford, UK: Butterworth-Heinemann.

Dess, G. G., & Picken, J. C. (2000). Changing Roles: Leadership in the 21st Century. *Organizational Dynamics*, 18–34. doi:10.1016/S0090-2616(00)88447-8

Gregorio, D. D., & Kassicieh, S. K. (2005). Drivers of E-Business Activity in Developed and Emerging Markets. *IEEE Transactions on Engineering Management*, *52*(2), 155. doi:10.1109/TEM.2005.844464

Khosrow-Pour, M. (Ed.). (2004). *The Social and Cognitive Impacts of E-Commerce on Modern Organizations*. Hershey, PA: Idea Group Publishing.

Khosrow-Pour, M. (Ed.). (2007). *Utilizing and Managing Commerce and Services Online*. Hershey, PA: Idea Group Publishing.

Lubbe, S., & Van Heerden, J. M. (Eds.). (2003). *The Economic and Social Impacts of E-Commerce*. Hershey, PA: Idea Group Publishing.

Malhotra, Y. (2000). *Knowledge Management and Virtual Organizations*. Hershey, PA: Idea Group Publishing.

Mariga, J. (Ed.). (2003). *Managing E-Commerce and Mobile Computing Technologies*. Hershey, PA: Idea Group Publishing.

Maxwell, J. C. (1999). *The 21 Indispensable Qualities of a Leader: Becoming the Person Others Will Want to Follow.* Nashville, TN: Thomas Nelson.

Northouse, P. G. (2007). *Leadership: Theory and Practice*. Thousand Oaks, CA: Sage Publications.

O'Brien, J. A. (2003). *Introduction to Information Systems: Essentials for the E-Business Enterprise* (11th Ed.). New York: McGraw Hill.

Pal, N., & Ray, J. M. (2001). *Pushing the Digital Frontier: Insights into the Changing Landscape of E-Business*. New York: AMACOM.

Quereshil, S., Kamal, M., & Wolcott, P. (2009). Information Technology Interventions for Growth and Competitiveness in Micro-Enterprises. *International Journal of E-Business Research*, *5*(1), 25–49.

Robbins, S. P., & Decenzo, D. A. (2004). *Fundamentals of Management* (4th Ed.). Upper Saddle River, NJ: Prentice Hall.

Shaw, M. J. (Ed.). (2002). *E-Business Management: Integration of Web Technologies with Business Models*. New York: Kluwer Academic Publishers.

Shaw, M. J. (Ed.). (2006). *E-Commerce and the Digital Economy*. Armonk, NY: M.E. Sharpe.

Stanford-Smith, B., Chiozza, E., & Edin, M. (Eds.). (2002). *Challenges and Achievements in E-Business and E-Work*. Amsterdam: IOS Press.

Stettner, M. (2000). *Skills for New Managers.* New York: McGraw Hill.

Tassabehji, R. (2003). *Applying E-Commerce in Business*. Trowbridge, UK: Sage Publications.

Taylor, M., & Murphy, A. (2004). SMEs and E-Business. *Journal of Small Business and Enterprise Development*, *11*(3), 280–289. doi:10.1108/14626000410551546

Thanasankit, T. (Ed.). (2003). *E-Commerce and Cultural Values*. Hershey, PA: Idea Group Publishing.

Whetten, D. A., & Cameron, K. S. (2006). *Developing Management Skills* (7th Ed.). Upper Saddle River, NJ: Prentice Hall.

## KEY TERMS AND DEFINITIONS

**Centralization:** Centralization means that the decision authority is located near the top of the organization. If the decision authority is pushed downward to lower organizational levels then the company is called to be decentralized.

**Complexity:** Complexity refers to the number and diversity of the elements in the internal and external environment of organization.

**E-Business:** E-business refers to a broader definition of e-commerce. It includes not only buying and selling of goods and services, but also, servicing customers, collaborating with business partners and suppliers, conducting electronic transactions within an organization.

**E-Commerce:** E-commerce can be defined as a concept that describes the process of buying, selling or exchanging, products, services and information via computer networks including the internet.

**Formalization:** Formalization refers to the extent to which explicit rules, regulations, policies and procedures govern organizational activities.

**Leadership:** Leadership can be defined as the process of influencing other people to understand and agree about what needs to be done and how it can be done effectively. It also consists of facilitating individual and collective efforts to accomplish the shared objectives and reach the goals.

**Transformational Leadership:** Leadership style that influences emotions and moral values of followers to divert their efforts towards a certain goal, by using motivation as a major tool.

# Chapter 30

# Adoption of e-Commerce by Canadian SMEs:

## Defining Organizational, Environmental and Innovation Characteristics

**Lynn L. Sparling**
*Okanagan College, Canada*

**Aileen Cater-Steel**
*University of Southern Queensland, Australia*

**Mark Toleman**
*University of Southern Queensland, Australia*

## INTRODUCTION

While online sales have experienced high growth rates, e-commerce adoption rates by Canadian SMEs have not kept pace. Canadian SMEs continue to lag behind the US and the EU in adopting e-commerce. Recently, a survey of SMEs' adoption of e-commerce was conducted to determine reasons for this low adoption rate (Sparling, 2007; Sparling, Cater-Steel, & Toleman, 2007). Constructs used in the survey focussed on three contexts: organizational, external environmental and innovation. The study found significant factors that differentiated adopters and non-adopters of e-commerce included technological opportunism and readiness, owner experience with computers, support within the organization, relative advantage and compatibility. This chapter focuses on the definitions of the variables in the organizational context.

Adoption and diffusion theories have been applied to the adoption of technological innovation, such as EDI and e-commerce. Many studies have combined elements of Rogers' (1995) theory of diffusion with other factors, such as organizational and external environmental factors, when examining technological innovation adoption. These hybrid models were necessary in order to capture the additional complexity and variance in the phenomena of technology adoption (Ordanini 2006). Organizational characteristics that were found in many of the studies include business size, business category, technological readiness, owner characteristics and support by top management. External environmental factors included competitive pressure, institutional

DOI: 10.4018/978-1-61520-611-7.ch030

pressure, and government pressure. No consistent set of factors affecting the adoption of e-commerce has been found to date. Many technological innovation adoption studies, with the exception of the e-commerce adoption studies, concentrated on large organizations. SMEs are the cornerstone of the Canadian economy - 99 percent of all established businesses in Canada have fewer than 200 employees (Industry Canada 2006).

## REVIEW OF E-COMMERCE ADOPTION LITERATURE

This chapter uses Rogers' (1995) definition of adoption: adoption is the decision to make full use of an innovation as the best course of action available, while rejection is the decision to not adopt. Rogers (1995) and many subsequent researchers, including Kendall et al. (2001) and Saythe and Beal (2001), have shown that perceptions of the attributes of an innovation affect its rate of adoption. Rogers (1995) identified five perceived attributes of innovations that affect their rate of adoption: relative advantage, degree of compatibility of the innovation, complexity, trialability and observability. He found these five characteristics to be the main determinants explaining 49 to 87 percent of the variance in the rate of adoption (Rogers 1995).

There is a growing body of research into information systems innovation adoption. Some of the information systems studied have been interorganisational systems (IOS), such as EDI. Henriksen (2002) defines an interorganisational system as an information system that is shared by two or more companies. EDI and e-commerce can be considered interorganisational systems in that information crosses organization boundaries. Both EDI and e-commerce can affect the supply chain, trading partners, technology providers and governing bodies. The relationships can be very complex, creating the need for many variables when examining the adoption of e-commerce. Ling (2001) argues that diffusion of innovation theory is relevant to the study of e-commerce due to the technical components of e-commerce, but that e-commerce has unique features, such as interorganisational elements, which distinguish it from other types of innovations. The technological innovation literature has not produced a consistent set of factors that affect organizational adoption.

For the purpose of this chapter, small- to medium-sized enterprises (SMEs) are defined as businesses with fewer than 200 employees. Different measures have been used to measure the size of organizations, including the number of employees, value of assets, revenue generated, and type of ownership. The definition of SMEs varies greatly when examining research studies or industry statistics, making comparisons difficult. For example, Industry Canada defines a goods producing firm as small if it has fewer than 100 employees, while the service producing firms' cut-off point is 50 employees. Above that size, and up to 500 employees, a firm is considered medium-sized. The OECD and US Government also use under 500 employees to define a SME (Cater-Steel & Grist 2006). The term "SME" (for small and medium enterprise) is used to refer to all these components of the economy together.

Many e-commerce adoption studies to date have focused on SMEs, realizing the importance of small business in the global economy and the potential benefits for SMEs of adoption of e-commerce. Two separate studies, one in Singapore and another in Australia, examined the low adoption rates of e-commerce by SMEs by comparing adopters with non-adopters using Rogers' innovation diffusion theory (1995). Kendall et al. (2001) found that adopters and non-adopters differed in terms of perceptions of relative advantage, compatibility, and trialability. Sathye and Beal (2001) found differences based on perceived relative advantage, compatibility, and organization size. Archer, Wang and Kang (2008) found very few differences between the opinions and perceptions of Internet adopters and non-adopters of online supply chain solutions.

Several studies of e-commerce adoption, such as Ching and Ellis (2004), Ling (2001), and Tsao, Lin and Lin (2004), only included SMEs that have already adopted e-commerce. Ching and Ellis (2004) collected data from 84 SMEs based in Hong Kong. SMEs were classified into three categories based on their level of adoption: traditionalists used the Web to advertise and provide information only; straddlers use more Web features, but only in addition to non-online services; and innovators conducted most of their business online. The authors then explored differences between the three groups. The study found that characteristics relating to the decision maker, the innovation and the environment affected the rate of e-commerce adoption in these SMEs. The significant decision maker characteristics were age, education and cosmopolitanism. Significant innovation characteristics included perceived advantages, perceived compatibility, and perceived costs. The significant environmental characteristic was pressure from customers.

Almost all the studies of technological innovation adoption have separated the explanatory variables into meaningful factors or contexts. Tornatzky and Fleischer's (1990) model, used by Henrikson (2002), suggested that there are three explanatory contexts that influence the process by which technological innovations are adopted in organizations: the organizational context, the technological context and the external environmental context.

Canadian travel agencies were surveyed by Raymond (2001). He found that informational and transactional implementation of web sites was determined by the environmental context whereas strategic implementation was determined by marketing strategy, the organizational context and the characteristics of electronic commerce. In a study of Canadian SME manufacturers, Raymond et al. (2005) called for further research on the level of alignment between the external and internal contexts in which e-business applications are introduced. In an earlier study of Canadian SME manufacturers, Raymond et al. (2001) examined marketing information system practices and identified the firms' marketing strategy impacted on the its marketing decisions and performance. MacKay et al. (2004) studied six small Canadian voluntary organizations to determine the primary factors that influence e-commerce adoption. Their findings indicate that perceived benefits, organizational readiness, and perceived pressure had a positive influence on adoption.

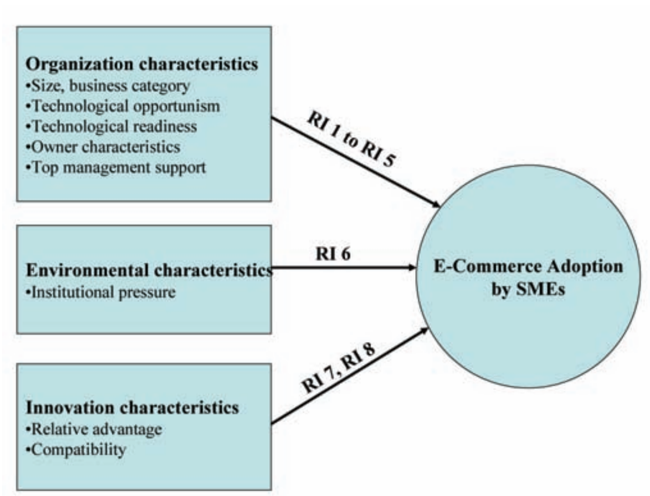
## PROPOSED MODEL

Although a few studies have examined e-commerce adoption by Canadian SMEs, none have compared adopters to non-adopters in Canada. The research model showing the research issues (RI) is presented in Figure 1. Although the model is similar to Raymond's (2001), it was arrived at independently after reviewing the literature. Each factor included in the model has been shown to increase e-commerce adoption rates in at least one previous study, but no study has tested this combination of factors. This study uses a unique combination of variables, organized in the three contexts: organizational characteristics, environmental characteristics, and innovation characteristics.

## ORGANISATIONAL CHARACTERISTICS

This context relates to the characteristics of an organization. Several organizational characteristics can relate to the adoption of IS, such as organization size, employees' technological abilities, willingness to change, organizational support, entrepreneurial traits, organizational compatibility, and organizational culture. "Organizational context looks at the structure and processes of an

*Figure 1. Proposed model of e-commerce adoption*




organisation that constrain or facilitate the adoption and implementation of innovations" (Chau & Tam 1997, p. 4).

## Size and Business Category

Buying and selling online tend to increase as the size of the business increases. To date, Internet transactions are dominated by large firms (Baker 2000, Industry Canada 2004, NOIE 2000). When studying SMEs that use e-commerce to do business internationally, Tiessen, Wright and Turner (2001) found a positive link between firm size and the SME's Internet commitment. This is consistent with other adoption studies (Frambach & Schillewaert 2002, Grover 1993, and Thong 1999). A study of Taiwanese SMEs by Chan and Lin (2007) found a positive relationship between enterprise size and website comprehensiveness. Industry Canada (2006) found a large discrepancy between small and larger firms selling over the Internet in 2005, with 16 percent of all businesses with over 500 employees selling on the Internet, compared to only 5.5 percent of all SMEs with fewer than 20 employees. The percentage of small and medium-sized firms selling online actually declined between 2004 and 2005.

The NOIE (2000) study noted that more Australian firms in the business and personal services industry were using the Internet to place orders online than businesses in other industry sectors. The NOIE (2000) study also found that e-commerce was being used as a significant element in the supply chain of businesses in the transport and storage industry. In Canada, four sectors led the way in terms of value of online sales in 2005: wholesale trade, retail trade, transportation and warehousing, and manufacturing (Statistics Canada 2006). These four sectors accounted for 68 percent of overall sales by private firms, for a value of $24.7 billion CDN. Statistics Canada (2006) provided the percentage of businesses in each business category that purchase online. The three sectors that had the highest percentages were information and cultural industries (67%), educational services (65%), and professional, scientific and technical services (60%).

## Technological Opportunism

Businesses rapidly adopting e-commerce tend to have a strategic culture, a business planning structure or strategy, and are prepared to innovate and explore new ways of doing business. There is also willingness by management to embrace new technology and explore new business directions (NOIE 2000). Srinivasan, Lilien and Rangaswamy (2002) hypothesized that differences in adoption of radical technologies among firms can be attributed to a sense-and-respond capability of firms with respect to new technologies. This capability is defined as technological opportunism. "The technology sensing capability is an organisation's ability to acquire knowledge about and understand new technology developments, which may be developed either internally or externally" (Srinivasan, Lilien & Rangaswamy 2002, p. 48). The response capability means the organisation is willing and able to respond to the new technologies sensed in the environment. Using e-business as a radical technology, Srinivasan, Lilien and Rangaswamy (2002) found that the extent of radical technology adoption is influenced by a firm's technological opportunism. The authors then conducted a second study to determine factors that make a firm technologically opportunistic. Top management's advocacy of new technologies, the firm's future focus, and organisation culture were found to be drivers of technological opportunism.

Wu, Mahajan and Balasubramanian (2004) examined how the learning ability of organizations facilitated e-business adoption and found that "organisations require an adequate absorptive capacity that facilitates (a) the quick recognition of new developments in the e-business arena, (b) an understanding of how e-business initiatives can augment existing operations, and (c) a continuous scanning of the environment of successful implementation stories that can be replicated" (2003, p. 430).

## Technological Readiness

Technological readiness concerns the level of sophistication of IT usage and management in the organization (Holmes & Srivastava, 1999). It is expected that companies currently using computer systems compatible with e-commerce would be more likely to accept the new technology and new ways of conducting business.

## Owner Characteristics

Entrepreneurial qualities, especially those of the owner, have often been used to explain the success of a business. In examining Australian SMEs, the NOIE (2000) study found that firms that adopt e-commerce are generally leaders and innovators in their industries, often with visionary leaders. These businesses tend to have an innovative, creative and dynamic owner/manager willing to explore and to experiment with innovation and to take risks. The owners and principals of these businesses generally are keenly aware of the competitive environment in which their businesses operate and are clear about how to move forward in that environment. They understand the essential elements of the marketing strategies for their businesses and the role e-commerce can play in those strategies (NOIE 2000). Wong and Turner (2001) also found that internal leadership was a very important factor in the initial adoption of e-commerce by SME suppliers in the Australian pyrethrum industry.

Entrepreneurial qualities, especially those of the owner, have often been used to explain the success of a business. The qualities are often diverse, but tend to include education levels, appropriate training, creativity and innovativeness. Maxwell and Westerfield (2002) related technological entrepreneurial characteristics to the adoption of innovative technology. They classified entrepreneurs as either *opportunistic* or *craftsman*. Their data indicated that the *opportunistic* entrepreneurs utilized innovative technology more than twice as often as the *craftsman* entrepreneurs (Maxwell & Westerfield 2002). *Opportunistic* entrepreneurs tend to have more formal education, have more marketing, selling, general administration, and merchandising skills, and plan for the future. *Craftsman* entrepreneurs tend to be involved in skilled trades. Kickul and Gundry (2001) identify dimensions of innovative behaviour associated with and found inside successful e-commerce firms, such as diversity and creativity in top management, as well as effective opportunity assessment. They suggest future investigation is needed into the role of entrepreneurial proactivity and innovative managerial behaviours in e-commerce organisations.

In a study of high growth SMEs in the Netherlands, Fiendta, Jeffcoate and Chappell (2002) found that the original founder often still plays a crucial role in the performance of these high growth companies. The research identified commitment as a success factor for rapid growth in SME e-commerce. Commitment was defined as the preparedness of a business, under the direction of its owner, to continuously innovate and reinvent its business strategy. Successful companies easily and quickly incorporated new ideas, technologies and market opportunities into their business strategy. These entrepreneurial characteristics are often a reflection of the owner's entrepreneurial spirit. Given the critical role of the entrepreneurial individual for the success of the e-commerce venture, Fiendta, Jeffcoate and Chappell (2002) suggest further research into owner profile, background and motivation.

Thong (1999) found that two characteristics of a firm's decision maker or CEO, innovativeness and IS knowledge, were positively associated with adoption of information systems in small businesses. Ching and Ellis (2004) examined the firm's decision maker's characteristics and found the decision-makers age, level of education and cosmopolitanism to be significant predictors of e-commerce adoption.

### Top Management Support

Organizational support refers to the extent to which IT implementation efforts are promoted by the top management in an organization (Croteau & Li 2003). Several studies have shown that senior management support plays an important role in technological innovation adoption (Lertwongsatien & Wongpinunwatana 2003; Tsao, Lin & Lin 2004; Grover 1993). From a planning viewpoint, Burgess (2008) noted that the motivation of owner/managers is a key factor in shaping the e-business development of a small business. It is anticipated that the level of organizational support would differ between SMEs that adopt e-commerce and the non-adopters.

## ENVIRONMENTAL CHARACTERISTICS

Typically the external environmental context includes market conditions such as competitive market forces, market uncertainty, and government regulation. Srinivasan, Lilien and Rangaswamy (2002) identified two components of institutional pressure: stakeholder pressures and competitive pressures. Stakeholder pressures can come from customers, trading partners, investors, suppliers, media and employees. Competitive pressures force a business to adopt a technology to maintain competitive advantage. As more competitors and trading partners adopt an innovation, small firms are more inclined to adopt the innovation in order to maintain their own competitive position. Companies have suffered reduced competitiveness resulting from not implementing IT improvements to match their competitors. Customers may pressure a business to provide its products/services online and non-adoption of e-commerce will be a competitive disadvantage. Suppliers may pressure a business to order online. Many governments, such as the Australian government, and large corporations are seeking to encourage the rapid adoption of e-commerce by business by mandating that their suppliers do business with them online (NOIE 2000).

Porter (2001) points out that Internet technology provides better opportunities for companies to establish distinctive strategic positioning than did previous generations of information technology. He believes that in order to remain competitive, companies are going to be forced to adopt Internet technology. Stakeholders such as customers, trading partners, suppliers, investors, the media and employees, can pressure a firm into adopting e-commerce. Relationships with any of the stakeholders may suffer if the firm does not implement e-commerce initiatives. In some cases, suppliers or customers may demand e-commerce for continuing relationships. Investors may view the firm as being technologically backward without e-commerce capabilities. Firms may feel that they will be left behind if they do not adopt e-commerce. Firms facing greater institutional pressure would be more likely to adopt e-commerce. Studying institutional pressures on SMEs to adopt e-commerce helps define opportunities for SMEs to gain competitive advantage.

## INNOVATION CHARACTERISTICS

Studies have repeatedly identified perceived benefits as one of the critical factors for adoption of the Internet (Ching & Ellis 2004; Kendall et al. 2001; Saythe & Beal 2001; Looi 2005). Similarly, Iacovou, Benbasat and Dexter (1995) identified perceived benefits as one of the most critical adoption factors for adoption of EDI. Kendall et al. (2001) and Saythe and Beal (2001) found that compatibility significantly influenced the adoption of e-commerce. Based on these results and those of other studies, relative advantage and compatibility are included as innovation characteristics in this study. These two perceived attributes appear the most frequently of the five found in Rogers' model.

**Relative advantage** is one of the most frequently used innovation characteristics in adoption research. Examples of benefits commonly associated with the adoption of e-commerce are: increased sales and profits, reduced costs, improved customer service and relationships, development of new markets, and streamlined business processes. Canadian SMEs reported improved financial results attributed to e-commerce in the form of increased revenue and decreased operating costs (McClean, Johnston & Wade 2002). Further study showed significant financial gains by SMEs in the US and the EU (Johnston, Wade, McClean 2007). On the other hand, few small businesses in Poon and Swatman's (2002) Australian study could identify direct, quantifiable benefits from Internet use, but most felt that indirect benefits were keeping them connected to the Internet. The positive perception by a small business that e-commerce will result in economic or social benefits should provide incentive for the business to adopt e-commerce.

**Compatibility** perceptions can include how well e-commerce fits with supplier and customer business processes, and how well e-commerce fits with the firm's current business processes. This fit can be both technical and organisational. Greater compatibility of an innovation with the organisation should be positively related to adoption of the innovation.

## CONCLUSION

Using a unique combination of the models and factors found significant in previous research studies, three categories of characteristics of SME e-commerce adopters and non-adopters proposed are worthy of further investigation. The three categories are: organisational characteristics, environmental characteristics, and innovation characteristics as shown in Figure 1.

In recent years, different models and combinations of models have been developed to predict adoption of various technological innovations, such as EDI, interorganisational systems, and e-commerce. This chapter has defined and combined the factors used consistently throughout the literature to develop a model of e-commerce adoption that could be used to guide SMEs, private sector managers and the Canadian government in achieving the goal of increased e-commerce adoption by SMEs, and subsequent improvement in growth and global competitiveness.

Additional research could be conducted to quantify and expand on SMEs' success with e-commerce adoption. Providing specific details about these successes would show SMEs the possible benefits of e-commerce adoption. Conducting studies of successful implementation and deployment of e-commerce by SMEs would provide excellent examples that would serve to educate SMEs considering adoption.

## REFERENCES


Archer, N., Wang, S., & Kang, C. (2008). Barriers to the adoption of online supply chain solutions. *Supply Chain Management: An International Journal*, *13*(1), 73–82. doi:10.1108/13598540810850337

Baker, C. (2000). *Survey of Information and Communications Technologies and Electronic Commerce, 1999*. Statistics Canada.

Cater-Steel, A. P., & Grist, S. (2006). e-Commerce Definition Dilemma. In S. Marshall, W. Taylor & X. Yu (Eds.), *The Encyclopedia of Developing Regional Communities with ICT* (pp. 152-158). Hershey, PA: Idea Group Publishing.

Chan, S.-C., & Lin, J.-Y. (2007). Factors Influencing the Website Comprehensiveness of Small to Medium-sized Enterprises: An Empirical Study. *International Journal of Management*, *24*(2), 203–215.

Ching, H., & Ellis, P. (2004). Marketing in Cyberspace: What Factors Drive E-Commerce Adoption? *Journal of Marketing Management*, *20*(3-4), 409–429. doi:10.1362/026725704323080470

Croteau, A., & Li, P. (2003). Critical success factors of CRM technological initiatives. *Canadian Journal of Administrative Sciences*, *20*(1), 21–34.

Frambach, R., & Schillweaert, N. (2002). Organisational innovation adoption A multi-level framework of determinants and opportunities for future research. *Journal of Business Research*, *55*(2), 163–176. doi:10.1016/S0148-2963(00)00152-1

Grover, V. (1993). An empirically derived model for the adoption of customer-based interorganisational systems. *Decision Sciences*, *24*(3), 603–640. doi:10.1111/j.1540-5915.1993.tb01295.x

Henriksen, H. (2002). *Performance, Pressures, and Politics: Motivators for Adoption of Interorganisational Information Systems*. PhD thesis, Copenhagen Business School, Denmark.

Holmes, T. L., & Srivastava, R. (1999). Effects of relationalism and readiness on EDI collaboration and outcomes. *Journal of Business and Industrial Marketing*, *14*(5), 390–402. doi:10.1108/08858629910290175

Iacovou, C., Benbasat, I., & Dexter, A. (1995). Electronic data interchange and small organisations: Adoption and Impact of Technology. *MIS Quarterly*, *19*(4), 465–486. doi:10.2307/249629

Industry Canada. (2006). *The Digital Economy in Canada, Canadian e-Commerce Statistics*. Retrieved June 10, 2007, from http://e-com.ic.gc.ca/epic/internet/inecic-ceac.nsf/vwGeneratedInterE/gv00163e.html

Johnston, D. A., Wade, M., & McClean, R. (2007). Does e-business matter to SMEs? a comparison of the financial impacts of Internet business solutions on European and North American SMEs. *Journal of Small Business Management*, *45*(3), 354–361. doi:10.1111/j.1540-627X.2007.00217.x

Kendall, J., Tung, L., Chua, K., Ng, C., & Tan, S. (2001). Electronic Commerce Adoption by SMEs in Singapore. In *Proceedings of the 34th Hawaii International Conference on System Sciences.*

Lertwongsatien, C., & Wongpinunwatana, N. (2003). E-Commerce Adoption in Thailand: An Empirical Study of Small and Medium Enterprises (SMEs). *Journal of Global Information Technology Management*, *6*(3), 67–82.

Ling, C. (2001). *Model of Factors Influences on Electronic commerce Adoption and Diffusion in Small- & Medium-sized Enterprises*. Curtin University of Technology, Australia.

Looi, H. C. (2005). E-commerce adoption in Brunei Darussalam: A quantitative analysis of factors influencing its adoption. *Communications of the Association for Information Systems*, *15*, 61–81.

MacKay, N., Parent, M., & Gemino, A. (2004). A model of electronic commerce adoption by small voluntary organizations. *European Journal of Information Systems*, *13*(2), 147–159. doi:10.1057/palgrave.ejis.3000491

Maxwell, J., & Westerfield, D. (2002). Technological Entrepreneurism Characteristics Related to the Adoption of Innovative Technology. *S.A.M. Advanced Management Journal*, *67*(1), 9–15.

McClean, R., Johnston, D., & Wade, M. (2002). *Net Impact Study Canada The SME Experience.* Retrieved November 9, 2002, from http://www.cebi.ca/410/net_impact.pdf

National Office for the Information Economy (NOIE). (2000). *Taking the Plunge – sink or Swim: Attitudes and Experiences of SMEs to E-commerce*. Retrieved January 20, 2003, from http://www.noie.gov.au/publications/NOIE/SME/SinkorSwim.doc

Ordanini, A. (2006). *Information Technology and Small Businesses*. London: Edward Elgar.

Poon, S., & Swatman, P. M. C. (1997). Small Business Use of the Internet. *International Marketing Review*, *14*(4/5), 385–403. doi:10.1108/02651339710184343

Raymond, L. (2001). Determinants of web site implementation in small businesses. *Internet Research: Electronic Networking Applications and Policy*, *11*(5), 411–424. doi:10.1108/10662240110410363

Raymond, L., Bergeron, F., & Blili, S. (2005). The assimilation of e-business in manufacturing SMEs: determinants and effects on growth and internationalization. *Electronic Markets*, *15*(2), 106–118. doi:10.1080/10196780500083761

Rogers, E. (1995). *Diffusion of Innovations* (4th Ed.). New York: Free Press.

Sathye, M., & Beal, D. (2001). Adoption of Electronic Commerce by SMEs: Australian Evidence. *The Journal of Business*, *1*(1).

Sparling, L. (2007). *Adoption of e-Commerce By SMEs in the Central Okanagan Region of Canada.* USQ, Toowoomba.

Sparling, L., Cater-Steel, A., & Toleman, M. (2007). *SME adoption of e-Commerce in the Central Okanagan region of Canada.* Paper presented at the ACIS 2007 18th Australasian Conference on Information Systems: the 3 Rs: Research, Relevance and Rigour - Coming of Age, Toowoomba, Australia.

Srinivasan, R., Lilien, G., & Rangaswamy, A. (2002). Technological Opportunism and Radical Technology Adoption: An Application to E-Business. *Journal of Marketing*, *66*(3), 47–61. doi:10.1509/jmkg.66.3.47.18508

Thong, J. (1999). An integrated model of information systems adoption in small businesses . *Journal of Management Information Systems*, *15*(4), 187–214.

Tornatzky, & Fleischer (1990). *Performance, Pressures, and Politics: Motivators for Adoption of Interorganisational Information Systems*. PhD thesis, Copenhagen Business School, Denmark.

Tsao, H., Lin, K., & Lin, C. (2004). An investigation of critical success factors in the adoption of B2B EC by Taiwanese companies. *Journal of American Academy of Business*, *5*(1), 198–202.

Wong, M.C., & Turner, P. (2001). *An Investigation of Drivers/Activators for the Adoption and Utilisation of B2B Electronic Commerce amongst Small and Medium Sized Suppliers to the Tasmanian Pyrethrum Industry, Australia*. University of Tasmania, Australia.

Wu, F., Mahajan, V., & Balasubramanian, S. (2003). An analysis of e-business adoption and its impact on business performance. *Journal of the Academy of Marketing Science*, *31*(4), 425–447. doi:10.1177/0092070303255379

## ADDITIONAL READING

Banham, H. (2004). Organisational Change in SMEs, DBA thesis, USQ.

Burgess, S. (2008). Determining Website Content for Small Businesses: Assisting the Planning of Owner/Managers . *International Journal of Knowledge Management Studies*, *2*(1), 143–161. doi:10.1504/IJKMS.2008.016449

CeBI. (2005). Canadian e-Business Initiative 2004, *Fast Forward 5.0, Making Connectivity work in Canada, RetrievedSeptember4, 2006, from*http://www.icce.ca/Public/Team1/Docs/fast_foward-en.pdf.

Chau, P., & Tam, K. (1997). Factors affecting the adoption of open systems: an exploratory study . *MIS Quarterly*, *21*(1), 1–24. doi:10.2307/249740

Chong, S., & Pervan, G. (2007). Factors Influencing the Extent of Deployment of Electronic Commerce for Small-and Medium-Sized Enterprises . *Journal of Electronic Commerce in Organizations*, *5*(1), 1–29.

Chwelos, P., Benbasat, I., & Dexter, A. (2001). Research Report: Empirical Test of an EDI Adoption Model . *Information Systems Research*, *12*(3), 304–321. doi:10.1287/isre.12.3.304.9708

Fiendta, S., Jeffcoate, J., & Chappell, C. (2002). Identifying Success Factors for Rapid Growth in SME E-commerce . *Small Business Economics*, *19*(1), 51–62. doi:10.1023/A:1016165825476

Industry Canada. (2004). Key Small Business Statistics. Retrieved November 2, 2004, from http://strategis.ic.gc.ca/epic/site/sbrp-rppe.nsf/en/rd00760e.html.

Kickul, J., & Gundry, L. (2001). Breaking through boundaries for organisational innovation: new managerial roles and practices in e-commerce firms . *Journal of Management*, *27*(3), 347–362. doi:10.1016/S0149-2063(01)00095-2

MacKay, N., Parent, M., & Gemino, A. (2004). A model of electronic commerce adoption by small voluntary organizations . *European Journal of Information Systems*, *13*(2), 147–159. doi:10.1057/palgrave.ejis.3000491

Porter, M. (2001). Strategy and the Internet. *Harvard Business Review*, *79*(3), 62–78.

Ramamurthy, G., & Premkumar, G. (1995). Determinants and Outcomes of EDI Diffusion . *IEEE Transactions on Engineering Management*, *42*(4), 332–351. doi:10.1109/17.482083

Raymond, L., Bergeron, F., & Blili, S. (2005). The assimilation of e-business in manufacturing SMEs: determinants and effects on growth and internationalization . *Electronic Markets*, *15*(2), 106–118. doi:10.1080/10196780500083761

Raymond, L., Brisoux, J., & Azami, A. (2001). Marketing information systems practices in small manufacturing firms: antecedents and consequences . *Journal of Computer Information Systems*, *41*(3), 32–41.

Roberts, B., & Toleman, M. (2007). One-size e-business adoption model does not fit all . *Journal of Theoretical and Applied Electronic Commerce Research*, *2*(3), 49–61.

Seyal, A., & Rahman, M. (2003). A Preliminary Investigation of E-Commerce Adoption in Small & Medium Enterprises in Brunei . *Journal of Global Information Technology Management*, *6*(2), 6–26.

Statistics Canada. The Daily April 20, 2006, *Electronic commerce and technology.* Retrieved June 1, 2006, from http://www.statcan.ca/Daily/English/060420/d060420b.htm.

Tiessen, J., Wright, R., & Turner, I. (2001). A model of e-commerce use by internationalizing SMEs . *Journal of International Management*, *7*, 211–233. doi:10.1016/S1075-4253(01)00045-X

Wade, M., Johnston, D. A., & McClean, R. (2004). Exploring the net impact of Internet business solution adoption on SME performance . *International Journal of Electronic Business*, *2*(4), 336–350. doi:10.1504/IJEB.2004.005637

Zhu, K., Kraemer, K., & Xu, S. (2003). Electronic business adoption by European firms: a cross-country assessment of the facilitators and inhibitors . *European Journal of Information Systems*, *12*, 251–268. doi:10.1057/palgrave.ejis.3000475

Zhuang, Y., & Lederer, A. (2004). The impact of top management commitment, business process redesign, and IT planning on the B2C e-commerce site. *Electronic Commerce Research*, *4*(4), 315–333. doi:10.1023/B:ELEC.0000037080.71668.70

## KEY TERMS AND DEFINITIONS

**Adoption:** the decision to make full use of an innovation as the best course of action available, while rejection is the decision to not adopt.

**Commitment:** the preparedness of a business, under the direction of its owner, to continuously innovate and reinvent its business strategy. Successful companies easily and quickly incorporated new ideas, technologies and market opportunities into their business strategy.

**E-Commerce:** the processing of business transactions using computer networks, including the Internet.

**External Environmental Context:** includes market conditions such as competitive market forces, market uncertainty, and government regulation.

**Interorganisational System:** an information system that is shared by two or more companies. EDI and e-commerce can be considered interorganisational systems in that information crosses organisationorganization boundaries.

**SME - Small Medium Enterprises:** in this chapter, small- to medium-sized enterprises (SMEs) are defined as businesses with fewer than 200 employees. Different measures have been used to measure the size of organizations, including the number of employees, value of assets, revenue generated, and type of ownership.

**Technological Opportunism:** The technology sensing capability is an organisation'sorganization's ability to acquire knowledge about and understand new technology developments, which may be developed either internally or externally.

# Chapter 31
# E-Business Strategy in Franchising

**Ye-Sho Chen**
*Louisiana State University, USA*

**Chuanlan Liu**
*Louisiana State University, USA*

**Qingfeng Zeng**
*Shanghai University of Finance and Economics, China*

## INTRODUCTION

**Franchising** as a global growth strategy is gaining its popularity (Justis and Judd, 2002; Thomas and Seid, 2000; Chen and Justis, 2006). For example, the U.S. Commercial Service estimated that China, having over 2,600 brands with 200,000 franchised retail stores in over 80 sectors, is now the largest franchise market in the world (U.S. Commercial Service, 2008). The popularity of franchising continues to increase, as we witness an emergence of a new e-business model, **Netchising**, which is the combination power of the Inter*net* for global demand-and-supply processes and the international fran*chising* arrangement for local responsiveness (Chen, Justis, and Yang, 2004; Chen, Chen, and Wu, 2006). For example, *Entrepreneur* magazine – well known for its Franchise 500 listing – in 2001 included Tech Businesses into its Franchise Zone that contains Internet Businesses, Tech Training, and Miscellaneous Tech Businesses. At the time of this writing, 45 companies are on its list. In his best seller, *Business @ the Speed of Thought*, Bill Gates (1999) wrote: “Information Technology and business are becoming inextricably interwoven. I don’t think anybody can talk meaningfully about one without talking about the other.” (p. 6) Gates’ point is quite true when one talks about e-business strategy in franchising. Thus, to see how e-business can be “meaningfully” used in franchising, one needs to know how franchising really works.

DOI: 10.4018/978-1-61520-611-7.ch031

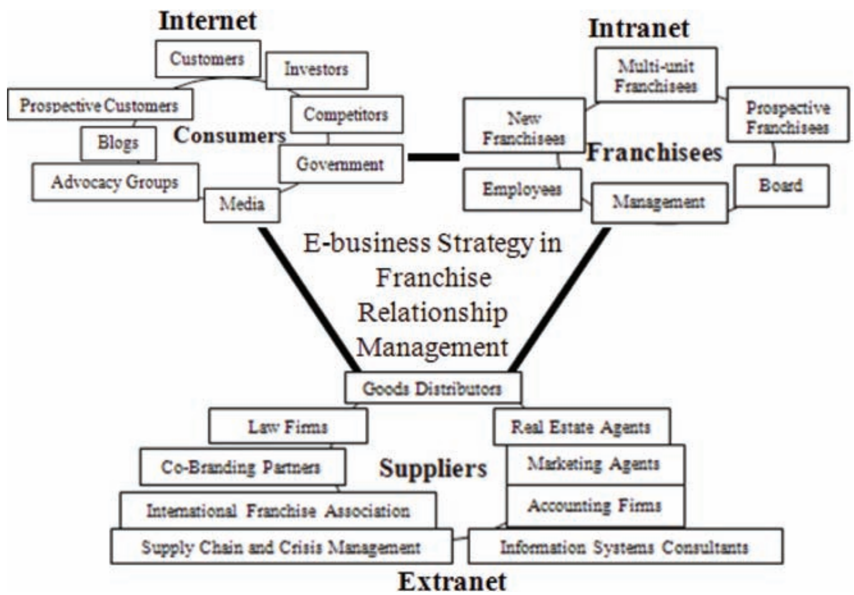
*Figure 1. Understanding how the franchisor/franchisee relationship works*


## FRANCHISING: BUILDING THE FRANCHISOR/FRANCHISEE RELATIONSHIP

Franchising is "a business opportunity by which the owner (producer or distributor) of a service or a trademarked product grants exclusive rights to an individual for the local distribution and/or sale of the service or product, and in return receives a payment or royalty and conformance to quality standards. The individual or business granting the business rights is called the *franchisor*, and the individual or business granted the right to operate in accordance with the chosen method to produce or sell the product or service is called the *franchisee*." (Justis and Judd, 2002, pp. 1-3) Developing a good relationship between the franchisor and the franchisee is the key for a successful franchise (Justis and Judd, 2002). Figure 1 describes how to build a good **franchisor/franchisee relationship**. The franchisor needs to learn continuously for the growth of the franchise. The learning process is developed through five stages (Justis and Judd, 2002): (1) Beginner – learning how to do it; (2) Novice – practicing doing it; (3) Advanced – doing it; (4) Master – teaching others to do it; and (5) Professional – becoming the best that you can be. Once reaching the Advanced stage, most preceding struggles have been overcome. However, further challenges will arise as the franchise continues growing. This is especially true once the system reaches the "Professional" stage, where various unpredicted and intricate problems could arise. Bud Hadfield (1995), the founder of Kwik Kopy franchise and the International Center of Entrepreneurial Development, aptly stated: "The more the company grows, the more it will be tested." (p. 156). To capture the learning process, a counter-clockwise round arrow surrounding the franchisor is used to depict the increasing intensity of learning as the franchisor continues to grow.

The franchisee also goes through five stages of franchisee life cycle (Schreuder, Krige, and Parker, 2000): (1) Courting: both the franchisee and the franchisor are eager with the relationship; (2) "We": the relationship starts to deteriorate, but the franchisee still values the relationship; (3) "Me": the franchisee starts to question the franchisor that the success so far is purely of his/her own work; (4) Rebel: the franchisee starts to challenge the franchisor; and (5) Renewal: the franchisee realizes the "win-win" solution is to continue working with the franchisor to grow the system. Similar to the franchisor, a counter-clockwise round arrow surrounding the franchisee is used in Figure 1 to depict the increasing intensity as the franchisee continues growing. As the franchisee progresses through the life cycle, the good relationship gradually develops an influencing process (Justis and Vincent, 2001), depicted in Figure 1 with a bi-directional arrow. By going through the processes of learning and influencing,

*Figure 2. E-Business strategy in franchise relationship management*




both the franchisor and the franchisee gain the progressive working knowledge of relationship management with the consumers and suppliers. The franchisor, the franchisee, the consumers, and the suppliers in Figure 1 are surrounded with dashed lines, indicating that there is no limit to the learning process.

## E-BUSINESS STRATEGY IN FRANCHISE RELATIONSHIP MANAGEMNET

With the advancement of Internet technology, franchise companies are adapting e-business strategies for perfecting the franchisor/franchisee relationship to grow their franchises globally. Figure 2 is a visual depiction of deploying **e-business strategy** in franchising. This community of franchise companies, consumers, and suppliers can be virtually connected for relationship management as follows:

- Intra-enterprise collaboration through Intranet, enabling the franchisor to build up relationships with the board of directors, multi-unit franchisees, new franchisees, prospective franchisees, franchisor management and employees;
- Collaboration with consumers through Internet, enabling the franchisor and the franchisees to build up relationships with customers, prospective customers, investors, competitors, media, blogs, advocacy groups, and government;
- Collaboration with suppliers through Extranet, enabling the franchisor and the franchisees to build up relationships with members and affiliates of international franchise association, law firms, co-branding partners, goods distributors, real estate agents, information systems consultants, accounting firms, and marketing agents.

*Table 1. The customer-service-life-cycle (CSLC) e-business strategy in franchising*

| CSLC | Sub-stages | Internet Strategy | Intranet Strategy | Extranet Strategy |
|---|---|---|---|---|
| Requirements | Understanding How Franchising Works | Using the web site as the friendly customer relationship management tool to address customer concerns at various stages (Chen, Chong, and Justis, 2002), e.g., providing useful on financing and showing how the franchise system may help finance the franchise investment Benchmarking and enhancing the web site continuously (Chen, Chong, and Justis, 2002; Chen, Justis, and Chong, 2008), e.g., identifying frequently the best practices of web deign in the industry and improving the web site accordingly | Transforming the organizational structure and corporate culture to fit the e-business operation pushed by the Intranet systems (Zeng, Chen, and Huang, 2008), e.g., designing an environment for more team work opportunities and establishing e-learning environment for the employees | Partnering with suppliers to enhance the various stages of CSLC continuously (Chen, Justis, and Wu, 2006), e.g., a franchise system may need to partner with banks to deliver good services at the stage of "Financing the Franchise Business". Aligning the Internet and Intranet Strategy with reputable Application Service Providers (ASP) having focused businesses reengineering around the stages of CSLC (Chen, Ford, Justis, and Chong, 2001). For example, Statability.com is a "visionary Web-based Reporting" portal for the hospitality industry. It has the focused business reengineering around the stage of "Managing the Franchise System". Its focused service is being respected by franchise companies in the hospitality industry, as is evidenced from the ever-increasing list of its client base, including Hilton and Marriott. |
| | Investigating Franchise Opportunities | | | |
| | Obtaining Franchisee Prospectus | | | |
| | Making the Choice | | | |
| Acquisition | Preparing Business Plan | | | |
| | Financing the Franchise Business | | | |
| | Signing the Contract | | | |
| Ownership | Marketing & Promoting the Franchise Products or Services | | Helping the franchisees make sales and serve their customers with proper policies dealing with the Internet encroachment issues | |
| | Managing the Franchise System | | Cultivating the franchisor/franchisee relationship with effective knowledge management tools (Chen, Chong, Justis, 2000a,b; Chen, Hammerstein, and Justis, 2002; Chen, Seidman, and Justis, 2005), e.g., basic communications support, distance learning, and centralized franchise applications such as employee recruitment and online ordering | |
| | Building the Relationship between the Franchisor and the Franchisee | | | |
| Renewal or Retirement | Becoming a Professional Multi-unit Franchisee or Retiring from the Franchise System | | | |

## HARNESSING THE E-BUSINESS STRATEGY AROUND THE CUSTOMER SERVICE LIFE CYCLE

Table 1 shows a **customer-service-life-cycle** (CSLC) (Ives and Mason, 1990) e-business strategy in franchising (Chen, Chong, and Justis, 2002) for relationship management depicted in Figure 2. Here we define the franchisee as the customer of the franchisor and the franchisee's customer as the customer's customer of the franchisor. The stages of CSLC are based on two well-known franchising books by Justis and Judd (2002) and Thomas and Seid (2000).

There are four major components in the e-business strategy:

(1) Benchmarking the Requirements and Acquisition stages. The CSLC model shown in Table 1 is a comprehensive guide for a franchise to develop its web site, especially at the stages of Requirements and Acquisition. The model may be used to compare a franchise's e-business strategy with its competitors. As the industry progresses, best practices based on the CSLC model will evolve and become a standard for benchmarking and websites enhancements.

(2) Helping the franchisees serve their customers in the Ownership stage without the Internet encroachment. There is a rich collection of studies in e-business in franchising (Chen, Chong, and Justis, 2002) showing how the Internet can help the franchisees serve their customers in the Ownership stage, including "Marketing & Promoting the Franchise Products/Services" and "Managing the Franchise System".

(3) Cultivating the Ownership and Renewal/Retirement stages with effective knowledge management. As mentioned earlier, the greatest challenge in the Ownership stage is to build up the relationship between the franchisor and franchisee. To cultivate the Ownership stage so that "Professional" franchisee can advance to the Renewal stage instead of retiring, Chen, Chong, and Justis (2000) suggest building an Intranet-based Franchising Knowledge Repository. The Repository provides a framework based on which a franchise system may transform into a learning organization.

(4) Partnering with the "disruptive technology" providers to enhance the CSLC stages. Innovative entrepreneurs will reengineer their franchise businesses around the CSLC model shown in Table 1. Their ability to track, analyze, and leverage the buying behaviors of their customers in the CSLC sub-stages is their real competitive advantage. For example, Statability.com is a "visionary Web-based Reporting" portal for the hospitality industry. In terms of the CSLC model, Statability.com is a focused business which reengineers around the sub-stages of Ownership. Its "disruptive technology" of reporting is adopted by many franchises in the hospitality industry. As discussed earlier, partnering with those "disruptive technology" providers will make the franchise system more competitive.

## ALIGNING THE CSLC-BASED E-BUSINESS STRATEGY WITH APPLICATION SERVICE PROVIDERS

Although Internet technology can help deploy the franchise's e-business strategy, the immediate question is: at what cost? Because of the need for e-business processes to monitor the linkage of internal information technologies with external processing and services, the e-business investment could be very expensive and complicated. Many franchise companies, especially small ones, find it financially difficult to invest in the e-business technologies; however, a new type of service in e-business called Application **Service Providers**

(ASP) promises to make e-business more economical and affordable to the franchise systems. The concept of subscribing information technologies through ASPs has special appeal in the franchising industry because an ASP can duplicate success for other similar franchises quickly and inexpensively (Chen, Ford, Justis, and Chong, 2001). When aligning the CSLC-based e-business strategy with ASPs, a franchise company should focus on (Chen, Ford, Justis, and Chong, 2001):

(1) Develop an overall vision of the *applications*, including software and hardware, needed for the company.
(2) Determine what applications and the specific *services*, e.g., to be available 24 hours a day and 7 days a week with 99.999% of reliability, you want an ASP to host, which have to be clearly defined in the Service Level Agreement.
(3) Evaluate ASP *providers*, i.e., vendors who provide the applications services, using flexibility and trust relationship as the two primary factors.

## FUTURE TRENDS: AN ATTENTION-BASED FRAMEWORK FOR THE FRANCHISEE TRAINING

The third industrial revolution, combining information technology with globalization, produces an environment where everyone is facing the problem of information overload. Simon (1971) spoke for us all when he said that ‘a wealth of information creates a poverty of attention.” (p.41) Getting the franchisee’s attention on training in an information rich world is a major challenge. Ocasio (1997) proposed an **attention-based theory** of the firm, which allows the firm to shield off irrelevant information and gain access to information relevant to what the firm focuses on. According to Ocasio (1997), attention is defined to “encompass the noticing, encoding, interpreting, and focusing of time and effort by organizational decision-makers on both (a) issues: the available repertoire of categories for making sense of the environment: problems, opportunities, and threats; and (b) answers: the available repertoire of action alternatives: proposals, routines, projects, programs, and procedures.” (p.188) Ocasio (1997) further classifies attention into three principles: (1) focus of attention, what decision makers do primarily depends on the selective issues and answers they focus attention on; (2) situated attention, what decision makers focus on and do depends primarily on the particular contextual environment they are located in; and (3) structural distribution of attention, how decision makers attend to the particular contextual environment they are in depends on how the firm’s attention structure (including rules, resources, and relationships) channels and distributes various issues, answers, and decision makers into specific communications and procedures.

In the context of franchising, what do focus of attention, situated attention, and attention structures look like? How does a franchise design an attention-based training program for the franchisees? We propose an attention-based framework in Table 2 for the franchisee training. Such a framework has two dimensions. The first dimension is the franchisee life cycle, consisting of Beginner in the Courting Phase, Novice in the “We”-Phase, Advanced in the “Me”-Phase, Master in the Rebel Phase (since the rebel ones tend to be those who know the system well and are capable of influencing others to follow them), and Professional in the Renewal Phase. It is vital for relationship building to understand which stage the franchisee is situated and allocate appropriate resources at different touch-points to help them perform their focuses of attention. The second dimension is the demand-and-supply value networks (Chen, Justis, and Wu, 2006), the attention structures of the franchise, consisting of customers, franchisee outlet, franchisor headquarters, suppliers and partners, and franchise community.

*Table 2. An attention-based framework for the franchisee training*

<table>
<tr><th colspan="2" rowspan="2">Situated Attention: Relationship Touch-points</th><th colspan="5">Attention Structures: Demand & Supply Value Networks</th></tr>
<tr><th>Customers</th><th>Franchisee Outlet</th><th>Franchisor Headquarters</th><th>Suppliers & Partners</th><th>Franchise Community</th></tr>
<tr><td rowspan="5">Franchisee Life Cycle</td><td>Beginner in the Courting Phase:<br>Beginner Guide</td><td colspan="5">Focus of Attention: Learning how to become a franchisee<br>Understanding how franchising works<br>Investigating franchise opportunities<br>Obtaining franchisee prospectus<br>Making the choice<br>Preparing business plan<br>Financing the franchised business<br>Signing the contract</td></tr>
<tr><td>Novice in the “We”-Phase:<br>Practicing</td><td colspan="5">Focus of Attention: Practicing how to do activities such as:<br>How to get training and services from the headquarters<br>How to find a good site<br>How to find suppliers<br>How to work with the franchisor<br>How to work with fellow franchisees</td></tr>
<tr><td>Advanced in the “Me”-Phase:<br>Doing</td><td colspan="5">Focus of Attention: Doing activities such as:<br>How to acquire and keep customers<br>How to hire, train, and fire employees<br>How to manage inventory<br>How to manage the back office operations</td></tr>
<tr><td>Master in the Rebel Phase:<br>Teaching Others</td><td colspan="5">Focus of Attention: Teaching others how to do activities such as:<br>How to teach others<br>How to work as team<br>How to do the bulleted processes above for Beginner, Novice, and Advanced franchisees</td></tr>
<tr><td>Professional in the Renewal Stage:<br>Creative Learning and Innovation</td><td colspan="5">Focus of Attention: Becoming the best he/she can be by:<br>Learning to creatively improve activities such as:<br>How to cut the cost of the operations<br>How to increase the profit of the operations<br>How to acquire other franchises and brands<br>Looking for opportunities for innovation such as:<br>Are there any new growth opportunities we can create based on our intangible assets of demand & supply value chains? How do we avoid the loss of this new venture?<br>Are there any partnership opportunities with our customers and suppliers so that their customers could become ours and vice versa.<br>What are the major concerns in the communities and how can we help to deal with them and build a good media relationship also?</td></tr>
</table>

The main body of the framework is the focus of attention of the franchise of different levels.

## CONCLUSION

Franchising has been popular as a growth strategy for businesses; it is even more so in today’s global and e-commerce world (Chen, Chen, and Wu, 2005). The essence of franchising lies in managing the good relationship between the franchisor and the franchisee. In this paper we showed e-business strategy plays an important role in growing and nurturing such a good relationship. Specifically, we discussed: (1) managing the franchisor/franchisee relationship through the CSLC approach, where organizational learning is believed to be the key to building the good relationship; (2) harnessing the e-business strategy around the CSLC approach, where four major components are discussed: benchmarking the requirements and acquisition stages, helping the franchisees serve their customers in the ownership stage and avoiding Internet encroachment, cultivating the ownership and renewal/retirement stages with effective knowledge management, and partnering with the "disruptive technology" providers to enhance the CSLC stages continuously; and (3) aligning the CSLC-based e-business strategy with application service providers, where trust relationship is the major issue.

## REFERENCES

Chen, Y., Chen, G., & Wu, S. (2006). A Simonian Approach to E-business Research: A Study in Netchising. In *Advanced Topics in E-Business Research: E-Business Innovation and Process Management, Vol. 1*.

Chen, Y., Chong, P., & Justis, R. T. (2000a). Information Technology Solutions to Increase Franchise Efficiency and Productivity. In *Proceedings of the 2000 Franchise China Conference and Exhibition*, Beijing (November 6-7), Guangzhou (November 9-10), and Shanghai (November 13-14), China.

Chen, Y., Chong, P., & Justis, R. T. (2000b). Franchising Knowledge Repository: A Structure for learning Organizations. In *Proceedings of the 14th Annual International Society of Franchising Conference*, San Diego, California, February 19-20.

Chen, Y., Chong, P., & Justis, R. T. (2002). E-Business Strategy in Franchising: A Customer-Service-Life-Cycle Approach. In *Proceedings of the 16th Annual International Society of Franchising Conference*, Orlando, Florida, February 8-10.

Chen, Y., Ford, C., Justis, R. T., & Chong, P. (2001). Application Service Providers (ASP) in Franchising: Opportunities and Issues. In *Proceedings of the 15th Annual International Society of Franchising Conference*, Las Vegas, Nevada, February 24-25.

Chen, Y., Hammerstein, S., & Justis, R. T. (2002). Knowledge, learning, and capabilities in franchise organizations. In *Proceedings of the 3rd European Conference on Organizational Knowledge, Learning, and Capabilities*, Athens, Greece, April 5-6.

Chen, Y., Justis, R., & Wu, S. (2006). Value networks in franchise organizations: A study in the senior care industry. In *Proceedings of the 20th Annual International Society of Franchising Conference*, Palm Springs, California, February 24-26.

Chen, Y., & Justis, R. T. (2006). Chinese Franchise Brands Going Globalization. In *1st Annual China Franchise International Summit*, International Franchise Academy, Zhuhai, China, November 9-11.

Chen, Y., Justis, R. T., & Chong, P. P. (2008). Data mining in franchise organizations. In J. Wang (Ed.), *Data Warehousing and Mining: Concepts, Methodologies, Tools, and Applications* (pp. 2722-2733).

Chen, Y., Justis, R. T., & Yang, H. L. (2004). Global E-Business, International Franchising, and Theory of Netchising: A Research Alliance of East and West. In *Proceedings of the 18th Annual International Society of Franchising Conference*, Las Vegas, Nevada, March 5-7.

Chen, Y., Seidman, W., & Justis, R. T. (2005). Strategy and docility in franchise organizations. In *the Proceedings of 19th Annual International Society of Franchising Conference*, London, UK, May 20-22.

Gates, B. (1999). *Business @ the Speed of Thought: Succeeding in the Digital Economy*. Clayton, Australia: Warner Books.

Hadfield, B. (1995). *Wealth Within Reach*. St. Paul, MN: Cypress Publishing.

Ives, B., & Mason, R. O. (1990). Can Information Technology Revitalize Your Customer Service? *Academy of Management Executive*, *4*(4), 52–69.

Justis, R. T., & Judd, R. J. (2002). *Franchising*. Cincinnati, OH: DAME Publishing.

Justis, R. T., & Vincent, W. S. (2001). *Achieving Wealth Through Franchising*. Avon, MA: Adams Media Corporation.

Ocasio, W. (1997). Towards an attention-based view of the firm. *Strategic Management Journal*, *18*, 187. doi:10.1002/(SICI)1097-0266(199707)18:1+<187::AID-SMJ936>3.3.CO;2-B

Schreuder, A. N., Krige, L., & Parker, E. (2000). The Franchisee Lifecycle Concept – A New Paradigm in Managing the Franchisee-Franchisor Relationship. In *Proceedings of the 14th annual International Society of Franchising Conference*, San Diego, California, February 19-20.

Simon, H. A. (1971). Designing organizations for an information rich world. In M. Greeberger (Ed.), *Computers, Communications, and the Public Interest* (pp. 38-52). Baltimore, MD: The Johns Hopkins Press.

Thomas, D., & Seid, M. (2000). *Franchising for Dummies*. Boston: IDG Books.

U.S. Commercial Service. (2008 April). *China Franchising Industry*. Beijing, China: The JLJ Group.

Zeng, Q., Chen, W., & Huang, L. (2008). E-Business Transformation: An Analysis Framework Based on Critical Organizational Dimensions. *Journal of Tsinghua Science and Technology*, *13*(3), 408–413. doi:10.1016/S1007-0214(08)70065-8

## KEY TERMS AND DEFINITIONS

**Customer Service Life Cycle:** Serving customers based on a process of four stages: Requirements, Acquisition, Ownership, and Retirement. Many companies are using the approach to harness the Internet to serve the customers.

**Franchising:** A business opportunity based on granting the business rights and collecting royalties in return.

**Franchisor:** The individual or business who grants the business rights.

**Franchisee:** The individual or business who receives the business rights and pay the royalties for using the rights.

**Franchisor/Franchisee Learning Process:** The stages of learning, including Beginner, Novice, Advanced, Master, and Professional.

**Franchisee Life Cycle:** The stages a franchisee goes through in the franchise system: Courting, “We”, “Me”, Rebel, Renewal.

**Franchisor/Franchisee Relationship Management:** The vital factor for the success of a franchise, including: Knowledge, Attitude, Motivation, Individual Behavior, and Group Behavior.

# Chapter 32

# Exploring the Impact of Government Policies and Corporate Strategies on the Diffusion of Mobile Data Services:

## Case of Economies at Different Stages of Transition

**Tugrul U Daim**
*Portland State University, USA*

**Jing Zhang**
*Beijing University of Posts and Telecommunications, China*

**Byung-Chul Choi**
*Samsung Information Systems America (SISA), USA.*

## ABSTRACT

*We are experiencing a revolution in the mobile industry as 3G transition is being realized globally. This represents a shift from voice driven services to multimedia driven ones. Worldwide subscriber number is reported to reach 700 million. This chapter will explore how governments and businesses impact this phenomenon with their policies and strategies. To be able to understand variations and to generalize conclusions, the authors looked at economies at different stages of transition. They explored US as the major economic power and then Korea as a country that reached the status of a developed nation recently and China that has been growing at an exponential rate. The comparison results reveal that the mobile data services have been developing better in South Korea and China than in the US. Mobile data services can be a large potential market and play an important strategic role in a national economy and society. A keystone strategy is effective to promote the diffusion of contents and applications for mobile services. It is important to lead customer consumptions and reach the balance between mobile data services and voice services. The experience from the three countries can provide significant insights for mobile operators in most other counties.*

DOI: 10.4018/978-1-61520-611-7.ch032

## INTRODUCTION

We focused on mobile network operators (MNOs) as our cases. In China, there are only two MNOs—China Mobile and China Unicom. In the US the four nationwide MNOs, AT&T, Verizon Wireless, Sprint Nextel and T-Mobile have about 87% market share by the volume of subscription. In South Korea, three MNOs—SKT, LGT and KTF compete in the market. Since all the three countries have few major operators covering dominating market share, they are holding real power over the industry. With the infrastructure integrating the value from terminals, equipment, systems and services, they are the most important hubs and have the strongest influence in the industry. The CPs and SPs are all connected to MNOs. Therefore, in terms of description of business strategy, we expect that operator-centric perspective can be prism reflecting general tendencies of various players in mobile communication industry.

As seen in Figure 1, the U.S with the revenue of about $140 billion in 2007 has the biggest market size of mobile services in value and has reached a high penetration rate (FCC, 2008; Mintel, 2007). China has the largest subscriber base of 547 million in the world, but the market size in value was just about $50 billion in 2007 (MII, 2008). Finally South Korea, with only 42 million subscribers and $21.4 billion revenue, presents high penetration rate and active innovations (SKT, 2007).

The cell phone voice service market is highly mature in the US showing the commoditization trend. The MOU (minutes of use per subscriber per month) and monthly ARPU (average revenue per user) of mobile subscribers are much higher than other countries as shown in Fig. 3. Living in the most developed country in the world, the consumers have very strong purchasing power and mature view of consumption. Market research has found that lowest cost per minute, quality of the network and good customer service are the three leading reasons to choose mobile service provider (Mintel, 2007). Although next-generation technologies and services have been launched since 2004, the cutting-edge hardware and services were not regarded as a draw for most consumers.

Although China has the largest user base of mobile services, but the penetration rate, ARPU and MOU are the lowest among the three coun-

*Figure 1. The number of subscribers and penetration rates of mobile services in the US, China and South Korea*

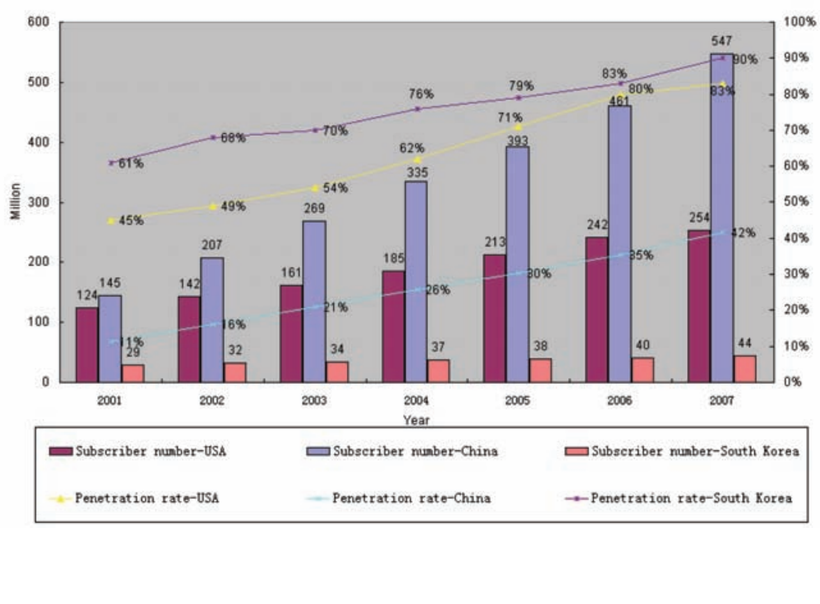
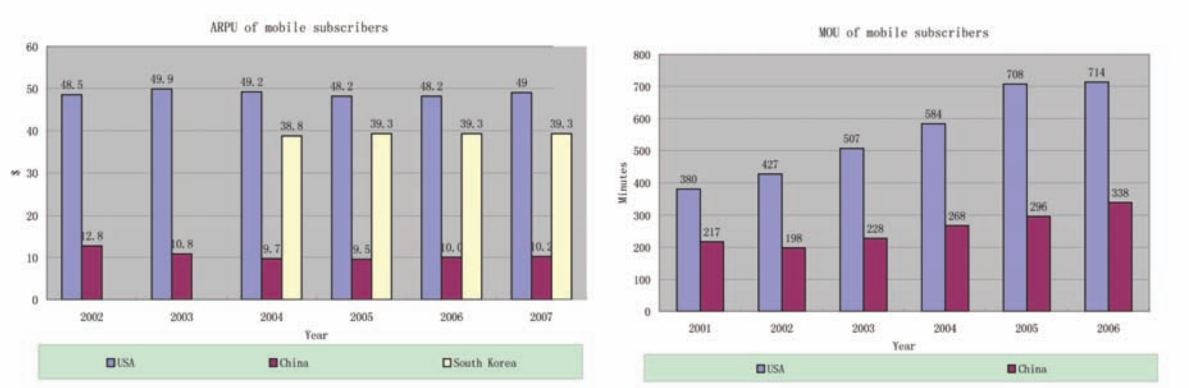


*Figure 2. The monthly ARPUs and MOUs of mobile subscribers in the US, China and South Korea*




tries which means there is still a large potential market (see Fig. 2). As the ARPU declined, the market simultaneously presents obvious polarization: the top end customers spend around $150 per month on mobile services, while low end customers only spend less than $8. The demands of different services vary across different customer groups. Especially the young generations are willing to adopt new handsets and services (CNNIC, 2007).

As mentioned above, South Korea has relatively small domestic market size compared with the US and China. The ARPU is a little bit lower than the US, but higher than China (see Fig. 3). It can be translated that South Korea customer also has strong purchasing power in terms of mobile service. Concerning MOU, since only calling minutes are charged and counted in MOU in South Korea, direct comparison between South Korea and the others might be improper. However, if we consider that only calling minutes has steadily shown around 200 for MOU since 2004 (SKT, 2007), we can predict it might be similar to the MOU in China. Customers in South Korea are famous for demanding preference and sensitivity to change of trend. This customer's tendency made South Korea test market of the world telecommunication industry (Ko, 2003).

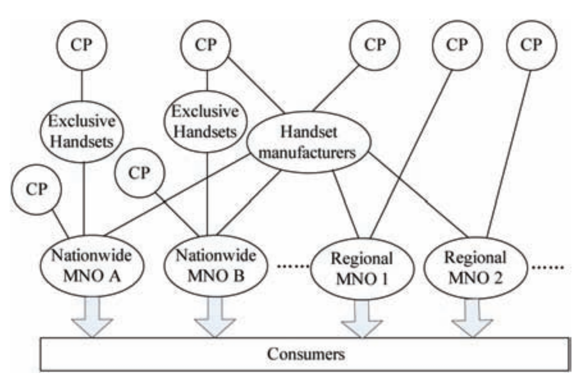
## Regulatory Policies

Different regulatory policies are observed in the three countries. But basically the telecommunication industry was designed by operators putting first because they possess oligopolistic power based on infrastructure. As a result, an operator-centric structure is found in all three countries.

## USA: Effective Competition

In the US, Congress established the promotion of competition as a fundamental goal for policy formation and regulation on mobile services in 1993.

*Figure 3. The value chain of mobile services in the US*



There is effective competition in the US mobile service marketplace. The report by FCC revealed that by the end of 2006, more than 150 companies identified themselves as mobile service providers (FCC, 2008). But they do not all compete head-to-head in each and every region because they have different geographic service areas. A great number of them are regional players and MVNOs (mobile virtual network operators) providing services for certain groups of subscribers. Four nationwide MNOs—AT&T, Verizon Wireless, Sprint Nextel and T-Mobile—hold spectrum licenses covering the entire land area, and thus population, of the US The market shares of them by volume of subscription in 2006 are respectively 26.8%, 26.0%, 23.0% and 11% . No single has a dominant share of the market. Different providers have chosen to deploy a variety of different technologies, including CDMA, GSM, TDMA, and iDEN, with divergent technology migration paths. Competition among multiple incompatible standard has emerged as a distinctive feature of the US mobile industry model.

## China: Oligopoly Under the Government Control

In China, the communication services are divided into basic services and VAS. Different principles and regulations are implemented on them. The key problem is how to set up orderly competition in the telecom service market. Consequently, the competition in basic service market is "designed" and controlled by the government. All the basic operators are largely state-owned companies. The two MNOs—China Mobile and China Unicom were set up respectively in 1999 and 1994 during the telecom reform. China Mobile was holding the absolute leading position with 69.4% market share at the end of 2007 (MII, 2008). The two strong nationwide MNOs have left no room for MVNOs in the market. In May 2008, the Chinese government began a new round reconstruction of the telecom industry for granting 3G licenses. It is expected that three MNOs will stand after the reconstruction. In contrast, more effective competition system has been established in VAS field. By the end of 2007, over 22,000 VAS licenses have been granted by the regulatory agencies in China (MII, 2008). To access customers and necessary infrastructure, these VAS companies have to cooperate with basic operators and provide various information services through the networks.

## South Korea: Oligopoly – Cooperate With Watchdog

The policy of South Korea government has been gradually changed through five times bid for selecting operator (Choi and Rho).. When South Korea government announced the first bid for selecting national operators in 1992, Government set the rule and noticed candidate companies to follow it one-sidedly. However, through the fourth bid invited in 2000 and the fifth bid invited in 2001, South Korea government recognized operator as a cooperator with transparent bid procedure and open result. The key role of government has been converted into strategic player from ruler. Accordingly operator companies were treated as partners of government for more efficient competition and contribution to national economy. This change was originated from the change of strategic cognition of government in terms of telecommunication industry. Two reasons can be summarize to explain the attitude of government toward mobile communication industry. First, South Korea government early caught that the mobile communications industry can greatly contribute to national economy as the automobile and electronic industry did before. Therefore, South Korea government started to focus on supporting operators rather than regulating. Second, due to the limitation of market size, in spite of world class mobile technology, South Korea had to consider not only domestic market but also oversea market. For this goal, South Korea government needed to build close relationship with major operator to backup their growth. Through five times bids from 1992 to 2001, South Korea currently has three private operators, SKT, LGT, and KTF. They have dominative influence on industry with taking approximately 50%, 20%, and 30% market share respectively. These three operators keep relationship with CP and SP, and provide customer with mobile data services

## CORPORATE STRATEGIES

### USA: Walled-Garden Strategies against Competition

In the US, based on the various incompatible 2G technologies, the MNOs have deployed mobile broadband networks following different paths since 2001. GPRS, EDGE, CDMA 1X, CDMA EV-DO, CDMA EV-DO Rev. A, WCDMA and HSDPA have been adopted. The CDMA EV-DO and EV-DO Revision A networks of CDMA operators (Verizon Wireless and Sprint Nextel) have covered 82% of the US population, and WCDMA/HSDPA networks of GSM/TDMA operators (AT&T and T-Mobile) have covered 43% (FCC, 2008). Some service providers have committed to the deployment of WiMAX networks. The new technologies allow typical downstream data transfer speeds of 400~800kbps.

The basic data services like SMS (short message service) began to be available at the end of the 1990s. However in the following years, the service providers paid more attention to voice services and marketed data services primarily as and add-on to voice services. The quality and price of voice service have always been paramount in the competition. The rapid decline of the voice service price greatly stimulated the usage of mobile calls. But the well developed voice services and relatively high prices of data services have restricted the growth of data service usage. Currently in the US mobile services market, mobile service for business activities such as e-commerce and internet business are more developed as an auxiliary measure rather than for individual's interest (Ko, 2003).

As for the value chain strategy, the US MNOs commonly take a walled-garden strategy, dominating the value chain with the control of the provision of handsets, contents and applications. With a high subsidy on terminals, MNOs sell low-price handsets to customers together with a mobile service contract. Usually the handsets are locked to their own networks. And customers have to pay the early termination fee if they choose to terminate the services before the end of the minimum term. Meanwhile, they tend to keep tight control on what applications are available and what services consumers can access on handsets by selling content through their own branded portals. The Apple iPhone launched by AT&T in June 2007 represents a fundamental departure from this walled garden business model. But Apple has itself also created a walled garden on the iPhone in terms of branding and applications. The exclusive agreement between Apple and AT&T makes iPhone unavailable for subscribers of any other service providers. Although the providers have begun selectively to allow third-party CPs to market multimedia content directly to their subscribers, the walled garden business model still dominate the mobile data service operation (FCC, 2008). Fig. 3 summarizes the value chain structure of MNOs in the US.

### China: Keystone Strategies Opened a New Market

Although China has not granted 3G licenses, which made China fall behind other countries, the MNOs and related VAS providers have prepared for mobile data services for years (Zhang and Liang, 2007). China Mobile has kept upgrading its GSM network since 2001, and now has deployed EDGE technologies. China Unicom has been developing the data services mainly based on its CDMA network, which has been upgraded to EV-DO. Based on the infrastructure technologies, multiple data service platforms such as SMS, MMS, WAP, BREW and JAVA, have been built to carry diversified contents and applications.

Besides, both China Mobile and China Unicom have realized that in the 3G era they could not be the dominators any longer and adopted a keystone ecosystem strategy[1]. To promote mobile data services, China Mobile introduced its "Monternet" program in November 2000, which adopted the similar way of NTT DoCoMo's i-mode in Japan (Xu, 2006; Preez and Pistorius, 2003). The core idea is the cooperation and revenue-sharing schemes between China Mobile and its VAS provider partners which are called SPs in the Monternet program. The Monternet program allows SPs to access China Mobile's network at any place, provide nation-wide VAS with contents/applications to the end customers, and charge the "information fee". By providing network transmission channels and sharing its billing system or other resources with SPs, China Mobile charges the "traffic fee" and shares a part of the information fee. The percentage that China Mobile can share with an SP in the information fee depends on their cooperation mode. If China Mobile takes more responsibilities and contributes more in the cooperation, it may keep a higher percentage of the information fee.

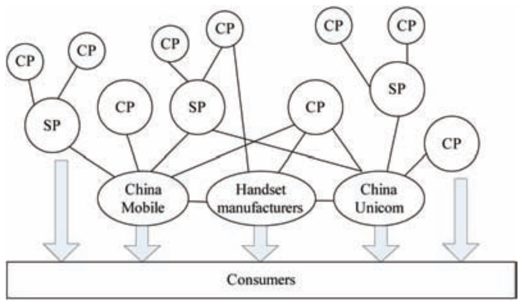
Monternet provided a sustainable revenue source for SPs and generated an overwhelming response from them. And accordingly a lot of CPs were set up to develop differentiated contents/applications particularly for mobile devices. SPs with the connection channels and access numbers work as a bridge that integrate the contents/applications from CPs and access to the mobile network. Some powerful CPs also have the opportunity to cooperate directly with China Mobile. Monternet actually established a new business model and changed the structure of the Internet and telecom industry in China. Following China Mobile's strategy, China Unicom also launched a similar platform UNI-INFO in 2001. Today, about 1000 SPs are cooperating with China Mobile, and over 500 SPs are cooperating with China Unicom providing nationwide services (China Mobile, 2008; China Unicom, 2008). And there are thousands of SPs are cooperating with their provincial branches to provide local services. At the same time, the operators also cooperate with handset manufacturers to launch models that are customized with some of their popular data services incorporated. But the customized handsets only hold a small market share, leaving the majority of the market for handsets independent of operators. Fig. 4 summarizes the value chain structure of mobile industry in China.

As keystone players, China Mobile and China Unicom have made great efforts especially in marketing to foster favorable environment for data services. They identified different customer groups, developed different service brand for them respectively, and promoted different service packages according to their demands. To maximize and optimize the effect of those activities, China Mobile and China Unicom properly utilize market segment and varied marketing strategies. Particularly, the young generation customers are accented in marketing data services. Special data packages (e.g. SMS package) and plans are designed for them to stimulate the usage. The advertising for the services adds more cultural sense on and makes cell phones and mobile services become symbols for personality, social status and fashion. The pricing strategy is a powerful measure in the process. The low-price data services, e.g. SMS, have become an important complement for voice services and get popular quickly all over the country.

## South Korea: Almighty Strategies Managing From Contents to Distribution

South Korea is the first country commercializing CDMA technology in 1996, and several technologies such as CDMA2000 1x EVDO, WCDMA, and PCS are used and competing in market. Based on

*Figure 4. The value chain of mobile services in China*



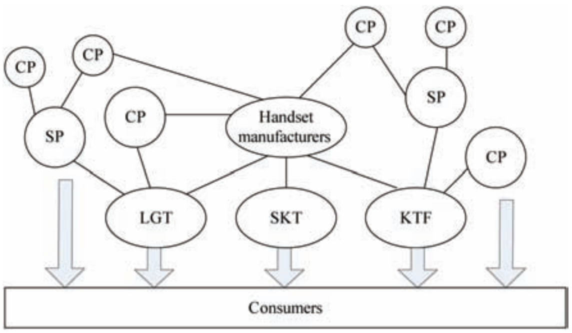

advantage of early starter, 3G technology already became popular in market and various cutting-edge technologies are currently competing for the future market. EVDO Rel.A and HSDPA compete for 3.5G market, and Wibro (Mobile WiMAX) developed by South Korea is commercialized in 2006. Now, government institute and companies are preparing for 4G era and trying to develop standard technology for it.

In South Korea, diverse applications are developed. Especially, convergence between broadcasting and mobile data service is lively. To grasp demanding customer's interest, South Korea operators have been among the leaders which suitably utilize various marketing strategies based on diversified application and various customized data services, and have been followed by China and other countries. Interestingly, owe to some major handset manufacturers, Samsung and LG, we can see some direct relationship between handset manufacturer and CP in South Korea. They produce various customized cellular phone such as diabetes-phone for a diabetic and Mecca phone for Muslims.

The operator's position in industry in South Korea is mainly similar to both U.S and China. In South Korea, few operators possess whole market share such as two operators are doing in China. They have national distribution channels such as four major national operators in US and exercise their power to handset companies as a retail dealer of handset. However, Korean operators' growth strategy to cope with change of the value chain is quite different from previous two countries. According to change of trend to digital convergence era, in perspective of operator, making cooperation with other corporation to secure and extend their influence already become common strategy all over the world.

However, three operators in South Korea are trying new trial no one had tried before. They want be a conductor of new digital convergence era beyond one of the key players in industry. Direct investment in CP and M&A with various CP and broadcasting station based on their abundant resource are the initial activities for this goal. In a nutshell, they want to be the almighty managing from producing contents to distributing those. The reasons for their intention can be summarized into two. First, diversification of distribution media channel (TV, computer, and phone etc) and emergence of OSMU (One Source Multi Use) move the source of value creation from distribution capacity to contents power. One killer content can contribute to revenue more than merely enlarging a number of voice service customers. Through managing whole process from producing contents to distributing it, the operator is able to secure huge revenue from value chain. Second, small domestic market size itself can be the strong motivation for companies to make strong alliance to go aboard. Though South Korea has many unique and good mobile contents, too many services might make domestic market red ocean. To compete or cooperate with major rival companies in other countries, strong alliance among operator, CP, and SP can be more effective than individuals. These two reasons lead Korean operators to try to be 'total media conglomerate' which want to have almightiness managing from planning contents to distributing it. Fig. 5 summarizes the value chain structure of mobile industry in South Korea.

*Figure 5. The value chain of mobile services in South Korea*




## DISCUSSION AND CONCLUSION

Through studying the policies and strategies of the three countries, we have found some success factors and problems as discussed above. The conclusions that can be conducted from this study are:

(1) The mobile data services have been developing better in South Korea and China than in the US. The mobile data services have been to some extent ignored by the US MNOs.

(2) Mobile data services can grow into a large market and industry. It can play an important strategic role in a national economy, both in improve the international competitiveness of developing new technologies and new services, and in providing information services for other sectors in the economy.

(3) A keystone strategy is effective to promote the diffusion of contents and applications, while walled-garden will restrict the diffusion of contents and applications. Almighty strategy is effective to integrate the competitiveness among players in industry. Yet at the same time, it can hurt diversity and fairness in industry.

Although each country has some special situations, the trend of commoditization of mobile voice services has been commonly admitted. Media convergence and content differentiation are the trends of the global information industry.

*Table 1. A summary of the key-points of the policies and strategies related to developing mobile data services in the US, China and South Korea*

| | USA | China | South Korea |
|---|---|---|---|
| Market | - Strong purchasing power<br>-Low interest in new services<br>- High ARPU and MOU<br>- Large potential in mobile data service | - Low average purchasing power<br>- High interest in new service<br>- low ARPU and MOU<br>- Polarized market<br>- Large potential | - Strong purchasing power<br>- High interest in new service<br>- High ARPU and MOU<br>- Relatively low potential |
| Regulatory policies | - Encouraging effective competition<br>- Four nationwide MNOs and a large number of regional providers and MVNOs<br>- Handset sales belongs to operator<br>- Basic service and VAS are open for competition | - Strict regulations on basic services<br>-Two oligopoly operators, thousands of VAS providers<br>- Handset sales is independent<br>- VAS are open for competition | - Government cooperate with operators<br>- Three oligopoly operators<br>- Handset sales belongs to operator<br>- Basic service and VAS are open for competition |
| Corporate (MNO's) strategies | - Emphasizing on voice service<br>- Multiple incompatible technologies<br>- High data service price & low voice service price<br>- Dominating the provision of handsets, services, contents and applications. | - Regarding data services as new market with strategic view<br>- Various technologies for developing mobile data service<br>- Keystone strategy to cooperate with VAS providers and CPs<br>- Emotion marketing and segment marketing | - Multiple exclusive technologies<br>- Almighty strategy<br>- Abundant applications for mobile data service<br>- Various customized mobile data service with diverse fare system |

Mobile data services will undoubtedly become the focus of mobile service industry. The experience summarized in this paper will have common implications for practices.

Our analysis shows that among the three countries, the US is behind the other two in developing mobile data services. Although the technologies have not been well developed in China, the mobile data services have gained a high prevalence among Chinese mobile subscribers. In South Korea, with strong manufacturing and mobile service technologies, diverse mobile services are provided for customers. The key-points of the market, policies, and business strategies in the three countries are summarized in Table 1.

## REFERENCES

China Mobile Limited Annual Report 2001-2007. *(n.d.)*.

China Unicom Limited Annual Report 2001-2007. *(n.d.)*.

Choi, B.-S. (2005). *The Competition of (Value Added Services) in Mobile Telecommunication Industry*. Economy Focus report no. 24., Samsung Economy Research Institute.

Choi, S.-R., & W.-J. Rho. (2003). The Government-Business relations in Telecom markets- Focus on the Mobile Telecommunication Industry. *Administration nonchong, 41*(3), 90.

CNNIC. (2007 May). *WAP development in China*. China Internet Network Information Center.

FCC. (2008 February). *Annual Report and Analysis of Competitive Market Conditions With Respect to Commercial Mobile Services* (12th report). Washington, DC: Federal Communications Commission.

Iansiti, M., & Levien, R. (2004a). Strategy as ecology. *Harvard Business Review*, *82*(3), 68–78.

iResearch. (2008). *Mobile VAS market development in China 2007~2008*. iResearch Consulting Group.

Ko, J.-M. (2003). *Contents Business in Mobile era*. Samsung Economy Research Institute.

MII. (2008). *The development report of the communications industry 2007*. Beijing: Ministry of Information Industry of People's Republic of China.

MINTEL. (2007 November). *Mobile Phone Services - US.*

NIDA. (2007 September). *Survey for wireless internet usage of wireless service type*.

Preez, G. T. D., & Pistorius, C. W. I. (2003). Analyzing technological threats and opportunities in wireless data services. *Technological Forecasting and Social Change*, *70*(1), 1–20. doi:10.1016/S0040-1625(02)00253-6

RNCOS. (2007). *3G Market Outlook (2007-2010)*.

SKT. (2007). *Finance Information*.

Xu, Y. (2003). Mobile data communications in China. *Communications of the ACM*, *46*(12), 81–85.

Zhang, J., & Liang, X. J. (2007). 3G in China: Environment and Prospect. In *Portland International Conference on Management of Engineering and Technology (PICMET)*, Portland, OR, USA.

## KEY TERMS AND DEFINITIONS

**CP:** (content provider) creates contents/applications for mobile subscribers. A pure CP does not have the channels, gateways or access number for connecting with an MNO/MVNO.

**SP:** (service provider) in this paper only refers to a VASP (value added service provider), which is a third-party provider rather than an MNO or

MVNO. SPs have connection channels and access numbers with which they can work as a bridge that integrate contents/applications and access to the mobile network. Usually an SP also creates and provides contents/applications, working as a CP (content provider).

**MNOs:** (mobile network operators) refer to the facilities-based providers that possess mobile communication infrastructure to provide mobile communication services.

**MVNOs:** (mobile virtual network operators) do not have the necessary infrastructure, but they provide services to public by purchasing airtime or leasing facilities from an MNO.

**VAS:** (value-added services) is a certain term for non-core telecom services, or for all services beyond standard voice calls and fax transmissions. Mobile data services are the main part of mobile VAS. Unless specifically noted, VAS in this paper only refers to mobile VAS.

## ENDNOTE

1 A keystone strategy is defined as a strategy that proactively shapes an innovation network, controls its health and benefits the performance of the firm by investing in capabilities, programs, tools, platforms and technologies that tie the network together (Iansiti and Levien, 2004)

# Section 5
# E-Business Models

# Chapter 33
# E-Business and the Resource-Based View:
## Towards a Research Agenda

**Pedro Soto-Acosta**
*University of Murcia, Spain*

## ABSTRACT

*The article provides a review of the adoption of a resource-based view of the firm (RBV) in eBusiness literature and, then, suggests directions for future research. First, a distinction is drawn between Internet resources and eBusiness capabilities. Second, the relationship between Internet resources and eBusiness value is emphasized. Third, the relationships among Internet resources, eBusiness capabilities and firm performance are argued and, finally, the complementarity of Internet resources and eBusiness capabilities is proposed as source of business value. In this regard, a set of propositions is advanced to help guide future research.*

## INTRODUCTION

The resource-based view of the firm (RBV) has been reflected in the information systems (IS) literature since the mid-1990s and is increasingly being used by business researchers to identify the characteristics of, so called, eBusiness. In particular the RBV provides guidance on identifying the contribution of these various technologies which may impact upon organizational performance (Santhanam & Hartono, 2003).

There is considerable debate about the value of eBusiness in this respect due to the gap between investment and the lack of empirical evidence for business enhancement. Case studies on firms such as eBay and Amazon demonstrate how to create business value, but there is a question as to whether the lessons learned from these "Internet giants" are more widely applicable. In this sense, the RBV has been offered as an explanation of how eBusiness overcomes its paradoxical nature and to what extent it is actually enabling increased organizational performance and value. Existing research (Zhu, 2004; Zhu & Kraemer, 2005) has found a significant relationship between eBusiness capabilities and firm performance. However, very little work has been undertaken to identify Internet resources and

DOI: 10.4018/978-1-61520-611-7.ch033

eBusiness capabilities. Similarly, although the complementarity of eBusiness capability has been studied (Zhu, 2004), little effort has been directed to assessing their fundamental impact. Moreover, the direct influences of Internet resources and eBusiness capabilities on performance has received very little attention. In this regard, the paper outlines how the RBV may augment research in eBusiness and its consequent added value.

The paper is structured as follows: The next two sections offer an overview of RBV in eBusiness research. Following that, Internet resources and eBusiness capabilities are described. Then, eBusiness value is discussed from a process perspective and a set of propositions are advanced to help guide future research.

## BACKGROUND

The RBV has its origins in the management strategy literature and has been used to answer one of the most extensively researched questions in the field, related to understanding the sources of sustained competitive advantages (Porter, 1985; Rumelt et al., 1991). The RBV is based on two underlying arguments: resource heterogeneity and resource immobility. Resources and capabilities possessed by competing firms are heterogeneously distributed and may be a source of competitive advantage when they are valuable, rare, difficult to imitate, and not substitutable by other resources (Barney, 1991; Wernerfelt, 1984). At the same time, resources and capabilities are a source of sustained competitive advantage, that is, differences may be long lasting (resource immobility) when protected by barriers to imitation (Mahoney & Pandian, 1992) or isolating mechanisms such as time-compression diseconomies, historical uniqueness, embeddedness and causal ambiguity (Barney, 1991; Dierickx & Cool, 1989; Peteraf, 1993). Consequently, the RBV suggests that the effects of individual, firm-specific resources and capabilities on performance can be significant (Mahoney & Pandian, 1992).

The RVB provides a solid foundation to differentiate between eBusiness characteristics and their separate influences on performance (Santhanam & Hartono, 2003). In this respect Internet resources are not difficult to imitate as multiple firms can purchase these systems and thereby implement multiple strategies (Barney, 1991).

However, firms may obtain competitive advantages from exploiting their physical technology in a better (and/or different) way than other firms, even though competing firms do not vary in terms of their Internet resources. A differentiating factor for improved organizational performance is strategic intent rather than simple technological deployment. Clearly, Internet resources are necessary, but not a sufficient condition, for competitive advantages (Clemons & Row, 1991). They rarely contribute directly to competitive advantage as they mainly form part of a complex chain of assets (eBusiness capabilities) that may lead to better performance (Bhardwaj, 2000, Bhatt and Grover, 2005; Mata et al., 1995; Ross et al., 1996; Santhanam & Hartono, 2003). For instance, Ross et al. (1996) provided illustrative case examples to underscore the notion that eBusiness capabilities can enhance the performance of firms.

The eBusiness literature suggests a significant positive relationship between eBusiness capabilities and firm performance (Zhu, 2004; Zhu & Kraemer, 2005; Ravichandran & Lertwongsatien, 2005). However, very little work has been undertaken to identify the important distinction between Internet resources and eBusiness capabilities and their separate influences on performance.

### Internet Resources and E-Business Capabilities

The RBV generally tends to define resources broadly to include assets, infrastructure, skills, etc. While resources serve as the basic units of analysis, firms create competitive advantage by assembling resources. Grant (1991) suggests that these capabilities are a result of teams of resources working together. Teece et al. (1997) argued that capabilities cannot easily be bought; they must be built. Thus, building capabilities is not only a matter of combining resources; capabilities are rooted in processes and business routines. Consequently, capabilities involve complex patterns of coordination between people and organizations. In this respect, Day (1994) describes capabilities as complex bundles of accumulated knowledge, exercised through organizational processes, which enable firms to coordinate activities and make use of their assets. Day argues that these are closely entwined. More recently, Makadok (2001) considers capability as a special type of resource defined as an organizationally embedded non-transferable firm-specific resource whose purpose is to improve the productivity of the other resources possessed by the firm.

For the purposes of the present paper, the above definitions of capability permit the identification of three important characteristics:

a) Capabilities are rooted in processes and business routines, because it is capability that enables the activities in a business process to be carried out.
b) Capabilities are firm-specific, while an ordinary resource is not. Because of this embeddedness, ownership of a capability cannot easily be transferred from one organization to another.
c) The primary purpose of a capability is to enhance the productivity of the other resources that the firm possesses.

Internet resources are asset-based, while eBusiness capabilities comprise strategic intent formed around the productive use of Information Technology (IT). As a result, a firm's eBusiness capability can be defined as its ability to mobilize and deploy Internet-based resources, in combination with or in the presence of other valued resources. eBusiness capabilities are firm-specific (or interfirm-specific) and rooted in processes and business routines. In this sense, a distinction may be drawn between external and internal eBusiness capabilities. The former refers to the ability to mobilize Internet-based resources and other corporate resources with external business agents (e.g. supplier and customers), while the latter represents the ability to mobilize Internet-based resources and other corporate resources within a firm's boundaries.

## E-Business Value from a Process Perspective

Although much research using the RBV has focused on an aggregated dependent variable, namely, firm performance, this may not be the best way to test the RBV (Ray et al., 2004). For example, because firms can have competitive advantage in some business activities and competitive disadvantage in others, examining the relationship between resources and capabilities associated with different processes within a firm and its overall performance can lead to misleading conclusions. Ray et al. (2004) proposed examining the effectiveness of business processes as a way to test the RBV logic. Another issue is that some IT investments may provide benefits after a certain period but increase operating costs in the short term. Thus, using firm performance at the macro level is meaningless and can again lead to misleading conclusions. Researchers suggest a process-oriented approach to overcome these confounding problems. The locus of impact, that is, the business process, should be the primary level of analysis. Within the literature on eBusiness, recent research also suggests a perspective based on processes to overcome these problems (Subramaniam & Shaw, 2002). These arguments lead to the conclusion that a process approach should be used to study the business value of eBusiness within the RBV, but there is a question as to what eBusiness processes create business value.

Traditionally, to study the business value of IT, the IS literature has used the value chain analysis of Porter (1985). For instance, Mahmood and Soon (1991) developed a comprehensive model for measuring the potential impact of IT. Their model suggests that IT can help firms to improve performance along the value chain, on downstream dimensions, internal dimensions within the organization, and upstream dimensions. Following, Mahmood and Soon (1991), Tallon et al. (2000) decomposed IT business value into downstream dimensions (sales support, customer services, and market expansions), internal dimensions (internal process, internal operation, and staff productivity), and upstream dimensions (coordination with suppliers and business partners). Recently, within the eBusiness literature, Zhu and Kraemer (2005) measured eBusiness value from upstream dimensions (impact on sales and procurement) and internal dimensions (impact on internal operations). This research, according to literature review and in consistency with Ray et al.'s (2004) and Subramaniam and Shaw's (2002) arguments, suggests for measuring eBusiness value the effectiveness of two processes: online procurement and online sales. The business value of these processes is discussed below.

eProcurement, or buying online, can potentially provide distinct value propositions to the firm. These come from the reduction of procurement and inventory costs, as well as strategic networks with suppliers that allow effective and efficient supply chain management (SCM). With regard to procurement costs, Kaplan and Sawhney (2002) indicated that buying in e-Marketplaces considerably reduces transaction costs. With regard to strategic links and SCM, Internet technologies can enhance SCM decision making by enabling the collection of real-time information, and access to and analysis of this data in order to facilitate collaboration between trading partners in a supply chain. In this sense, Frohlich and Westbrook (2002) showed the importance of linking customers and suppliers together in tightly integrated networks. As a result of eProcurement, the collection of real-time information on demand is possible and, more importantly, products and services are delivered quickly and reliably when and where they are needed (Frohlich, 2002).

eSales, or selling online, can potentially provide distinct value propositions to the firm. These come from its impact on the volume of sales, the number of customers and the quality of customer service. The Internet present high reach and richness of information (Evans & Wurster, 1999), it connects firms to consumers in geographic areas that were costly to reach before the Internet (Steinfield et al., 2002). All this can help increasing sales and number of customers. For instance, virtual communities enable frequent interactions on a wide range of topics and thereby create a loyalty and enhance transaction frequency (Amit & Zott, 2001). At the same time, eBusiness allows innovation in the way firms do business (new business models), which may again influence sales and number of customers.

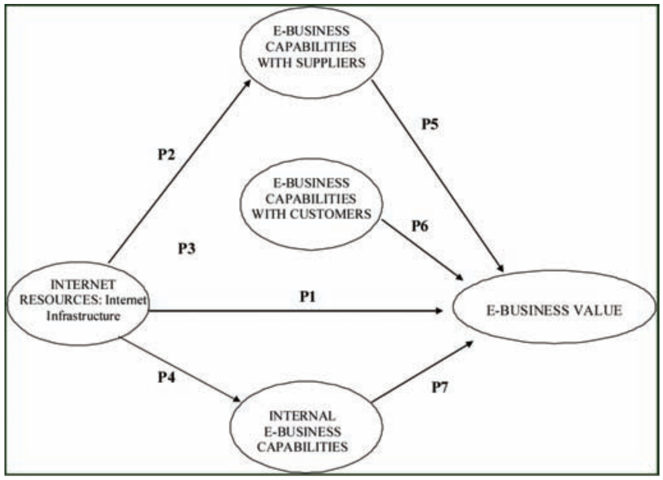
## FUTURE RESEARCH DIRECTIONS

Two key implications emerge from the preceding discussions. First, it is important to recognize the fundamental differences that exist between Internet resources and eBusiness capabilities. Second, the distinct influences on performance of Internet resources and eBusiness capabilities and their complementarity as source of business value. Figures 1 and 2 show the prepositions discussed below.

### Internet Resources and E-Business Value

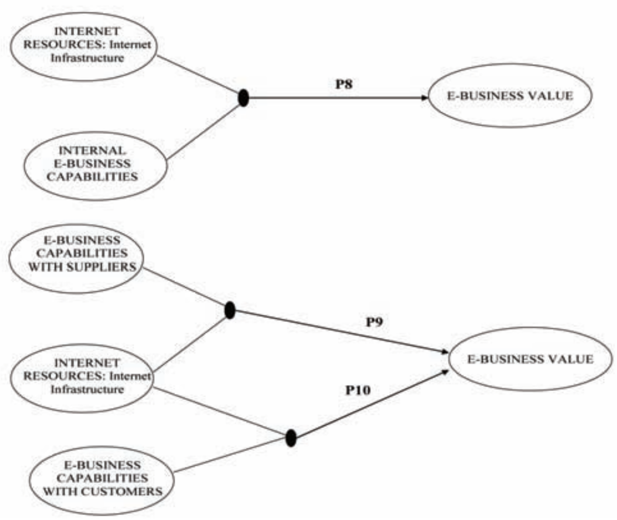
Firms obtain competitive advantages on the basis of corporate resources that are firm specific, valuable, rare, imperfectly imitable, and not strategically substitutable by other resources (Barney,

*Figure 1. Internet resources and e-business capabilities (direct relationships)*




1991). eBusiness resources are easy to duplicate, and, hence do not provide per se competitive advantages (Santhanam & Hartono, 2003). Although Internet infrastructure is argued to be valuable, it is not a source of competitive advantage (Bhatt y Grover, 2005). Thus, Internet infrastructure will rarely lead to superior performance, it is by itself imitable. If one firm can purchase certain Internet technologies and thereby implement some strategies, then other firms should also be able to purchase these technologies, and thus such tools should not be a source of competitive advantage. Furthermore, as the diffusion of the Internet continues, the ability of proprietary Internet infrastructure to be a source of competitive advantage continues to be eroded. These arguments indicate that Internet resources may not have a significant impact on eBusiness value. Thus, the following proposition is suggested:

*Figure 2. The complementarity of Internet resources and e-business capabilities*



**Proposition 1:** There is no relationship between Internet resources and eBusiness value

## Internet Resources and E-Business Capabilities

Although IS research has previously analyzed the influence of resources and capabilities on firm performance, the research is fragmented and key gaps exist in the literature. Thus, despite research has been undertaken to identify different resources and capabilities, and to analyze their direct effects on the performance of firms, the relationship between resources and capabilities has not been systematically studied. Only recent studies such as Ravichandran and Lertwongsatien's (2005) offer a clear distinction between resources and capabilities. In this sense, Ravichandran and Lertwongsatien argue that examining the relationship between resources and capabilities can provide a better understanding of how resources could be deployed to develop capabilities. More specifically, within the area of eBusiness, recent studies have identified distinct eBusiness capabilities and studied their effect on performance (e.g. Zhu, 2004; Zhu & Kraemer, 2005). However, very little work has been undertaken to identify Internet resources and eBusiness capabilities and to study their relationship. Resources are the raw material in the development of capabilities. This relationship is implicit in the definition of capabilities as an organization's ability to assemble, integrate, and deploy valued resources, usually, in combination (Amit & Shoemaker, 1993). Hence, the second, third and fourth propositions posit a positive relationship between Internet resources and eBusiness capabilities.

**Proposition 2:** There is a positive relationship between Internet resources and eBusiness capabilities with suppliers

**Proposition 3:** There is a positive relationship between Internet resources and eBusiness capabilities with customers

**Proposition 4:** There is a positive relationship between Internet resources and internal eBusiness capabilities

## E-Business Capabilities and E-Business Value

Investing in eBusiness is not a necessary nor sufficient condition for improving firm performance, since eBusiness investments might be misused (Tallon et al., 2000). In this sense, Internet resources cannot improve organizational performance if they are not used appropriately. However, when used appropriately Internet resources are expected to create intermediary effects, such as Internet technology being embedded in products and services, streamlined business processes, and improved decisions, which can be expected to have an influence on the performance of the firm (Ravichandran & Lertwongsatien, 2005).

Grant (1991) and Makadok (1991) emphasize that while resources by themselves can serve as basic units of analysis, firms create competitive advantage by assembling these resources to create organizational capabilities. Makadok states that these firm-specific capabilities, embedded in organizational processes, provide economic returns because that firm is more effective than its rivals in deploying resources. eBusiness researchers have adopted this capability logic of resources by arguing that competitors may easily duplicate investments in Internet resources by purchasing the same hardware and software and, hence, Internet resources per se do not provide competitive advantages. Rather, it is the manner in which firms leverage their Internet resources to create unique capabilities that impact firm performance (Clemons & Row, 1991; Mata et al, 1995). Thus, it is expected that external and internal eBusiness capabilities have the potential to create business value. The following propositions incorporate these expectations:

**Proposition 5:** There is a positive relationship between eBusiness capabilities with suppliers and eBusiness value

**Proposition 6:** There is a positive relationship between eBusiness capabilities with customers and eBusiness value

**Proposition 7:** There is a positive relationship between internal eBusiness capabilities and eBusiness value

### The Complementarity of Internet Resources and internal E-Business Capabilities

Although there is research that posit a direct relationship between IT resources and firm performance (Bharadwaj, 2000; Feeny & Willcoks, 1998; Santhanam & Hartono, 2003), others have questioned the direct-effect argument and emphasized that IT resources are likely to affect firm performance only when they are deployed to create unique complementarities with other firm resources (Clemons & Row, 1991; Powell & Dent-Micallef, 1997).

Firm resources are considered complementary when the presence of one resource enhances the value or effect of another resource (Ravichandran & Lertwongsatien, 2005; Zhu, 2004). For example, the complementarity between online offerings and offline assets is the essence of "clicks-and-mortar" companies. Customers who buy products over the Internet value the possibility of getting support and service offered through bricks-and-mortar retail outlets, including the convenience of in-store pickup and return (Zhu, 2004). Hence the RBV highlights the role of complementarity as a source of value creation in eBusiness, though is not the only source as suggested by Amit and Zott (2001). As mentioned earlier, Internet resources are not difficult to imitate and per se do not provide competitive advantages. However, having a proper Internet infrastructure may facilitate the internal processing of online operations and this way influence positively firm performance. That is, the fact of possessing an adequate Internet infrastructure can be critical for the influence of internal eBusiness capabilities on business value. Similarly, possessing an adequate Internet infrastructure may facilitate collaboration between trading partners in a supply chain, linking customers and suppliers together in tightly integrated networks. Thus, the following propositions are suggested:

**Proposition 8:** The complementarity between Internet resources and internal eBusiness capabilities explains variations in eBusiness value

**Proposition 9:** The complementarity between Internet resources and eBusiness capabilities with suppliers explains variations in eBusiness value

**Proposition 10:** The complementarity between Internet resources and eBusiness capabilities with customers explains variations in eBusiness value

## CONCLUSION

The RBV is being extensively used by IS and eBusiness researchers. In this respect, research offers a useful distinction between resources and capabilities. The former is asset-based, while the latter comprises a mixture of assets formed around the productive use of IT. In general, resources are not difficult to imitate; Internet technology is by itself typically imitable. Internet resources rarely contribute directly to competitive advantage. Instead, they form part of a complex chain of assets (eBusiness capabilities) that may lead to better performance. Thus, some researchers have described this in terms of capabilities and argue that these can create uniqueness and provide organizations a competitive advantage (Bhardwaj, 2000, Bhatt & Grover, 2005; Mata et al., 1995; Ross et al., 1996; Santhanam & Hartono, 2003). However, despite research has analyzed the relationship between capabilities and firm performance, only recent studies such as Ravichandran & Lertwongsatien's (2005) offer a clear distinction between IT resources and capabilities.

Within the eBusiness literature, recent studies have found a significant positive relationship between eBusiness capabilities and firm performance (Zhu, 2004; Zhu & Kraemer, 2005). However, very little work has been undertaken to identify Internet resources and eBusiness capabilities and study their separate influences on performance. Similarly, the relationship between Internet resources and eBusiness capabilities has not been studied. Moreover, little effort has been directed to assessing the complementarity of Internet resources and eBusiness capabilities. This article provides discussions, issues and ideas to help cover these gaps in the research.

## REFERENCES


Amit, R., & Schoemaker, P. J. (1993). Strategic assets and organizational rent. *Strategic Management Journal*, *14*(1), 33–46. doi:10.1002/smj.4250140105

Amit, R., & Zott, C. (2001). Value creation in e-business. *Strategic Management Journal*, *22*(6-7), 493–520. doi:10.1002/smj.187

Barney, J. B. (1997). Firm Resources and Sustained Competitive Advantage. *Journal of Management*, *7*, 99–120.

Bharadwaj, A. S. (2000). A resource-based perspective on information technology capability and firm performance: an empirical investigation. *MIS Quarterly*, *24*(1), 169–196. doi:10.2307/3250983

Bhatt, G. D., & Grover, V. (2005). Types of information technology capabilities and their role in competitive advantage: an empirical study. *Journal of Management Information Systems*, *22*(2), 253–277.

Clemons, E. K., & Row, M. C. (1991). Sustaining IT advantage: the role of structural differences. *MIS Quarterly*, *15*(3), 275–292. doi:10.2307/249639

Day, G. S. (1994). The capabilities of market-driven organizations. *Journal of Marketing*, *58*(4), 37–52. doi:10.2307/1251915

Dierickx, I., & Cool, K. (1898). Asset Stock Accumulation and Sustainability of Competitive Advantage. *Management Science*, *35*(12), 1504–1511. doi:10.1287/mnsc.35.12.1504

Evans, P. B., & Wruster, T. S. (Eds.). (1999). *Blown to bits: how the new economics of information transforms strategy*. Harvard Business School Press: Boston, MA.

Feeny, D. F., & Willcocks, L. P. (1998). Core IS capabilities for exploiting information technology. *Sloan Management Review*, *39*(3), 9–21.

Frohlich, M. T. (2002). e-Integration in the supply chain: barriers and performance. *Decision Sciences*, *33*(4), 537–555. doi:10.1111/j.1540-5915.2002.tb01655.x

Frohlich, M. T., & Westbrook, R. (2002). Demand chain management in manufacturing and services: web-based integration, drivers and performance. *Journal of Operations Management*, *20*(6), 729–745. doi:10.1016/S0272-6963(02)00037-2

Grant, R. M. (1991). The resource-based theory of competitive advantage: implications for strategy formulation. *California Management Review*, *33*(1), 114–135.

Kaplan, S., & Sawhney, M. (2000). E-hubs: the new B2B marketplaces. *Harvard Business Review*, *70*(1), 71–79.

Mahmood, M., & Soon, S. K. (1991). A comprehensive model for measuring the potential impact of information technology on organizational strategic variables. *Decision Sciences*, *22*(4), 869–897. doi:10.1111/j.1540-5915.1991.tb00368.x

Mahoney, J. T., & Pandian, J. R. (1992). The resource-based view of the firm within the conversation of strategic management. *Strategic Management Journal*, *13*(5), 363–380. doi:10.1002/smj.4250130505

Makadok, R. (2001). Toward a synthesis of the resource-based and dynamic-capability views of rent creation. *Strategic Management Journal*, *22*(5), 387–402. doi:10.1002/smj.158

Mata, F. J., Fuerst, W. L., & Barney, J. B. (1995). Information technology and sustained competitive advantage: a resource-based analysis. *MIS Quarterly*, *19*(4), 487–505. doi:10.2307/249630

Peteraf, M. A. (1993). The cornerstones of competitive advantage: a resource-based view. *Strategic Management Journal*, *14*, 179–191. doi:10.1002/smj.4250140303

Porter, M. (1985). *Competitive advantage: creating and sustaining superior performance*. New York: Free Press.

Powell, T. C., & Dent-micallef, A. (1997). Information technology as competitive advantage: the role of human, business, and technology resources. *Strategic Management Journal*, *18*(5), 375–405. doi:10.1002/(SICI)1097-0266(199705)18:5<375::AID-SMJ876>3.0.CO;2-7

Ravichandran, T., & Lertwongsatien, C. (2005). Effect of Information Systems Resources and Capabilities on Firm Performance: A Resource-Based Perspective. *Journal of Management Information Systems*, *21*(4), 237–276.

Ray, G., Barney, J. B., & Muhanna, W. A. (2004). Capabilities, business processes and competitive advantage: choosing the dependent variable in empirical tests of the resource-based view. *Strategic Management Journal*, *25*, 23–37. doi:10.1002/smj.366

Ross, J. W., Beath, C. M., & Goodhue, D. L. (1996). Develop long-term competitiveness through IT assets. *Sloan Management Review*, *38*(1), 31–42.

Rumelt, R. P., Schendel, D., & Teece, D. J. (1991). Strategic management and economics. *Strategic Management Journal*, *12*, 5–29. doi:10.1002/smj.4250121003

Santhanam, R., & Hartono, E. (2003). Issues in linking information technology capability to firm performance. *MIS Quarterly*, *27*(1), 125–153.

Steinfield, C., Mahler, A., & Bauer, J. (1999). Electronic commerce and the local merchant: opportunities for synergy between physical and Web presence. *Electronic Markets*, *9*(2), 51–57. doi:10.1080/101967899359247

Subramaniam, C., & Shaw, M. J. (2002). A study of the value and impact of B2B e-commerce: the case of web-based procurement. *International Journal of Electronic Commerce*, *6*(4), 19–40.

Tallon, P., Kraemer, K., & Gurbaxani, V. (2000). Executives' perceptions of the business value of information technology: a process-oriented approach. *Journal of Management Information Systems*, *16*(4), 137–165.

Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, *18*(7), 509–533. doi:10.1002/(SICI)1097-0266(199708)18:7<509::AID-SMJ882>3.0.CO;2-Z

Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic Management Journal*, *5*, 171–180. doi:10.1002/smj.4250050207

Zhu, K. (2004). The complementarity of information technology infrastructure and e-commerce capability: a resource-based assessment of their business value. *Journal of Management Information Systems*, *21*(1), 167–202.

Zhu, K., & Kraemer, K. (2005). Post-adoption variations in usage and value of e-business by organizations: cross-country evidence from the retail industry. *Information Systems Research*, *16*(1), 61–84. doi:10.1287/isre.1050.0045

## ADDITIONAL READING

Barua, A., Konana, P., Whinston, A. B., & Yin, F. (2004). An Empirical Investigation of Net-Enabled. Business Value. *MIS Quarterly*, *28*(4), 585–620.

Devaraj, S., Krajewski, L., & Wei, J. C. (2007). Impact of eBusiness technologies on operational performance: The role of production information integration in the supply chain. *Journal of Operations Management*, *25*(6), 1199–1216. doi:10.1016/j.jom.2007.01.002

Johnson, P. F., Klassen, R. D., Leenders, M. R., & Awaysheh, A. (2007). Utilizing e-business technologies in supply chains: The impact of firm characteristics and teams. *Journal of Operations Management*, *25*(6), 1255–1274. doi:10.1016/j.jom.2007.01.005

Meroño-Cerdan, A., & Soto-Acosta, P. (2007). External web content and its influence on organizational performance. *European Journal of Information Systems*, *16*(1), 66–80. doi:10.1057/palgrave.ejis.3000656

Sanders, N. R. (2007). An empirical study of the impact of e-business technologies on organizational collaboration and performance. *Journal of Operations Management*, *25*(6), 1332–1347. doi:10.1016/j.jom.2007.01.008

Soto-Acosta, P. (2008). The e-Business performance measurement in SMEs. *International Journal of Enterprise Network Management*, *2*(3), 268–279. doi:10.1504/IJENM.2008.018781

Soto-Acosta, P., & Meroño-Cerdan, A. (2006). An analysis and comparison of web development between local governments and SMEs in Spain. *International Journal of Electronic Business*, *4*(2), 191–203.

Soto-Acosta, P., & Meroño-Cerdan, A. (2008). Analyzing e-Business value creation from a resource-based perspective. *International Journal of Information Management*, *28*(1), 49–60. doi:10.1016/j.ijinfomgt.2007.05.001

Soto-Acosta, P., & Meroño-Cerdan, A. (2009). Evaluating Internet Technologies Business Effectiveness. *Telematics and Informatics*, *26*(2), 211–221. doi:10.1016/j.tele.2008.01.004

Zhu, K., & Kraemer, K. L. (2002). E-commerce metrics for net-enhanced organizations: assessing the value of e-commerce to firm performance in the manufacturing sector. *Information Systems Research*, *13*(3), 275–295. doi:10.1287/isre.13.3.275.82

## KEY TERMS AND DEFINITIONS

**e-Marketplace:** A business-to-business (B2B) Internet trading forum in which multiple buyers and sellers exchange goods and services within an industry group or geographic region.

**External eBusiness Capabilities:** The ability to mobilize and deploy Internet-based resources and other valued corporate resources with external business agents (e.g. supplier and customers).

**Internal eBusiness Capabilities:** The ability to mobilize Internet-based resources and other valued corporate resources within a firm's boundaries.

**Internet:** Relates to Internet Protocol based networks: www, extranet over the internet, EDI over the internet, internet-enabled mobile phones.

**Supply Chain Management:** An internet-based software solution that supports the management of logistics and inventory along the entire value chain and connects business partners.

# Chapter 34
# E-Commerce Business Models: Part 1

**Khaled Ahmed Nagaty**
*The British University in Egypt*

## ABSTARCT

*In this article the author explained the classes of e-commerce business models and their advantages and disadvantages. He discussed the important issues and problems facing e-commerce web sites and how to build a successful e-commerce Web site using techniques of security, privacy and authentication, guidelines of maintenance, collecting user's information for personalization, using multi-tier architecture to achieve high performance and high availability.*

## INTRODUCTION

Internet and computers have revolutionized the electronic transactions which involve the transaction of ownership or right to use products or services online. E-commerce not only involves buying and selling over the Internet but also collaborating with business partners. It is not constrained by time or physical location it can be conducted at any time from any place which opened unlimited new markets. A business model is a framework of how an organization generates revenue. E-commerce business models use the Internet to carry on their activities and generate revenue. They have been developed from being a plain text websites to interactive e-commerce hubs that use Internet and mobile technologies to reach their current customers and attract the potential customers. Some services and products can be delivered by the internet while others do not. Services that can be delivered through the internet include distance learning, financial services, pension services, legal services, news services, and advisory services, information services such as information on travel flights, buses and trains services.

However, services that cannot be delivered using the internet include police and law enforcement treatment, fire brigade services, first aid, nursing, physiotherapy, surgery operations, dental services, hairdressing, house cleaning, waste disposal and

DOI: 10.4018/978-1-61520-611-7.ch034

washing services, plumbing and hosing, ventilating and heating services, forensics, transportation, freight and shipping services, building services, wedding, childcare, security and warehousing. Products that difficult to be delivered through the internet include jewels and timepieces, footwear, beauty care and cosmetics, furniture, frames of eyeglasses. All these products need to be tried out and assessed by the customers. In jewels ladies want to try out different models of jewels to choose a suitable one. In furniture it is hard to describe the required design and colors through the Internet and customers need to touch and try the furniture before taking a decision. The same issue applied for beauty care and cosmetics where ladies want to compare between different colors on their faces before taking a decision. However, an e-commerce business will not work well unless there is a well equipped infrastructure which includes computers that can connect to the Internet Service Provider (ISP) through dial-up lines or dedicated lines that offer a high bit rates such as digital subscriber lines (DSL). DSL is recommended if a user wants a faster access to the internet. ISPs provide the Internet access to customers at their homes, business and institutions. Berners-Lee in 1989-1991 and his associates developed the essential components of a Web site which are: HTML, HTTP, a Web server and a browser. The HyperText Markup Language (HTML) which is a programming language can be used to build Web pages on a Web server. Remote client computers which are called Web clients can access these Web pages using the HyperText Transfer Protocol (HTTP) to be displayed using Web browsers. Customers should easily interact with their Web sites or they will be lost to competitors and discouraging return visits to this Web site which results in sales losses. Software tools are required to achieve high levels of interactivity with Web sites which may include:

- Common Gateway Interface (CGI): is a standard protocol for communication between Web clients' browsers and application software running on a Web server that allows the Web server to respond to requests from Web clients. Each time a request is received the CGI analyzes the request and if it identifies a file stored on the server it sends the file back to the user, and if it is required to execute a command on an application it runs the command and sends the output back to the user.
- Active Server Pages (ASP): is a development software tool which can be used to create and run dynamic and interactive Web server applications. When a client's browser requests ASP file from a Web server it is processed on the server and the output is in pure HTML code which is sent to the client's browser to display it in a formatted text. ASP is a Microsoft technology that was designed to run on Windows operating system that runs Microsoft Internet Information Server (IIS). The active content is written with a scripting language.
- Java: is a programming language used to build interactive contents on the client computer thus saving considerable server load. A Java program is called applet when it runs from a Web page and called servlets when it runs on server. A Java program is first translated into Java intermediate language (Bytecode) which is then executed on an interpreter called Java Virtual Machine (JVM). JVM interprets the intermediate code to machine code. Any computer that runs JVM is able to interpret the intermediate code which gives the Java language the ability to run on any platform such as Linux, Mac OS X or Windows.
- Java Server Pages (JSP): is a Java technology that allows developers to create Web pages that contain dynamically generated content. It can combine any document types such as HTML or Extensible Markup Language (XML) tags to encapsulate the logic that generates the content for the

response page. In this way, JSP separates Web presentation from Web content. JSP pages are not restricted to a specific platform or Web server. JSP is developed by Sun and it is like an ASP page and has a lot from ASP technology. The active content is written in Java which allows writing complex logic with complex error handling that may not possible in ASP.

- JavaScript: it is unrelated to the Java programming language despite its name. It is the Netscape-developed object scripting language that is used to control objects on an HTML page and handle interactions with Web browsers. It is a script language used in millions of Web pages to create a variety of special effects, add functionality and to handle verification and validation of input users' forms. It detects the actions of the user and reacts to them. You can run client side JavaScript within ASP pages. JavaScript can be used for more simple client side such as filling forms while ASP is used for more server sided validation, fetch data, generating pages,…etc.
- ActiveX: is an object oriented programming tool that is used to create a self-sufficient program called ActiveX control which can be automatically downloaded and executed by Web browser. Active X controls are small applications written in common programming languages like Visual Basic. If the required control is not one of the standard controls in the Web browser a dialog box prompts the user to download the correct control. For example, when you open a Web page using Internet Explorer that contains a video clips the pre-loaded ActiveX control allows Windows Media files to be played directly in the Web page without the need to run the Window Media Player separately. ActiveX has full access to client's resources such as printers, networks and hard drives.
- VBScript: is programming language from Microsoft which is a subset of its Visual Basic programming language designed for interpretation by Web browsers. It is designed to compete with JavaScript. VBScript can be used for server-side as well as client-side while JavaScript is used only for client-side. VBScript supports only the Internet Explorer browser while JavaScript supports all browsers. VBScript is case insensitive while JavaScript is case sensitive.
- PHP: is an HTML embedded scripting language where much of its syntax is taken from C, Java and Perl languages with some unique features of PHP. This language allows web developers to write dynamic web pages quickly.
- ColdFusion: is a product of Macromedia, it is a popular, sophisticated and integrated set of products for building interactive Web applications. ColdFusion consists of ColdFusion Studio to build a Web site and ColdFusion Server to serve Web pages to users. ColdFusion is based on the standard HTML in addition to the server-side ColdFusion Markup Language (CFML). CFML provides the capability of controlling the application behavior, the ability to integrate multiple server technologies and dynamically generate the content returned to the Web browser. When a Web browser requests a page in a ColdFusion application it is automatically pre-processed by the ColdFusion application server. The application server reads the client's data and executes the application logic that is written in CFML in the page, the server interacts with database servers, file systems and mail servers and dynamically generates the HTML Web page which is returned to the browser. ColdFusion can be used when real time application is required where live data can be incorporated into dynamically Web pages.

- DreamWeaver: is a product of Macromedia that allows you to create Web pages both static and dynamic. It consists of an application server and ColdFusion Markup Languages (CFML). Most ColdFusion developers write their ColdFusion pages using DreamWeaver. DreamWeaver saves time by automatic closing HTML and CFML tags, auto-generate some CFML code, providing auto-complete menus as you type and color coding the text of your code to improve readability.

## BACKGROUND

E-commerce business model is important for companies to survive in global economy. E-commerce business model is a fertile ground for innovation (Amit and Zott, 2000). When the Internet was made available for the public in 1994, many analysts expected that e-commerce would be a major economic sector in the near future. However, the major progress for e-commerce occurred when security protocols have sufficiently developed and widely deployed which led to more secured transactions over the Internet. A substantial number of primitive e-commerce web sites have been developed in late 20th century and the year 2000 and although many e-commerce web sites were collapsed in the dot.com fall in 2000 and 2001, many companies started to develop web sites with e-commerce capabilities. E-commerce can be divided into four main classes: B2B, B2C, C2B, and C2C.

- B2B (Business-to-Business)

B2B is the exchange of products, services, or information between businesses rather than between businesses and consumers. Businesses exchange products, services and information with other businesses rather than customers such as manufacturers selling to distributors, wholesalers selling to retailers or company providing services to other companies. Pricing is often negotiable to obtain lower prices on your supplies and with minimum human intervention due to businesses systems integration. B2B is now growing in an exponential rate where companies of all sizes are buying and selling products and services over the Internet. Businesses can make real time transactions with other businesses to improve their efficiency and productivity. Analysts expect the revenue of B2B will exceed the B2C revenue in the near future despite early expectations for B2C flourishing. An example of B2B e-commerce model is e-procurement sites where a company purchasing agents can buy from suppliers, ask for offers or bidding to purchase at a desired price.

- B2C (Business-to-Customer)

B2C is the transactions that occur between a businesses and customers. Businesses selling products or provide services to customers or the retailing part of e-commerce on the Internet. B2C businesses had a major role in flourishing of e-commerce where customers got large discount on shopping and provided free online services. Businesses got its products to the market faster with minimum costs and they were adapting more quickly to customers demand. Many spectators argue that the B2C was once flourished and now it is often seen unsuccessful, less frequently and will not thrive again. However, despite of disappointments some analysts predict that B2C will flourish again and continue to grow but not just easy and popular as initially expected. An example of B2C e-commerce model is www.necx.com which provides access to materials purchased in bulk and resell them to customers.

- C2B (Customer-to-Business)

C2B e-commerce is rare in practice but in theory it means a customer wants to sell a product or a service to a business. Customers naming their prices for various products or services. Companies review the consumer's requirements and bid on the request. The customer reviews the bids and selects the company they want. C2B enables customers to pay for their bills online from any place with no need to come to the store. Examples of this type of e-commerce model www.fotolia.com where photographers and designers offer their works for selling to companies. Other examples of C2B model are online advertising sites like Google Adsense, online surveys like www.surveyscout.com where individuals offer the service to reply to the company's survey and companies pay individuals for this service.

- C2C (Customer-to-Customer)

It is a person-to-person transactions which take place every day since 1995. It facilitates transactions between customers through a third party. A good example of this e-commerce type is auctions web sites like eBay where consumers can buy and sell using online payment systems like PayPal to send and receive money online with ease.

## Major Advantages of E-Commerce Business Models are [Knowledge@Wharton, 2008]:

- Efficiency: e-business models increase business efficiency in several ways. They reduce search costs for online customers and provide them with detailed information along with their prices. They encourage customers to do business by increasing transaction efficiency, security and speed. Also, it allows reverse marketing where buyers put their desired purchases for bidding among sellers which is known as reverse auction. E-business models reduce both inventory and distributions costs for companies.
- Cross-selling: companies can increase their value creation for their own products by pushing new products to current customers based on their past purchases, this increases customer's dependence on the company and decreases the probability a customer switches to competitors.
- Complementaries: a company can increase its value creation by accompanying its products with other products. Customers will buy more of the complementary products regardless of their prices if they buy more of the core products. Also, a company can bundle its product by complementary products from other suppliers. Once a selling occurs, an e-business model can offer to the customer the complementary products associated with the purchased product.
- Customer lock-in: keeping the customer dependent on the company a longer time by making the customer engage with the company in repeated transactions.
- Customer satisfaction: increasing the degree to which online customers are accommodated by service offerings. It increases the quality of service as well as the volume of transactions while decreasing the volume of complaints.
- Speed: advances in communications allow transactions to be done almost instantaneously. There is no need to wait weeks for a money transaction or catalogue to arrive by post.
- Availability: online services are available any time of day or night and from any place.

In general, e-commerce business models provide tools to handle large information masses with improved security, reliability, user friendly, low costs, accessibility and customizability which help flourishing e-commerce.

### Major Disadvantages of E-Commerce Business Models

- Feel and touch: websites allow customers to browse products but do not allow touching them which prevents many customers to make an accurate decision.
- Trust: customers are unwilling to accept E-commerce due to privacy and security concerns (Turban, 2004; Awad, 2003).

## SUCCESSFUL E- COMMERCE WEBSITES

### Issues, Controversies, Problems

There are numerous studies reporting the fact that e-commerce sites are failing in usability, ease of use and general functionality (Tarafdar and Zhang, 2005; Aladwani and Palvia, 2002; Ranganathan and Ganapathy, 2002; Yang et al., 2003; Long & McMellon, 2004). Users often fail when they try to purchase products on an e-commerce site (Nielsen and Norman, 2000; Zona Research, 1999). It is not just the customers' failure but also the site fails to sell. However, chiefly for reasons of growing importance of online transactions in business-to-consumer (B2C) and business-to-business (B2B), e-business models need for development and survival cannot be ignored for organizations working in complex operational environment coupled with the dynamism of technological environment that principally unbounded and constantly evolving. Security is also an important issue on the Internet where sensitive payment details such as a credit card number may be intercepted or stolen which leads to the loss of customers' confidence especially if this information is used in an illegal transactions. Hackers may access customer files and corrupting customers' accounts. As customers are unseen you are not sure of the identity of online visitors which arises the problem of authentication. Achieving high availability and performance are important issues. Loss of availability may occur due to hardware failure, computer viruses that may corrupt data or applications operating on the Web server or due to lack of maintenance which makes the Web site unavailable. The failure to achieve high availability and high performance will cause the business to loose customers through frustration. Also, problems of integration of new versions of e-commerce software with existing ones may also appear. Governments and businesses encourage e-Commerce but there is some resistance by consumers due to concerns about security and privacy. Currently, e-commerce business models require a customer to provide more personal information than it is required. Many people are concerned that this information will then be re-used for another purpose or sold to direct marketers. Some analysts argue that despite of the improvement in information encryption there still a danger that credit card information may be stolen and used in an illegal purchasing on the Internet.

However, we argue that transmission of messages over the Internet was significantly improved after using the Secure Socket Layer (SSL) protocol which uses private and public key encryption and digital certificates. It is the customer's responsibility to be careful not to disclose his card information to anybody or leaving his card in unsecured places. Other important issues for e-commerce Web site is the loss of privacy which means loss of individual privacy when using the Internet.

### Solutions and Recommendations

#### Website Security

Organizations conducting business online have many web applications in the form of shopping carts, submission forms, login pages, dynamic content and customized application. In the B2C model Web applications allow Web client's to access the Web server to retrieve, submit or update data. These data may be sensitive such as user's credit card data, user's social number, user's bank account details or even user's medical record. To maintain high availability on the cyberspace the business web site should be available 24 x 7 which invites hackers to launch attacks on the backend corporate database. In case of a hacker gained access to the organization's sensitive data and got use of it then the organization's business will be in a serious trouble. The business will lose clients' and stakeholders' trust and eventually may be closed down. Business Web sites receive and send sensitive information to their clients and it is important to guarantee information integrity which means that this information has not been changed during its transmission.

E-commerce Web sites use the Secure Socket Layer (SSL) protocol to protect their sensitive information. This technology makes it easier and safer for online customers to trust Web sites in three essential ways (VeriSign, 2008):

1. Enables encryption of sensitive information during online transactions.
2. Each SSL Certificate contains unique, authenticated information about the certificate owner.
3. A Certificate Authority verifies the identity of the certificate owner when it is issued.

The SSL protocol is well designed with respect to preventing eavesdropping and avoiding successful man in the middle attacks. However, it is less concerned with the processes and procedures that a person or organization must go through to acquire a certificate.

Additional methods of Web security include (Hoffer, et al., 2007):

1. Restrict the number of users accessing the Web server as much as possible and limit the number of users with administrative rights.
2. Keep a minimum number of open ports on the Web server.
3. Remove any unneeded programs that load automatically when setting up the server, they may provide a hacker with the access desired.

Other essential elements of Web site security are firewalls and protection against worms and viruses. Fire walls protect the web Site's servers against hackers and the latest version of anti-viruses protects data files from being corrupted by worms or viruses.

## Website Privacy

In the B2C models, companies collect information about visiting clients such as user preferences, shopping cart contents to use it later in marketing purposes or in running promotions. An e-commerce Web site should keep products placed in a shopping cart by customers otherwise they will be deleted when these customers log out. E-commerce Web sites use cookies to identify users and prepare customized Web pages for them. A cookie is a piece of information that a website server sends to a user's browser when he accesses that site. They can be placed on a user's machine to collect information about this user without changing any configurations of the user's computer. When your browser receives the information it saves it on your hard-disk unless your browser doesn't support cookies. Each time you access this web site using this computer, the information that was previously received is sent back to the website server by your browser. Most commonly used Web browsers support the use of cookies. Cookies indicate to a website that a customer had been previously there and tell what parts of the website a customer had visited. It also records customer's habits and what he is interested in. This information can be used to tailor advertisements that suit customer's interests. Cookies can be prevented by allowing the computer to delete them when a browser starts up or a browser must notify the user or take permission whenever a cookie is to be written to the computer's hard disk. Software products that can reject or manage cookies such as Cookie Crusher, Cookie Cruncher or Cookie Pal are now available.

## Website Authentication

Authentication is the process of verifying the identity of the user as a pre-requisite to allowing him to accesses system's resources. With the growing number of online customers e-commerce authentication becomes more and more important issue in e-commerce security. All e-commerce systems should apply an authentication methodology to allow user's access to sensitive data and preventing malicious access. Passwords are the most common methods to identify an e-commerce Web site visitor. A visitor is able to log into the Website as long as he supplied the correct password. The major drawback of using this method is that a password may be compromised by someone. Passwords should not be shared by others or written down where others may find them. They should not be sent over networks without being encrypted because they can be easily compromised if they are intercepted.

Non-repudiation is an important issue in e-commerce where a user should not be able to repudiate having signed a contract or sent the message. By using a digital signature a signer cannot claim that he did not sign a message. Some schemes of non-repudiation use time stamps with the digital signature.

## Website Personalization

Websites personalize services to their customers according to their preferences, needs, interests, tastes and wishes and organizes them to be in easy reach. This brings the vendor and end customer closer than ever before and improves access to relevant products. A vendor can now personalize product message for individual customers on massive scale (Mobasher, 2004). User's information is extracted form his profile provided when the user logged into the Website. The Website retrieval system can use this information to pursue one or more of the goals posed by the user. The information provided by the user is a list of attribute-value pairs where each attribute is assigned a proper value depending upon each user. Attributes can be divided into (Abbattista et al., 2002):

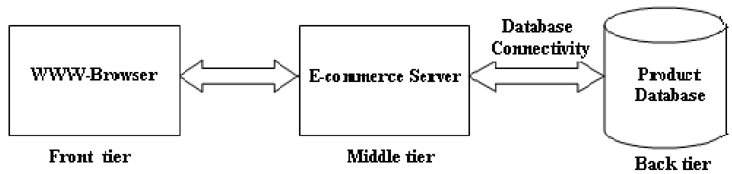
1. Explicit where values are given by the user.
2. Existing where values can be collected from existing applications, such as register systems (e.g., ADDRESS, JOB).
3. Implicit where values are collected from the user behavior and history of his navigation.

Personalization builds credibility especially when it traces user's behavior and selects new stories according to customer's preferences. Ads can be personalized where a Web site gains credibility when ads match the topic a customer is reading about (Fogg, 2003).

## Website Maintenance

Maintenance solutions prevent Website problems such as broken links or navigational disconnects. Maintenance includes operational tasks such as installing the latest software patches, the latest anti-virus software, performing frequent backups, de-fragmenting the storage and system upgrading to keep system performance at optimum and improve its scalability to cope with business growth (Turban, 2004; Awad, 2003). Regular backups may be impractical for e-commerce Web sites as it is must be always remain available so a cold backup where a Web site server is totally shutdown is not practical. A hot backup is used where a selected part of the database which contains dynamic data is shutdown for backup. Incremental backup for the information that changed since the last backup is suitable for e-commerce Web sites. It does not

*Figure 1. Three tier architecture for e-commerce web site*




take much time to complete and allow for long time between full backups (Hoffer et al., 2007). Differential backup is a cumulative backup of all changes made since the last full backup. It is useful for Web sites in their fast recovery from failures as it requires only a full backup and the latest differential backup to restore the site. The disadvantage is that as more days elapsed since the last full backup more data needs to be backed up, especially if a significant proportion of the data has been changed. The more frequent the backups are the faster the Web site recovers when a failure occurs. So, it is important to maintain a good policy for backups.

## Website Architecture

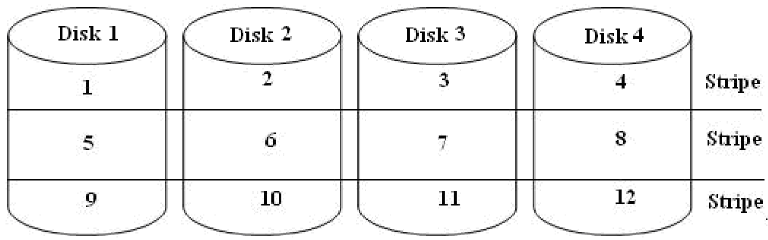
E-commerce Web sites using multi-tier architecture are flexible, scalable, and responsive to the expectations of clients. This is because the functionality of the application is divided into logical components that are associated with a tier. Each component is a service that is built and maintained independently of other services. Services communicate with each other using protocol that enables a service to receive and send information from and to other services (The Complete Reference, 2002). Figure 1 shows an example of multi-tier architecture e-commerce Web site. The requirements for high availability which include:

1. A high mean time between failures for all hardware components
2. Fast recovery from failures when they do occur
3. Good administrative tools and policies for system maintenance
4. Support for online administrative activities where possible

To fulfill the requirements of high availability and high performance hardware and software components must be assembled in redundancy whenever possible. Redundant equipment at every level of the multi-tier architecture provides a Web site some degree from failure and scalable processing to handle traffic surges. As an example redundancy of database servers enables one server to take over requests for another server in case of failure. Also, if an application server fails, the load balancers can direct requests to other servers. Clustering software manages an automated failover to clustered equipment when necessary.

Allowing fast recovery from logical errors such as database corruptions is an important aspect of maintaining high availability for e-commerce web sites. The most frequently techniques that are used are disk mirroring and stripping techniques. To be able to switch to an existing copy of the database it must be mirrored, that means two copies of database are kept and simultaneously updated. Redundant Array of Independent Disks (RAID) system that implements mirroring is a technology employs the simultaneous use of two or more hard disks to achieve high levels of performance, availability, and larger data volume sizes. Critical data gains protection from disk failures if stored in RAID or mirrored configurations. A disk failure can be quickly recovered from the mirrored disk with no interruption in service to the user.

*Figure 2. Data stripped on four disks as adapted from Hoffer et al., 2007*




Another technique that can be used with RAID is stripping. Stripping is a way of "slicing" data and storing it across multiple devices to improve access performance by distributing I/O among many devices. Figure 2 shows data stripped on four hard disks (Hoffer et al., 2007)

## FUTURE RESEARCH DIRECTIONS

There are an increasing number of legitimate Web sites being attacked throughout 2008 by being compromised or used as a host to deliver malware to their unsuspecting visitors. There are many Web threats trends such as (Symantec, 2009):

1) Viral attacks are dynamically changing making traditional antivirus solutions ineffective.
2) Attacks targeting browser plug-ins instead of only the browser itself.
3) Increasing number of users being infected by misleading applications.
4) Using SQL injection to infect the main stream Web sites.
5) Spam and spyware threats.

It is a vicious cycle after every security risk solution a new security hole is discovered. This makes the need for more intelligent security solutions are critical.

In Website authentication using regular passwords is a weak protection mechanism which means that a strong need for more effective password mechanisms is required. Two factors authentication require two types of identification to access a Website online. A combination of something you know such as passwords and something you have such as fingerprints, iris and face is some sort of two factor authentication. Also using dynamic authentication may be a useful addition as a part of a wider, integrated suite of authentication services. GLS token device displays a unique 6 digit number that changes every 60 seconds called a token code provides a more secure way of accessing government online services. To logon a user must provide his username, password and token code (E-government, 2007).

Although cryptography industry developed enhanced algorithms to enhance privacy and protect personal data developments in research, design and technology around security are still needed to reduce risks of privacy violation.

## CONCLUSION

In this chapter we discussed the main classes of e-commerce business models and their advantages and disadvantages. We discussed the problems and issues facing e-commerce Web sites such as security, authentication, privacy, performance and availability and their possible solutions. Finally, we introduced some of the future research trends in Web site security and authentication.

## REFERENCES

Abbattista, F., Degemmis, M., Fanizzi, N., Licchelli, O., Lops, P., Semeraro, G., & Zambetta, F. (2002). Learning User Profiles for Content-Based Filtering in e-Commerce. *In Atti del Workshop AI*IA su Apprendimento Automatico: Metodi e Applicazioni*, Siena, Settembre 6-11, 2002.

Aladwani, A. M., & Palvia, P. C. (2002). Developing and validating an instrument for measuring user-perceived web quality. *Information & Management*, *39*(6), 467–476. doi:10.1016/S0378-7206(01)00113-6

Amit, R., & Zott, C. (2000). Value Drivers of E-commerce Business models. In *The Wharton Conference on Winners and Losers in the E-Commerce Shakeout*, October 20, 2000.

Awad, E. M. (2003). *Electronic Commerce: from vision to fulfillment*. Upper Saddle River, NJ: Prentice Hall.

E-government. (2007). *Online Authentication Trends 2007*. Retrieved on March 17, 2009, from http://www.e.govt.nz/services/authentication/library/docs/authtrends-2007

Fogg, B. J. (2003). *Persuasive Technology: Using Computers to Change What We Think and Do.* San Francisco: Morgan Kaufmann.

Hoffer, J. A., Prescott, M. B., & McFadden, F. R. (2007). *Modern Database Management* (8th Ed.). Upper Saddle River, NJ: Prentice Hall.

Kambil, A., Ari Ginsberg, A., & Bloch, M. (1998). *Reinventing Value Propositions* [Working Paper]. NYU Center for Research on Information Systems. Knowledge@Wharton. (n.d.). *Creating Value through E-Commerce Business Models*. Retrieved December 25, 2008, from http://knowledge.wharton.upenn.edu/article.cfm?articleid=254

Long, M., & McMellon, C. (2004). Exploring the determinants of retail service quality on the internet. *Journal of Services Marketing*, *18*(1), 78–90. doi:10.1108/08876040410520726

Mobasher, B. (2004). *Web Usage Mining and Personalization*. Retrieved on February 5, 2009, from http://maya.cs.depaul.edu/~mobasher/papers/IC-Handbook-04.pdf

Nielsen, J., & Norman, D. A. (2000). *Web-site usability: usability on the web isn't a luxury*. Retrieved March 28, 2000, from http://www.informationweek.com/773/web.htm

Ranganathan, C., & Ganapathy, S. (2002). Key dimensions of business-to-consumer web sites. *Information & Management*, *39*(6), 457–465. doi:10.1016/S0378-7206(01)00112-4

Symantec. (2009). *Internet Security Threats Report.* Retrieved on March 15, 2009, from http://www.symantec.com

Tarafdar, M., & Zhang, J. (2007). Determinants of reach and loyalty–a study of website performance and implications for website design. *Journal of Computer Information Systems*, *48*(2), 16–24.

The Complete Reference. (2002). *J2EE Multi-tier Architecture*. Retrieved on January 14, 2009, from http://searchwebservices.techtarget.com/searchWebServices/downloads/J2EE_TCRCH02.pdf

Turban, E., King, D., Lee, J., & Viehland, D. (2004). *Electronic Commerce: A Managerial Perspective*. Upper Saddle River, NJ: Pearson Prentice Hall.

VeriSign. (2008). *Secure Sockets Layer (SSL). How It Works*. Retrieved January 24, 2009, from http://www.verisign.com/ssl/ssl-information-center/how-ssl-security-works

Yang, Z., Peterson, R., & Cai, S. (2003). Service quality dimensions of internet purchasing: an exploratory analysis. *Journal of Services Marketing*, *17*(7), 685–698. doi:10.1108/08876040310501241

Zona Research. (1999). *Zona research's online shopping report*. Retrieved April 4, 2000 from http://www.zonaresearch.com/info/press/preleases99.htm

## KEY TERMS AND DEFINITIONS

**E-Commerce:** it is the process of buying and selling products or services over the Internet.

**Multi-Tier Architecture:** is the architecture of an application that has at least three layers separated from each other. Each layer interacts with only the layer directly above or below it, and has specific functions to do.

**Website Authentication:** it is any process by which a Website verifies that someone is who he claims he is.

**Website Maintenance:** it is the process of updating the elements of a Website.

**Website Personalization:** it is a process with which an online user customizes a Website to its preferences, wishes and interests.

**Website Privacy:** it is the process with which a Website protects its information from being disclosed to unauthorized online users.

**Website Security:** it is an application that restricts access to certain areas within the user's website.

# Chapter 35
# E-Commerce Business Models: Part 2

**Khaled Ahmed Nagaty**
*The British University in Egypt*

## ABSTARCT

*In this article the author explained some of the common artificial intelligence techniques used in e-commerce web sites and how these techniques are implemented in auctions, intermediaries and e-marketplaces to increase customer's satisfaction, minimize the look up time, reduce costs and improve the usability of e-commerce Web sites so that visitors can quickly access the required information or perform required transactions without being overwhelmed or confused with the large amount of data.*

## INTRODUCTION

E-commerce business models are using computing and communication technologies to make transactions between a business and its customers online. As the number of clients on the Internet grows rapidly the computation also grows and efficient techniques are required to respond to client's requests within a short time. Artificial Intelligence (AI) is used to learn human behaviors and imitate human intelligence. AI is now playing an important role in e-commerce. In B2C models there are a large numbers of buyers and sellers where buyers specify their preferences and sellers specify their products and selling prices. The major role of AI techniques in B2C e-commerce is to come up with the best match between a buyer and seller. Examples of e-commerce systems in B2C that are using AI techniques are product selection and recommendation, negotiation and auction systems. In B2B e-commerce the major role of AI techniques is supply chain management. They help clients taking the right decisions (Kwok, 2000).

## BACKGROUND

In B2C e-commerce business models important AI techniques are:

DOI: 10.4018/978-1-61520-611-7.ch035

1. Intelligent agents: they are personalized software, member of the bot family and use machine-learning algorithms to accommodate user's preferences without extensive rewriting of code and rules. Intelligent agents can be used in information gathering, prediction purposes, searching e-marketplaces on behalf of their owners enabling one-stop shopping on the web, reducing shopping costs, give the customer the opportunity to set his preferences, choose what to buy and from whom to buy, they also help a customer to enter negotiations and participate in auctions. According to (Nwana, 1996), the most important characteristics of intelligent agents are:
   - Autonomy: means that agents process their work independently and proactively without any intervention from their owners.
   - Cooperation: means that agents are able to communicate with one another, negotiating on certain issues.
   - Learning: means that agents are able to learn as they react or interact with their environment and other agents.

Sellers use intelligent agents to track demand and market share changes, engage in competitive knowledge mining, negotiate and even learn through collaboration from buyer agents. Buyers may need decision agents to comparison shop, while sellers may need a broker, provider, and merchant agent to sell a product (Sinmao, 1999).

2. CBR technique (Prasad, 1995): CBR plays an important role in e-commerce applications for product recommendations by using context-sensitive information related to E-commerce as cases in CBR to help users take the right decision quickly (Kumar et al., 2005). CBR works as follows: Step-1: Take customer preferences. Customers preferences may vague or rate their preferences ranging from 'must have' to 'not important'. Step-2: Retrieve products with similar offers from case base and submit them to the customer. Step-3 Customer may accept a similar offer or quit the process if he is no longer interested. Step-4: Customer may modify his preferences and go to step 2. A widely used formula for CBR in identifying similar products is based on the similarity or disparity measure between two products. It uses the nearest neighbor retrieval approach based on the weighted Euclidean distance (Wettschereck and Aha, 1995). A most recent CBR-based system for recommending utilities in sports domain is presented in (Prasad and Clementi 2002). Figure 1 shows a CBR e-commerce system.
3. ACF technique (Hayes et al, 2001): is an Automated Collaborative Filtering that is similar to Case Base Reasoning (CBR). While the CBR produces a solution the ACF produces recommended components for the target user profile. It is defined as 'a method of making automatic predictions (filtering) about the interests of a user by collecting taste information from many users (collaboration)." (Encyclopedia.thefreedictionary.com 2004). In ACF based recommender web sites, each ACF customer profile contains records about the historical customer's consumptions of items with either explicit or implicit ratings. An ACF case is an incomplete one – it is essentially one row in the user–item matrix and will usually be quite sparsely populated. The goal of ACF is case completion which is an incremental enhancement of the user profile based on feedback given by the user. The system uses the information it has to retrieve similar user profiles and extract completion information for the case profile which is then offered to the user. ACF has a recommendation cycle with indefinite iterations of recommendation processes where items recommended for inclusion in the user

profile are determined by the user feedback to date. The recommendation cycle includes three phases: the *retrieve* phase where similar profiles are retrieved, the *reuse* phase and the *revise* phase.

4. GBR approach (Burke 2000): is a goal-based reasoning approach used to find products similar to those already known to the user. There are always some standard goals for each product domain, where a similarity metric between two products is measured regarding these goals. Different users might have different rankings of goals or different goals altogether. For each goal, a similarity metric between each pair of products defines how close the two products with respect to that goal. . Interaction between goals should be looked at and combination of metrics is used to achieve ranking of products.
5. Content-Based techniques (Abbattista, et al., 2002): these techniques make use of textual annotations usually describing the products offered by e-commerce Websites. The recommender system uses the qualitative value of the products information to generate the list of products. By using the users' feedback the system can adapt automatically and its performance is enhanced comprehensively (Weihong and Yi, 2006). In content-based systems only the data of the current user are exploited in building a recommendation. It requires a description of user interests that is either matched in the items' catalog or provided as input for the learned user model to output a recommendation.
6. Hybrid technique: This is a combination of ACF and KB techniques. Knowledge base is considered a complementary to the above techniques where a knowledge base on customers is used to reason about customer's preferences.

Supply Chain Management (SCM) is the key factor for successful B2B e-commerce. The rise of e-commerce has further heightened the importance of SCM as companies reengineer processes as they are moved online (Fenstermacher and Zeng, 1999). A number of AI-based SCM problem solving approaches are available. Most of them are agent-based where each agent is responsible for one or more activities of the SCM (Prasad, 2003).

## INTELLIGENT E- COMMERCE WEBSITES

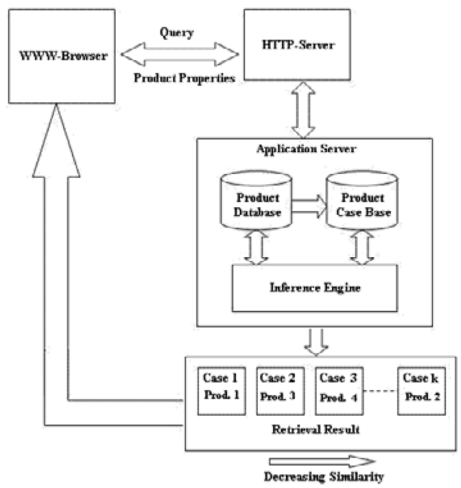
### Issues, Controversies, Problems

One of the major problems on the Internet is lack of advising where no human advisors are available to advice customers online to identify what products better fit their preferences. Some researchers argue that using AI in e-commerce would result in a market being overtaken by machines. Also, there is a belief that decisions taken by human intelligence is much better than decisions taken by artificial intelligence techniques. However, some researches argue that artificial intelligence could be helpful to guide people in taking their right decisions but not replacing the human intelligence.

### Solutions and Recommendations

The major advantage of using artificial intelligent techniques in e-commerce business models is advising the customers on the items they want to buy through the Internet. Advising on the internet is important because there are no real persons to advice customers on the internet. This advice helps online customers to browse a large number of products (Prasad, 2003).

*Figure 1. A CBR e-commerce system*




## B2C E-Commerce Systems

### E-Auctions

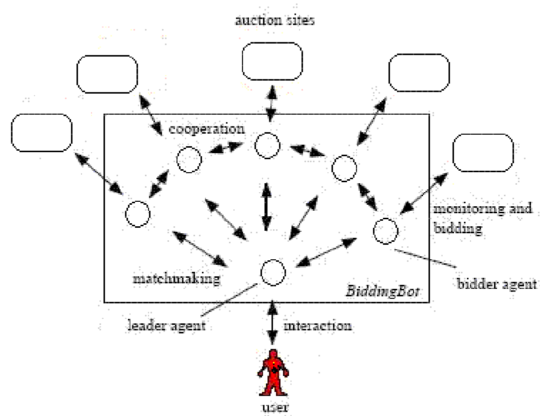
It is difficult for online customers to attend, monitor and bid at the multiple auction sites simultaneously. Intelligent agents support users in attending, monitoring and bidding in multiple auctions on behalf of their users. *BiddingBot* is a multi-agent system that monitors prices in multiple e-auction sites to get the better prices for goods. Figure 2, shows architecture of the multi-agent e-auctions. The system consists of two major types of agents, namely, the bidder agents which gather prices of the required products based on the user input keywords describing the product. The bidder agents cooperatively bid to the several e-auction sites based on the user's valuation and decision about the price of the item. The leader agents inform the user whether the product can be awarded or not (Ito et al. 2000). The common example of e- auction is *eBay's Auction Web* English auction [http://pages. ebay.com]. The seller input a description of the product he wants to sell with some preferences such as the payment method, where to ship and who pays for it and the minimum price a seller will accept for this item. Then, the seller initializes an agent to negotiate the price with his preferences. The *eBay's Auction Web's* English auction provides a bidder "phantom" bidding service, called proxy bidding, which is equivalent to initialize a buying agent where the bidder input the value of the maximum bid with his preference of the price should be not higher than the maximum bid. *FishMarket Auction House* is Dutch auction where the price is the main issue of negotiation. *Eauction House* is combinatorial auction where the prices of combination of items are negotiable.

The University of Michigan developed a general purpose e-auction called the AuctionBot where users create new auctions to buy or sell products. The users can select an auction type and specify its parameters such as clearing times, method for resolving bidding ties, the number of sellers permitted, etc. The AuctionBot also provides an application programmable interface (API) for users to create their own software agents to autonomously compete as buyers or sellers in the AuctionBot marketplace.

### Intermediaries

Intelligent intermediaries are standing between the parties of contract usually buyers (clients) and sellers (servers) and perform functions necessary to fulfill a contract. "These new intermediation services assist buyers and sellers in searching for relevant information and in matching customers with suppliers." (Meck, 2004). Intelligent intermediaries encapsulate knowledge on specific subjects, information sources, and interfaces to help users seeking information on a particular subject. E-commerce models are intended to perform the services of the human intermediaries especially in areas where human expertise is expensive. E-commerce intermediaries are often classified into four categories namely, brokers, auctioneers, dealers and exchanges. Intelligent agents can help to overcome the knowledge gap between online

*Figure 2. Multi agent e-auction as adapted from ww.cs.cmu.edu/~softagents/papers/itota-icmas00-poster.pdf*

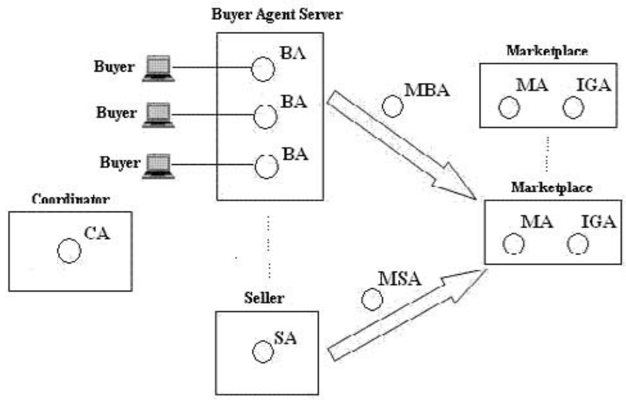



buyers and sellers and make recommendations based on the stored experience. Buying agents collect information on vendors and products that may fit the needs of their owners, evaluate the different offerings, negotiate about the terms of transaction, make decisions, place orders and finally decide a payment method. Selling agents can adapt the offerings of broker agents according to the requirements of each customer. Selling agents are proactive they go to e-market places to contact buying agents and negotiate with them trying to sell their products. An example of intelligent intermediaries is the intelligent brokers which can select, configure, and adapt problem solving methods for a test case. The intelligent brokers receive many requests from various customers and use them to access different libraries searching for the best problem solving method which are adapted and configured into a knowledge system for the customer. Intelligent intermediaries facilitate the activities of buying and selling agents. They have the ability of matchmaking where they can put customers seeking products with special specifications into contact with providers whose products match these specifications. Intelligent intermediaries should be autonomous, proactive, responsive and adaptive so they can perform the tasks of finding, classifying, organizing and adapting information on behalf of humans which can resolve the problem of information overload on the Internet (Sun and Finnie, 2004).

## E-Marketplaces

They are an online market, usually B2B, in which potential buyers and sellers exchange information about goods or services. After reaching an agreement physical goods and services can be delivered to the customer later on. E-market places can operate according to different e-business models including catalog-based e-sales and e-procurement, auctions and reverse auctions, and exchanges. Intelligent mobile agents enable mobile access and automated trading in commercial e-marketplaces based on integration of mobile agents and intelligent decision making agents [Ryszard Kowalczyk, Bogdan Franczyk, Andreas Speck, 2002]. Searching a large number of products available on e-marketplaces buyers can benefit from choosing the best products with the least prices and sellers can promptly serve the buyers in an efficient manner (Susanne Klaue, Karl Kurbel, Iouri Loutchko, 25-26 June 2001). We have to mention that agents working on e-

*Figure 3. Architecture of e-marketplaces as adapted from Wang et al. (2002)*




marketplaces are usually autonomous and their capabilities to cooperate differ from e-marketplace to e-marketplace (Nwana, 1996). Wang et al, (2002) proposed architecture for e-market places. There are four types of server in the proposed architecture which are:

1) Coordinator Server,
2) Marketplace,
3) Buyer Agent Server,
4) Seller Server.

Each server includes several agents and mobile agents. Figure 3 shows the architecture of e-marketplaces. They are described as follows:

1. Coordinator Server: contains a static agent called the Coordinator Agent that monitors and manages Marketplaces, Buyer Agent Servers and Seller Agents. It provides the functions of register and authentic query and cooperates with other CA.
2. Marketplace: is a platform that supports the transaction facilities for mobile agent of sellers and buyers. There are two kinds of static Agents and two kinds of Mobile Agent in the Marketplace:
   ◦ Management Agent (MA): MA is a static Agent in the Marketplace. It has two abilities: 1) manages the registration of Mobile Agents when they enter into this Marketplace, 2) manages the activities of agents in this Marketplace.
   ◦ Information Gathering Agent (IGA): IGA is a static agent in the Marketplace to gather the related information which includes the records of transaction, the information of the productions, requirements of customers…etc.
   ◦ Mobile Buyer Agent (MBA)**:** MBA stands for the buyer, moves from one Marketplace to another marketplace and trades with Mobile Seller Agent.
   ◦ Mobile Seller Agent (MSA): MSA stands for the seller, moves from one Marketplace to another and trades with MBA.
3. Buyer Agent Server: The Buyer Agent Sever provides the web interface which helps user to control agent to carry the e-commerce activation. The Buyer Agent Server is managed by the Buyer Server Management Agent (BSMA). The BSMA will produce Buyer Agent (BA) for each user to serve its user. BA will produce Mobile Buyer Agent (MBA) according to the requirements of the

user to go to every marketplace and make bargains.

4. Seller Server: Any company which wants to join an *e*-marketplace should build a Seller Server. There are two main Agents in a Seller Server, include:
   - Seller Agent (SA): SA which has two main abilities:
     1) Manages Seller Server,
     2) Creates mobile seller agents and dispatches them to Marketplaces for selling productions.
   - Mobile Seller Agent (MSA): MBA moves from one Marketplace to another and executes missions that are assigned by SA.

## Recommender Systems

Recommender systems help customers on the Internet to select products suitable to their needs. These systems learn about customers buying patterns and build a preferences model learned from these patterns and automatically recommend products that fit the customer's preferences and improve the look to buy ratio. A number of research projects have focused on recommender systems (Resnick & Varian,1997 ; Sarwar et al., 2000). Collaborative filtering is a common recommendation technique that aggregates data about a customer's behavior then filters the gathered data and patterns using techniques that involve collaboration with multiple agents and data sources to use it to recommend products. The main assumption of collaborative filtering is that what agreed on in the past could be agreed on in the future. A good example for Web sites using this technique is Amazon.com. Another approach used by recommender systems is content-based filtering. Recommender systems using this approach use current and past preferences of a specific user to make future predictions. These systems have to learn interests of users which require a large number of examples this makes them vulnerable for poor recommendations. A third approach is the knowledge-based approach where knowledge about customers and description of the items that will be suggested is used to predict products. A similarity matching between the description of an input product and stored products in the database will retrieve a sorted list with highly recommended products are on top. In the CBR approach for recommender systems the knowledge is mainly stored in a case base. A case stores information about the recommended products, information about the user and the time of recommendation.

## E-Negotiation

E-negotiation is an important part of e-commerce where all parties involved in the negotiation process are software agents.

## B2B E-Commerce Systems

## E-Procurement

E-procurement is the most important area of development in B2B systems. It exploits the Internet and agent technologies to perform procurement-related processes such as buy and sell goods and services and eventually it will restructure the way in which an organization will purchase its goods. In e-procurement negotiating agents play important roles in the transaction between two or more business enterprises. So, intelligent agents should have negotiating capabilities which requires knowledge of underlying business logics. Besides raw data and abstracted information, the knowledge of an agent provides business intelligence, which in turn promotes smart business. (Sarkar and Kundu, 2007). In the agent based approach for multi-market e-procurement the coordination agents and service agents are the fundamental agents (Ben-Ameur, et al., 2005):

- Coordinator agents

A coordinator agent is responsible for extracting a global goal of the company's request for buying products or services. The global goal is divided into sub-goals each corresponding to the task of obtaining an item of the required products or services. The agent should arrange the sub-goals in a structured manner preferably in a graph, taking into account the dependencies and relationships between these items.

The coordination agent generates a plan to execute the requests of the sub-goals considering those to be published in parallel and those to be published sequentially. After generating this plan the coordinator agent publishes the structured sub-goals graph in a shared space and activates the first sub-goal. It attached to the sub-goals graph and waits for responses published by service agents. The coordinator agent has an evaluator module which uses an optimization function based on user's needs and preferences placed in the requisitioning phase to evaluate services agents' responses to sub-goals and aggregating them into a global response to the user's request. The coordinator agent then either activates new goals, deactivate previous ones or relax constraints on them.

- Service agents

Service agents have the necessary knowledge, awareness of external sources and protocols required to communicate, interact with external markets, capabilities to determine which requests to serve, request information, starting negotiations and concluding transactions and publishing their responses or results in the shared space.

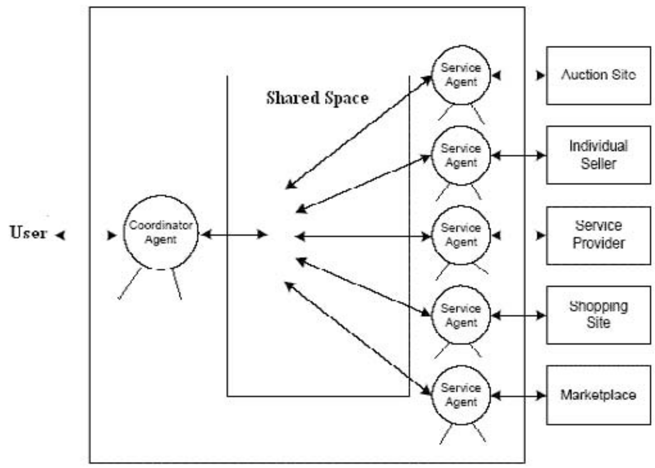
Figure 4 shows an e-procurement system with its coordinator and service agents sharing a space.

An intelligent aggregation approach for automatically aggregating demands can reduce procurement costs in enterprise e-procurement (Wang and Miller, 2005).

## FUTURE RESEARCH DIRECTIONS

1. 3D Virtual shopping: this technology replicates the real shopping experience which will give online stores the look and feel of their real world counterparts. An online customer can go right down to aisles, taking the lift and choosing floor number just in a real store. With product placement and displays mimicking physical stores customers can browse the merchandise and find what they want and make purchases online. Customers unfamiliar with the physical store can be trained for their visit, and won't feel lost when they walk through the door.
2. Swarm technology: swarm buying is a group buying online which aims to bring buyers and sellers together similar to bulk buying clubs. A user can start or join a swarm the swarm then grows. The larger the swarm the larger the benefits and the more attractive to sellers. Swarms can focus on a product, sellers then bid to supply the swarm and the prices fall. Swarm buying is predicted to be the global e-commerce revolution.
3. Social shopping: where consumers shop in a social networking environment where users benefit from crowd and exchange views and ideas about products, prices and deals. An example of social networks is MySpace which is overtaken internationally by its main competitor the Facebook.
4. Mobile payment systems: this technology helps micro-retailers to participate in online economy which will flourish the global economy.

*Figure 4. Intelligent e-procurement system as adapted from Ben-Ameur et al., 2005*




## CONCLUSION

In this chapter we showed how artificial intelligence plays an important role to advice customers on the Internet. We discussed some important AI techniques that are used in B2C and B2B e-commerce applications. We also discussed the most common B2C and B2B e-commerce applications that implement the CBR and intelligent agent techniques. In B2C we discussed auctions, intermediaries, e-marketplaces and in B2B we discussed the e-procurement application. Finally we introduced some of the future trends in e-commerce which are mainly the 3D virtual shopping and swarm buying.

## REFERENCES

Abbattista, F., Degemmis, M., Fanizzi, N., Licchelli, O., Lops, P., Semeraro, G., & Zambetta, F. (2002). Learning User Profiles for Content-Based Filtering in e-Commerce. *In Atti del Workshop AI*IA su Apprendimento Automatico: Metodi e Applicazioni*, Siena, Settembre, 2002.

Burke, R. (2000). Knowledge-Based Recommender Systems. *Encyclopedia of Library and Information Science*.

Fenstermacher, K. D., & Zeng, D. (1999). Know Your Supply Chain, *In Proceedings of the AAAI-00 Workshop on Knowledge-Based Electronic Markets, USA*.

Hayes, C., Cunningham, P., & Smyth, B. (2001). A Case-based Reasoning View of Automated Collaborative. In *Proceedings of 4th International Conference on Case-Based Reasoning, ICCBR2001*.

Klaue, S., Kurbel, K., & Loutchko, I. (June 25-26, 2001). Automated Negotiation on Agent-Based e-Marketplaces: An Overview. *In 14th Bled Electronic Commerce Conference*, Bled, Slovenia.

Kowalczyk, R., Franczyk, B., & Speck, A. (2002). InterMarket – Towards Intelligent Mobile Agent e-Marketplaces. *In Proceedings of the Ninth Annual IEEE International Conference and Workshop on the Engineering of Computer-Based Systems (ECBS.02)*.

Kumar, P., Gopalan, S., & Sridhar, V. (2005). Context enabled Multi-CBR based Recommendation Engine for E-commerce. *In Proceedings of the 2005 IEEE International Conference on e-Business Engineering (ICEBE'05)*.

Nwana, H. (1996). Software agents: An overview. *The Knowledge Engineering Review*, *11*, 205–244. doi:10.1017/S026988890000789X

Prasad, B. (1995). Planning With Case-Based Structures. *In D. Aha and A. Ram (Eds.). In Proceedings of the American Association for Artificial Intelligence (AAAI) Fall Symposium on Adaptation of Knowledge For Reuse*. Cambridge, MA:MIT, USA

Prasad, B. (2003). Intelligent Techniques for E-commerce. *Journal of Electronic Commerce Research*, *4*(2), 65–71.

Prasad, B., & Clementi, J. P. (2002). A Knowledge-Based E-Commerce System for Product Recommendation in Sports Domain. *In Proceedings of the International Conference on Information and Knowledge Engineering*, Las Vegas, USA.

Resnick, P., & Varian, H. R. (1997). Recommender systems. *Communications of the ACM*, *40*(3), 56–58. doi:10.1145/245108.245121

Sarkar, B. B., & Kundu, P. (December 13-15, 2007). Intelligent Negotiating Agent in Steel Procurement Process. *In International Conference on Computational Intelligence and Multimedia Applications* (Vol. 2, pp. 93 - 97)

Sarwar, B. M., Karypis, G., Konstan, J. A., & Riedl, J. (2000). Analysis of recommendation algorithms for e-commerce. *In ACM Conference on Electronic Commerce,* (pp.158–167).

Sinmao, M. V. (1999). *Intelligent Agents & E-Commerce*. Retrieved on January 27, 2009, from http://www.cis.udel.edu/~wchen/Sinmaom.htm

Sun, A., & Finnie, G. R. (2004). *Intelligent Techniques in E-Commerce: A Case Based Reasoning Perspective*. New York: Springer

Wang, G., & Miller, S. (2005). Intelligent Aggregation of Purchase Orders in E-procurement. *In Proceedings of the 2005 Ninth IEEE International EDOC Enterprise Computing Conference (EDOC'05)*. Ben-Ameur, H., Vaucher, S., Gérin-Lajoie, R. Kropf, P., & Chaib-draa, R. (2005). Towards an Agent-Based Approach for Multimarket package e-Procurement. *In International Conference on Electronic Commerce Research (ICECR-5)*

Wang, Y.-H., Wang, W.-N., Wang, C.-A., & Cheng, A.-C. (2002). An Agent Based e-marketplace over e-business. *In Proceedings of the First International Symposium on Cyber Worlds (CW.02)*

Weihong, H., & Yi, C. (2006). An E-commerce recommender system based on content-based filtering. *Wuhan University Journal of Natural Sciences,11*(5).

Wettschereck, D., & Aha, D. W. (1995). Weighting Features. *In Proceedings of the First International Conference on Case-Based Reasoning*. New York: Springer.

## KEY TERMS AND DEFINITIONS

**Automated Collaborative Filtering:** is a technique for providing recommendations and based on statistical matches of peoples' tastes.

**Case Base Reasoning:** is the process of solving new problems based on the solutions of similar past problems.

**E-Auctions:** is an electronic process where buyers use internet-based software to bid against each other online for the goods to be sold.

**E-Market Places:** is an electronic exchange where sellers and buyers communicate to conduct business over the Internet.

**E-Procurement:** is a process that is useful in streamlining an organization's purchases in a timely fashion with the best price.

**Intermediary:** can be a person or organization that facilitates a contract or services between two other parties

**Mobile Agent:** is software that characterizes with autonomy, learning and mobility.

# Chapter 36
# Creating Business Opportunities Based on Use of Electronic Knowledge Business Models

**Tsung-Yi Chen**
*Nanhua University, Taiwan*

**Yuh-Min Chen**
*National Cheng Kung University, Taiwan*

## INTRODUCTION

The advent of the innovation economy has transformed knowledge into the most valuable corporate asset and a key driver of product and service innovation. Therefore, the determinants of enterprise success have shifted from external factors, such as market and competitive factors, to internal factors, such as dynamic innovation capability, based on enterprise core competences and knowledge. Knowledge-based enterprises can convert intellectual assets (IA) into currency via commercial methods such as sales, licensing, joint ventures, strategic alliances, mergers, new business entities and donations (Skyrme, 2001; Sullivan, 2000; Wang *et al*., 2009). Trading and sharing of knowledge with other enterprises can be more beneficial than using knowledge internally. Electronic commerce (e-commerce) supports on-line functions such as transmission, trading and making payments for products and services. Moreover, electronic commerce-based knowledge commerce (k-commerce) denotes real-time marketing and the delivery of existing organizational knowledge via the Internet to enable the legal and rapid transfer of knowledge from owners to consumers.

Given a strategy that exploits the potential of the Internet and knowledge commercialization, almost any enterprise can benefit from k-commerce. This investigation explores the knowledge value chain in the collaborative innovation era, introduces the k-commerce model, and analyzes possible revenue streams and opportunities associated with k-commerce. Additionally, this work examines related issues and infrastructure, including models, methods and technologies for practicing k-commerce.

DOI: 10.4018/978-1-61520-611-7.ch036

## BACKGROUND

Globalization alone cannot efficiently maintain global competitiveness, and enterprise competitive advantage and innovative growth can only be realized using new business models that are genuinely and appropriately open and able to support peer production, knowledge sharing, global mobile commerce and collaborative innovation. Enterprises must effectively utilize external knowledge and innovation resources together with internal and external creativity or a market-oriented approach to create value by accelerating new technology and knowledge development (Chesbrough, 2003). For example, applying knowledge trading or exchange among enterprises introduces creativity and new technologies to enterprises, and sharing internal knowledge with business partners can reduce innovation costs and expedite R&D on new knowledge and products. Successful knowledge-based enterprises require the ability to leverage internal and external enterprise intellectual capital and package it into high value-added, knowledge-based products and differentiated services able to swiftly and efficiently solve customer problems (Skyrme, 2001).

Enterprise IA may include knowledge, customer relations, human resources, social relationship network, innovation capabilities, business strategies, decision-making competences, operational network, organizational learning efficiency, team communication mechanism or brand image, all of which can assist with wealth creation. Knowledge-based assets possess the following characteristics (Dominique, 2004): 1) Non-physical, meaning they frequently lack a material format; 2) Uniqueness, meaning they have different values from other assets; 3) Concurrent usability, meaning multiple users can use them at any given time; and 4) Value uncertainty. Once the decision to commercialize certain knowledge assets has been made, the enterprise must be able to swiftly seal the licensing agreement and implement commercialization (Sullivan, 2000). Numerous real world cases demonstrate that knowledge used for external purposes often generates more benefits and business opportunities than that used internally. However, precautions are necessary when utilizing knowledge to generate benefits to avoid irreparable damages caused by extensive use of corporate knowledge assets. Despite this caveat, some enterprises unfortunately are still unaware of their own knowledge assets or marketability. When equipped with a strategy that combines Internet potential and knowledge commercialization, almost every enterprise can create revenues and opportunities via k-commerce.

The k-commerce environment remains flawed and frequently suffers the following problems: 1) users experience difficulty identifying required knowledge in the face of overwhelming volumes of information and knowledge; 2) methods or media via which knowledge producers and knowledge requesters can find one another are lacking; 3) methods for more accurately evaluating knowledge reliability are lacking; 4) trust between knowledge trading parties is extremely fragile, increasing trading risks and reducing trading motivation; 5) knowledge is constructed significantly differently from previously, with permission of extensive collaboration and unclear knowledge ownership, increasing the difficulty of knowledge trading; 6) low reproduction costs of digital knowledge create challenges in copyright protection; 7) difficulty in pricing knowledge based on knowledge product features, including originality, relevance, uniqueness and size; and 8) various methods of applying and citing knowledge complicate royalty fee calculation (Skyrme, 2001; Kafentzis *et al*., 2004; Harrison, 2007; Wang & Lin, 2008).

## VALUE CHAIN OF KNOWLEDGE IN THE COLLABORATIVE INNOVATIVE ERA

Among various methods that challenge traditional business models and are used to achieve a collaborative economy, Wiki has embraced the concept of allowing more people to engage in web-based collaborative creation, in turn helping to popularize information, broaden perspectives, stimulate creative thinking, and create good opportunities for acquiring new knowledge. The modern manufacturing environment has gradually evolved to comprise virtual teams (VTs) combining enterprises and individuals, each contributing to fulfill assigned tasks to achieve set objectives (Samarah *et al*., 2007; Chen *et al*., 2008; Voegtli, 1996).

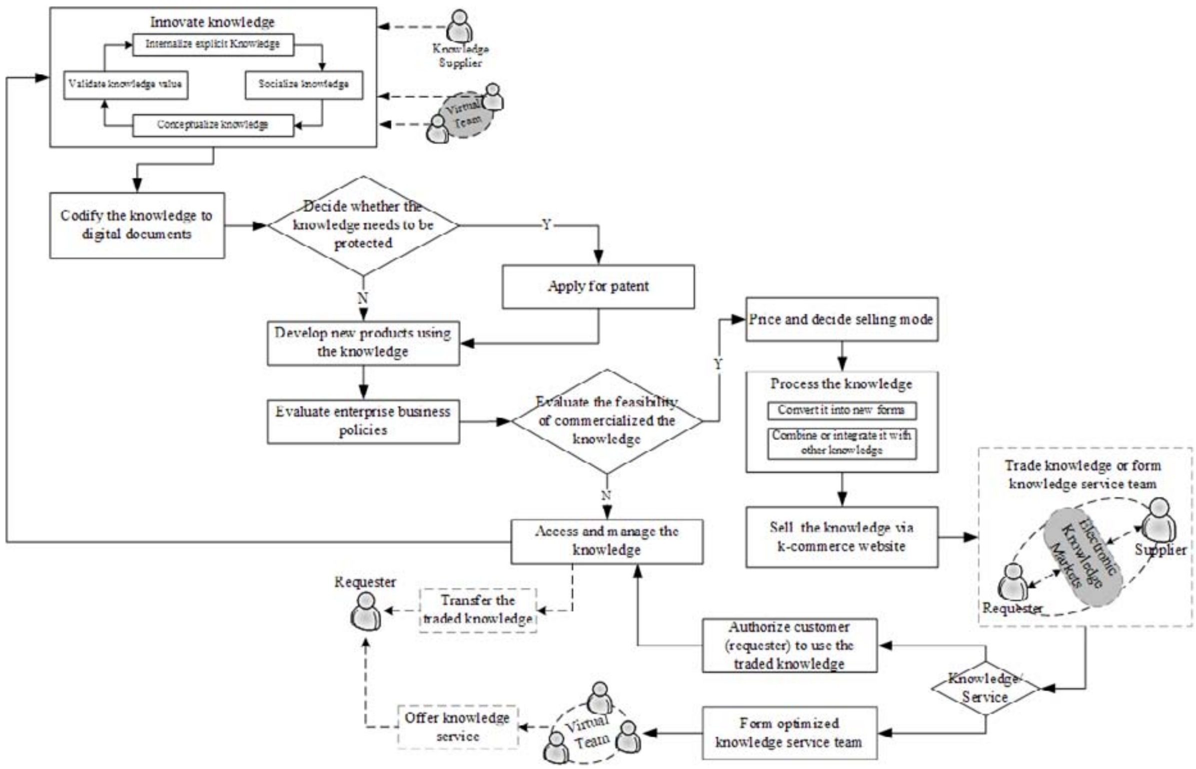
Knowledge construction describes how an organization performs knowledge creation, namely via the following four steps:

- Step 1: Internalize explicit knowledge into tacit knowledge as workers continuously learn by doing.
- Step 2: Undertake socialization, which enables organization members to share knowledge via communication, discussion, and dialogue, thus creating organizational knowledge.
- Step 3: Conceptualize organizational knowledge, which involves the externalization and conceptualization of organizational knowledge to facilitate learning by other members, followed by the materialization of organizational knowledge through encouraging experiments in materializing conceptual knowledge or transforming it into products.
- Step 4: Validate knowledge value and incorporate knowledge into the organizational knowledge database.

Historically, business innovation has been conducted in a closed manner within enterprises, where workers develop knowledge independently within an enterprise before commercialization into concrete products and services. However, more recently such closed innovation patterns have gradually been replaced by more open, collaborative modes, in which innovation activities are completed more rapidly via collaboration with the outside world. Furthermore, the need for collaboration modes increases with the degree to which the innovation concerned is globalized or technically advanced. Consequently, this study divides the knowledge construction modes it discusses into the following two types: 1) Independent mode: Knowledge created in association with a series of enterprise product manufacturing activities; and 2) Collaborative mode: Knowledge developed in co-R&D and co-manufacturing of products or parts that is owned by a VT with an operational life cycle that covers all product life cycle activities. Furthermore, almost all knowledge can be developed by VTs in the collaborative mode (Hlupic & Qureshi, 2003).

Figure 1 shows the complete notion of the k-commerce-based knowledge value chain in collaborative innovation. Generally, knowledge value is explored from two perspectives, namely, intrinsic knowledge value and value added through knowledge use (Skyrme, 2001). In k-commerce, the knowledge value chain comprises a series of knowledge-based activities spanning knowledge innovation to realizing knowledge value via Internet-based transactions. When an enterprise or VT creates an innovation involving a new product or knowledge, that innovation must first be codified and converted into written documents or other formats for storage in the enterprise or VT knowledge base. Knowledge owners, who can be individuals, enterprises, or VTs, must determine whether an innovation requires patent protection as necessary. Innovations are applied to production or products, and enterprises can subsequently assess the need for commercialization. Knowledge pricing and selling mode selection comprise the next step, during which commercialization is deemed favorable, and are followed by selling knowledge electronically to other knowledge requesters. Knowledge processing includes converting knowledge into new forms, and combining or integrating it with other knowledge. The processed knowledge is then sold via electronic

*Figure 1. Knowledge value chain in collaborative innovation*




knowledge markets that match supplier offerings of knowledge and services with requester requirements. Knowledge suppliers authorize knowledge requesters to use traded knowledge or form virtual knowledge service teams to provide customized service to requesters. Finally, knowledge is continually stored, managed and refined, packaged in suitable forms, and combined with other knowledge to add value through marketing and knowledge use.

## KNOWLEDGE BUSINESS MODEL

Business models are an approach to business operations that can help enterprises achieve profits (Turban *et al*., 2008). Business models involve a series of planned activities or business processes, focused on market profitability. Electronic commerce is a popular and growing electronic business model that enables the trading of physical products in various manners via the Internet, with buyers and sellers transacting directly online (Laudon & Traver, 2003; Turban *et al*., 2008). Information commerce enables the trading of information products such as software, commercial data and reports (Aberer & Wombacher, 2001; Kevin & Yukika, 2003; Wang & Lin, 2008). Information products are valuable intangible and non-physical goods, and examples include stock exchange prices, electronic books, train or movie schedules, images, audio or video files and software. Knowledge is one type of information product, and possesses the following distinguishing characteristics compared to physical products: 1) the creation, printing, storage, replication, distribution, search and proofreading of information products are performed under significantly different principles than for physical products; 2) production costs are high, but replication and distribution costs are low; 3) the value life cycle is short; 4) the value rapidly reduces over time; 5) validation and security issues are crucial to information products; and 6) knowledge products can be arbitrarily dissembled or assembled to offer variously sized knowledge products (Jazayeri & Podnar, 2001).

Knowledge business models refer to the use of organizational knowledge to transmit knowledge from creators to consumers by leveraging powerful marketing and transmission tools (Kafentzis *et al*., 2004). This investigation defines knowledge business models (also known as k-commerce) as a series of planned business processes that generate profits through trading and exchanging knowledge on the Internet, forming VTs for offering unique knowledge services to knowledge requesters, and refining existing knowledge or combining different knowledge types to devise new knowledge. When enterprise knowledge is transferred to other enterprises, various factors, including mindsets, languages and ontological concepts, may contribute to knowledge heterogeneity among knowledge users or within the system, thus creating new demands for the following competences: 1) evaluating knowledge content, potential users and knowledge value; 2) providing consistent access to knowledge under a distributed mode; and 3) seamlessly integrating heterogeneous knowledge stored in various depositories (Kafentzis *et al*., 2004).

## Intellectual Assets in K-Commerce

The Internet has provided enterprises with a capital assets market that offers unprecedented opportunities by enabling the rapid and large-volume production, utilization, replication, sale, and exchange of IAs, yet that simultaneously enables infringement behaviors like the counterfeiting or plagiarizing of IAs. Knowledge commerce includes the sale and licensing of IAs, and the digitization of intellectual works for expediency has created numerous problems. For example, sellers require assurance that their intellectual property will not be infringed upon, while buyers are concerned with product authenticity. Thus international agreements are necessary to protect copyrights, patents, and trademarks from piracy or fraud. Intellectual property rights (IPR) (Hlupic & Qureshi, 2003; Harrison, 2007) in k-commerce denote various tangible and intangible mental creations, including copyrights, patents, trademarks, and domain names. Copyright laws stipulate that upon completion of a creative work the author is automatically granted copyright, which is legally protected even without authorship registration.

Intellectual assets are becoming increasingly important in the knowledge economy era, and are becoming increasingly significant in corporate asset valuation, which is especially true for knowledge-based enterprises (Harrison, 2007).

The conventional approach to intellectual property management, as currently adopted by most industries, maintains that patents, copyrights, and trademarks should be utilized to provide adequate control and protection for resources and innovations unique to an enterprise (Hlupic & Qureshi, 2003). While digital creations can easily be shared, mixed, and reused for different purposes, they are also readily replicable. From the perspective of the conventional management approach to IAs, digitization has undoubtedly created new infringement problems for digital authors. Some smart enterprises have adopted a balanced approach to managing their IAs by protecting certain assets while sharing others, enabling them to rapidly roll out new products that win market acceptance.

## Revenues and Opportunities from K-Commerce

Knowledge value varies with time and degree of knowledge circulation, and market demand for specific knowledge materially influences knowledge value. Generally, up to date knowledge commands higher prices, and thus accelerating knowledge time-to-market is crucial to revenue.

The revenue model denotes how enterprises create revenue, generate profits and maximize investment returns (Turban *et al*., 2008; Du & Lao, 2008). The k-commerce revenue models can be examined using the following four dimensions:

1) **Benefits for knowledge suppliers:** suppliers include individuals, companies, and VTs, and the benefits of k-commerce to them include opportunities for market expansion and increased knowledge product sales, improved corporate reputation and image, reduced operating costs, provision of customized knowledge services, accelerated circulation of knowledge and innovation, and increased knowledge-associated added value.
2) **Benefits for knowledge requesters:** reduced knowledge innovation costs, accelerated and expedient acquisition of new knowledge, customized knowledge services, and increased knowledge sources.
3) **Benefits for knowledge service providers:** revenue from offering on-line services, and acquisition of large volumes of trading information from the knowledge market, including scale and type of demand, changes and trends, and customer information.
4) **Benefits for knowledge processors:** revenue from knowledge processing, refining and combining, and increased knowledge breadth and depth.

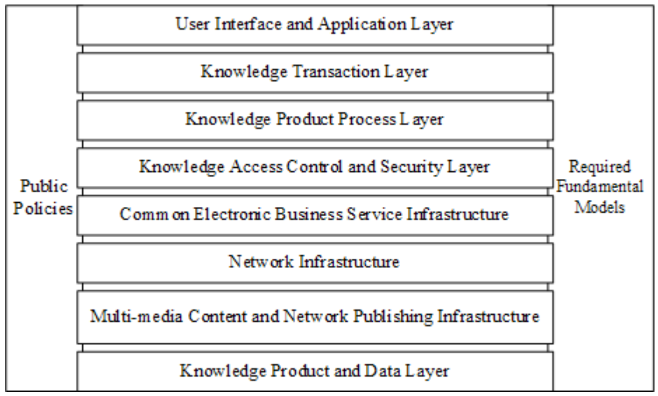
K-commerce services can be classified as free and charged. Charged services often levy fees on a monthly or annual basis. In comparison, free services can frequently attract more customers. From a strict product perspective, k-commerce resembles network services in the sense that services offered include both paid and free or shared knowledge. Based on profit models for e-commerce (Laudon & Traver, 2003; Turban *et al*., 2008; Skyrme, 2001), profit models for k-commerce analyzed in this study include: 1) sales fees: where profits are generated from selling knowledge products; 2) transaction fees: where service charges are levied for offering marketplace or transaction information, and a flat fee or percentage of sales volume is charged on individual transactions; 3) subscription fees: a service charge levied (typically levied on a monthly or annual basis) for delivering specific knowledge; 4) advertising fees: where advertising opportunities are offered and charged for based on space, exposure period, or click number; 5) affiliate fees: where charges are levied on other websites for providing hyperlinks; 6) licensing fees: comprising revenue from patent or knowledge authorization; and 7) service fees: for example fees charged by knowledge service providers upon transaction completion, or fees charged to trading parties for providing mediating services upon completion of bidding.

Besides the above profits, k-commerce also offers other profit modes, including: 1) recreating value for knowledge that no longer has market value by repackaging it for applications in different industries or fields; and 2) processing knowledge, including knowledge evaluation fees, integration fees, packaging fees, and refining fees, which refers to revenue from services offered by knowledge processing agents, such as knowledge integrators, refiners, publishers, aggregators, evaluators, and packagers.

## ISSUES AND INFRASTRUCTURE RELATED TO K-COMMERCE SUCCESS

Issues associated with practicing k-commerce include: 1) methods of presenting knowledge product information and knowledge product requirements on k-commerce websites, 2) method used for meat-knowledge creation, including directories, indexes, summaries and abstracts associated with knowledge products, 3) efficient knowledge search method and precision matching between buyers and sellers, 4) secure, fair and smooth knowledge trading methods, 5) revenue

*Figure 2. K-commerce infrastructure*




generation via k-commerce, 6) fair and transparent knowledge value assessment method, 7) approach for validating knowledge content and quality, 8) method for knowledge customization, 9) reputation and trust assessment between knowledge buyers and sellers, 10) pre-qualified assessment method for buyers and sellers, 11) knowledge format conversion for different buyer needs, 12) risk evaluation method for use in knowledge trading or sharing with competitors, and 13) cost and feasibility of knowledge conveyance from sellers to buyers. To develop k-commerce requires supporting and realizing k-commerce infrastructure, including methods, technologies and services. The infrastructure (Fig. 2) comprises eight layers and two pillars, as follows:

- **User Interface and Application Layer**: The layer offers all users of the k-commerce platform, including knowledge suppliers and requesters, business service suppliers, processors and third-parties, a knowledge trading portal that offers e-catalog, knowledge product information, e-advertisement, e-paper, video conference and industrial community functions.
- **Knowledge Transaction Layer**: This layer performs knowledge trading services, including matching, on-line auction, bidding, exchange, negotiation, brokerage, VT matchmaking, and transaction process fulfillment. Take matching service for example. The platform performs matching based on feature descriptions of knowledge owned or requested by the supplier or requester to help trading parties identify optimal matches between knowledge and requesters. Furthermore, the negotiation service applies intelligent agent technologies to negotiate based on conditions set by trading parties or the floor price to assist trading parities in rapidly reaching a consensus.
- **Knowledge Product Process Layer**: This layer provides knowledge services, including knowledge product management, integration, classification, refinement and packaging, after-sales services, pricing and evaluation, which are required by knowledge processors to pre-process knowledge before sales.
- **Knowledge Access Control and Security Layer**: This layer manages and delivers service authorization to platform users, and grants knowledge users access to intra-physical and extra-physical knowledge objects stored in the knowledge product and data layers based on the knowledge license for processing knowledge trading records.

- **Common Electronic Business Service Infrastructure**: This layer facilitates the establishment of a secure environment for knowledge trading and provides services and technologies such as: (1) security technologies: data encryption standard, digital watermark, and digital envelope; (2) certificate authority services: authentication, public key infrastructure, digital certificate, and digital signature, and (3) electronic payments: smart card and e-check.
- **Multi-media Content and Network Publishing Infrastructure**: This layer includes functions like network transmission and exchange, multimedia content production, and web-based content publishing.
- **Network Infrastructure:** This structure is responsible for various data transmission modes, including WAN, LAN, VAN, Internet and wireless, and provides firewall protection to ensure network security.
- **Knowledge Product and Data Layer:** This layer comprises multiple distributed data depositories used to store transaction data and physical knowledge objects on the k-commerce platform.
- **Public Policies:** Commercial success of k-commerce requires adequate public policy support in areas such as taxation law, legal systems, privacy, regulations, patents, IP rights, and technical standards.
- **Required Fundamental Models:** Realizing k-commerce requires support from fundamental models related to knowledge process, transaction, security and representation, for example the knowledge product representation model is required to clearly display knowledge products online.

## FUTURE RESEARCH DIRECTIONS

Future studies should develop and define knowledge business models based on various perspectives, including role in knowledge value chain, product and service, process, price, and profit, thus providing adequate solutions to knowledge trading activities such as sales, search for knowledge, negotiation, and valuation of IAs, engaging both knowledge producers and requesters in collaboration. Additionally, enhancing knowledge trading activities requires resolving the issues mentioned above.

Although resembling other e-commerce trading models, knowledge trading through k-commerce requires more stringent information security standards in the areas of authentication, confidentiality of personal data and knowledge products, knowledge data integrity and non-repudiation (prevention of nonpayment). Consequently, Internet security and protective measures for IAs, for example how to establish user identity authentication, knowledge authorization, confidentiality and integrity control of knowledge and trading data, and trading certification, have become key information security problems. Besides security issues, the following issues have been identified as key research directions with potential to help achieve k-commerce objectives: 1) a fully functional k-commerce website, 2) an efficient and accurate knowledge product search method, 3) an automatic method for fair knowledge pricing and value assessment, 4) a secure knowledge trading environment and processes, and 5) an effective method of negotiating knowledge trades.

## CONCLUSION

Changes in business environment have led enterprises to strive for innovation and transformation, creating new business opportunities while transforming old business models. In the future commercial environment focused on the innovation economy, any enterprise wishing to achieve profits from developing new technologies or ideas will need to adopt a more open operating mode that focuses on introducing creativity or technology from outside, or that shares more internal knowledge with business partners, to reduce innovation costs and accelerate R&D cycles. Knowledge commerce provides an excellent solution to such problems. To summarize, this investigation has contributed to realizing a collaborative k-commerce environment and expediting the circulation of enterprise knowledge assets, thus increasing value creation.

## REFERENCES

Aberer, K., & Wombacher, A. (2001). A language for information commerce processes. In *Third International Workshop on Advanced Issues of E-Commerce and Web-based Information Systems* (pp. 21-22).

Chen, T.-Y., Chen, Y.-M., & Chu, H.-C. (2008). Developing a trust evaluation method for between coworkers in virtual teaming for enabling resource sharing and collaboration. *Computers in Industry*, *59*(6), 565–579. doi:10.1016/j.compind.2008.01.001

Chesbrough, H. (2003). *Open innovation: The new imperative for creating and profiting from technology*. Boston: Harvard Business School Press.

Dominique, F. (2004). The patent system and the dynamics of innovation in Europe. *Science & Public Policy*, *3*(6), 449–456.

Du, M., & Lao, G. (2008). Value chain & profit model analysis in e-tourism and case study. In *The 4th International Conference on Wireless Communications, Networking and Mobile Computing* (pp. 1-4).

Harrison, R. J. (2007). Creating value in a medical device company through intellectual assets. In *Proceedings of the 29th Annual International Conference of the IEEE EMBS* (pp. 4381-4385).

Hlupic, V., & Qureshi, S. (2003). A research model for collaboration value creation from intellectual capital. In *Proceedings of the 25th International Conference on information technology Interfaces* (pp. 431-437).

Jazayeri, M., & Podnar, I. (2001). A business and domain model for information commerce. In *Proceedings of the 34th Annual Hawaii International Conference on System Sciences* (pp. 10).

Kafentzis, K., Mentzas, G., Apostolou, D., & Georgolios, P. (2004). Knowledge marketplaces: strategic issues and business models. *Journal of Knowledge Management*, *8*(1), 130–146. doi:10.1108/13673270410523961

Kevin, C. D., & Yukika, A. (2003). Case study constructing internal knowledge markets: considerations from mini cases. *International Journal of Information Management*, *23*, 345–353. doi:10.1016/S0268-4012(03)00056-2

Laudon, K., & Traver, C. (2003). *E-commerce: business, technology, society*. Upper Saddle River, NJ: Prentice Hall.

Samarah, I., Paul, S., & Tadisina, S. (2007). Collaboration technology support for knowledge conversion in virtual teams: a theoretical perspective. *Proceedings of the 40th Hawaii International Conference on System Sciences* (pp. 1-10).

Skyrme, D. J. (2001). *Capitalizing on knowledge: From e-business to k-business*. Amsterdam: Elsevier Science.

Sullivan, P. H. (2000). *Value-driven intellectual capital: How to convert intangible corporate assets into market value*. Hoboken, NJ: John Wiley & Sons, Inc.

Turban, E., King, D., Viehland, D., & Lee, J. (2008). *Electronic commerce: A managerial perspective*. Upper Saddle River, NJ: Pearson Education, Inc.

Voegtli, C. (1996). Real-world challenges: using the virtual enterprise for successful product development projects. In *International Conference on Engineering and Technology Management* (pp. 698-704).

Wang, J.-C., Chiang, C.-H., & Lin, S.-W. (2009). Network structure of innovation: can brokerage or closure predict patent quality? In *Proceedings of the 42nd Hawaii International Conference on System sciences* (pp. 1-10).

Wang, Y., & Lin, K.-J. (2008). Reputation-oriented trustworthy computing in e-commerce environments. *IEEE Internet Computing*, *12*(4), 55–59. doi:10.1109/MIC.2008.84

## KEY TERMS AND DEFINITIONS

**Business Model:** A business operation approach involving a series of planned activities or business processes by which an enterprise can generate revenue.

**Collaborative Innovation:** Knowledge or products are created cooperatively by members of a virtual team, bringing together various individuals and enterprises with complementary ideas, knowledge and skills.

**Electronic Commerce (E-Commerce):** A popular and growing electronic business model that enables the trading of physical products on the Internet.

**Intellectual Assets (IA):** Important enterprise assets such as patents, trade secrets, knowledge, experience, and staff skills that can be converted into profits, create value, as well as enhance business performance and economic growth.

**Knowledge Commerce (K-Commerce):** A series of planned business processes that generate profits by trading and exchanging knowledge via the Internet, forming virtual teams for offering unique knowledge services to knowledge requesters, and refining existing knowledge or combining different types of knowledge to create new knowledge.

# Chapter 37

# Online Private Sales Clubs:
## An Emerging Model of Fashionable E-Commerce at Promotional Prices

**Ana Isabel Jiménez-Zarco**
*Open University of Catalonia, Spain*

**María Pilar Martínez-Ruiz**
*Castilla la Mancha University, Spain*

**Silvia Sivera-Bello**
*Open University of Catalonia, Spain*

**Sandra Vilajoana-Alejandre**
*Open University of Catalonia, Spain*

## INTRODUCTION

Considering the advantages of the Internet for commercializing a vast array of products and services (Steinfeld and Whitten, 1999; Webb, 2002), it is little wonder that more and more companies have decided to offer a broad array of products online (Jiménez, 2005). Some companies even have chosen to use the Internet as the exclusive channel for selling products and services. When they follow this route, one of the most successful sales models has been the online private sales club, a multibrand outlet format that relies on a strong, free-flowing relationship among the company, the supplier, and the consumer (B2B2C). The model also adopts an attractive and innovative (relational, emotional, holistic) marketing strategic orientation that combines the attractiveness of traditional marketing elements, including prestigious brands, sales promotions, and exclusive distribution, with marketing elements specific to virtual markets, such as viral communication, intensive customer relationship management (CRM) systems, and secure payment methods.

Companies that adopt these strategies (e.g., **BuyVip**, **Vente-Privee**, **Secret Sales**) enjoy growth rates of up to 200% that ensure them high numbers of registered users (e.g., BuyVip counts 2 million users registered in different European countries) and elevated sales volumes (e.g., Vente-Privee earned 350 million Euros in 2007). In turn, traditional investors such as **Bertelsmann Digital Media Investments**, **Molins Capital Inversión** and **Summit Partners** consider them solid investment opportunities.

DOI: 10.4018/978-1-61520-611-7.ch037

By analyzing the sales model adopted by those companies, we attempt to identify some of the keys to success, as well as the growth opportunities associated with this particular business model.

## THE BUSINESS MODEL: ADAPTATION OR INNOVATION OF THE OUTLET?

The outlet business model and online private sales clubs offer several similarities that may induce some doubts about the origin of the latter model. A priori, it might seem that online private sales clubs simply represent an adaptation of the traditional outlet model to virtual markets. However, the presence of certain strategic and tactic elements, particularly of this commercial format, prompts us to argue instead that online private sales clubs are innovative instead of adaptive.

### Outlet Model

The outlet model grew out of conventional markets in the United States and reached Europe during the 1980s and 1990s (Figueras, 2004). Its business formula is quite simple: An outdated or defective product frequently produced by a prestigious or high-quality brand, ships to outlet stores that sell the product at a lower **price** than is usual in traditional retail stores (Barthélemy, 2006).

The benefits for both the producer and the client are clear. The producer earns revenues from obsolete or faulty products and can sell excess stock and collections of samples without damaging its image. Many firms therefore recognize the outlet format as an ideal complement to selective or exclusive sales systems. Because producers must renew their offers frequently, especially in fashion industries, they need a system that enables them to sell seasonal excess adequately and quickly. The advantages for the client derive from the ability to acquire various products (e.g., apparel, designer objects, sports articles) from famous and popular brands at discounted prices.

The success and expansion of this commercial format has been extensive; in some commercial markets, traditional outlet stores have evolved from small storefronts located in the city surroundings (Figueras, 2004) to vast stores located in city centers and malls, including in some cases entire centers dedicated solely to outlet stores. Thus, in the same arena, consumers can find outlet stores that sell different brands. The ambience and services offered often do not differ from those provided by traditional stores. However, the disposition and display of products may be less visible.

### Innovation in the Model: Radical or Incremental?

Attempts to apply proven business models from conventional markets to the Internet arena have prompted some firms to use the Internet as either a complementary sales channel that represents an extension of their physical channel or an exclusive market for clients (Vilaseca et al., 2007).

According to Kim and Galliers (2004), online private sales clubs constitute a real innovation of the multibrand outlet model that is marked by interactivity and connectivity. The Internet's inherently high interactivity enables firms to intensify their relationships with customers through more direct communications that are adapted to individual needs, characteristics, and behaviors. Furthermore, the Internet's open and global nature provides greater connectivity in the form of a shared global space for communications and commercial exchanges.

Despite the benefits of this new model though, firms must recognize that potential and existing clients move in both real and virtual markets simultaneously. Thus, "electronic clients" can access goods online with a click while also obtaining impartial information. To guarantee the success of the online sales private club model, firms must combine strategic and tactical elements that are particularly adapted to this new medium.

## KEYS TO SUCCESS

The success of online private sales clubs depends on their ability to provide an attractive, diverse array of products and services that offer value to consumers. This new strategic orientation, along with tight bonds with suppliers and clients, represents a key element of the new commercial formula.

### New Strategic Marketing Approach

In a traditional outlet, the marketing strategy features two key elements: a prestigious brand and an attractive price. For online private sales clubs, these elements remain, but firms also are characterized by a higher customer orientation level.

To satisfy clients continuously, organizations must establish a triple orientation within their marketing strategies: relational, emotional, and holistic. According to Palvia (2009), strategies associated with online private sales clubs include tight, stable relationships with clients. Within these relationships, brands play a key role as attractions. For example, selling exclusive brands such as DKNY, Pepe Jeans, or Thomas Burberry increases client interest in buying, which thereby initiates the relationship. However, if the objective is to consolidate the client relationship in the long run, online private sales clubs also need to enrich their marketing mix with additional elements that will guarantee the generation of emotional bonds with the firm.

Value, equity, trust, commitment, satisfaction, and loyalty determine the stability and strength of a client–firm relationship (Chiu, 2004; Awad and Ragowsky, 2008). Thus, with the objective of developing strong relationships, online private sales clubs enrich a traditional relational marketing orientation with two additional orientations: emotional and holistic. By combining these orientations, this model attempts to enrich the client–firm relationship through the provision of content, proximity, and personality. An emotional marketing orientation focuses on the experiential dimension of consumption, whereas a holistic marketing orientation seeks to know and understand clients by integrating them into a relationship based on direct and bidirectional communication (Zineldin, 2000).

### Company Relationships with Suppliers and Clients

Carpinter (2001) and Chakraborty et al. (2003) argue that the success of a firm online depends on its ability to (1) create relationship networks, (2) highlight the client as the “star” of the business, (3) provide transparent and accessible information, (4) make the firm available on the Internet, (5) establish global relationships, and (6) guarantee privacy and security. It seems evident that firms that employ the online private sales club model also must have these capacities, perhaps to an even greater extent.

As retailers, online private sales clubs maintain close relationships with their suppliers and end clients. Their position in the value chain means that the success of their relationship with clients (B2C) depends not only on the value that the relationship offers but also on the value that other agents add to it and on their relationships with suppliers (B2B). The key rests in the flow of the integral relationship, which we refer to as B2B2C.

#### Characteristics of the B2B Relationships

To satisfy the client, all the agents in the value chain must participate in the process of creating value. Therefore, a close relationship between the supplier and the distributor constitutes a key for the success of the business model. To offer prestigious brands at attractive prices, the retailers need not only the cooperation but also the complicity of suppliers (Jeannet et al., 2008).

The selection of suppliers depends, in principle, on finding brands that have an excellent image, though as the model becomes more consolidated, alternative brands may benefit from cross-trust effects. Thus, online private sales clubs may offer suitable platforms for manufacturers to test new offers and brands.

The products sold through online private sales clubs often are search products that consumers can evaluate easily and objectively from the information that the channel provides. But some clubs also offer experience goods, which the client might have acquired previously through physical channels. That is, a customer might know his or her preferred size and quality, which reduces the risk of making a purchase error. In either case, clients have detailed information about the items' sizes, colors, and so on, as well as communication systems that help them resolve their potential doubts about the purchase act (e.g., FAQ sections, virtual assistants).

Finally, online private sales clubs make significant and efficient use of information and communications systems that connect the firms and suppliers. In turn, two of the key model features are as follows:

- The role of the cybermediaries, which do not keep suppliers' products in stock but act as intermediaries between the supplier brand and the end client.
- The efficacy of the logistics process that makes the product available to the consumer rapidly and securely, as well as in the required condition.

In this sense, online private clubs adopt a cost leadership competitive strategy (see Porter, 1988) but also enjoy the value of shortages in terms of quantities and the time limits on the offer. In the act of purchasing, the client knows exactly how many units are available (often quite few), as well as the deadline for the offer (e.g., from hours to a few days); these factors add to the perceived value and can incite impulse buying.

## Characteristics of the B2C Relationship

An exhaustive analysis of some European companies that have adopted this new e-commerce format reveals the key elements that appear to characterize their marketing mix strategies. As we will see next, some companies have combined traditional and online marketing elements whereas others have only adopted exclusive marketing online elements.

These companies employ unique procedures and operate in different markets. Specifically, Secret Sales relies mainly on British capital, Vente-Privee is primarily French, and BuyVip, though a Spanish company, has stockholdings in German, British, and Latvian companies.

The results of our analysis reveal several features that constitute the central axis of strategic and tactical marketing strategies relative to their marketing mixes.

(1) Product

The range offered usually focuses on new fashion articles, original designs, and items acquired from manufacturers or distributors located in the countries in which the company has its headquarters. Moreover, the brands are very prestigious and tend to pursue exclusive, high-quality positioning. To reinforce this brand positioning, clients must become members of the private sales clubs, by registering online, to acquire the products.

(2) Price

The sale price is remarkably lower than the regular cost of the items in conventional physical establishments. This price generally includes VAT and other taxes, as well as shipping expenses, which appear itemized separately from the sale price of the product.

All payments are made by credit card, and payment security is totally guaranteed. As part of this security guarantee, online private sales clubs usually employ a payment system that features platforms developed by financial entities (e.g., Banco Popular for BuyVip) or popular online payment systems such as PayPal.

(3) Communication

Of the various communication tools the online private sales clubs use, sales promotions, advertising, direct marketing, and viral marketing are particularly important.

One of the most important incentives used to promote the sale of items is the discount price. For a short period of time—usually two to five days—online private sales clubs offer discounts of 20–80 percent off their regular prices. In addition, the clubs advertise products and services and thereby provide information about their characteristics. Although the information initially offered is that provided by the suppliers, some virtual outlets repackage the information to make it representative of the particular Web site; for example, a specific site might create videos that emphasize the exclusivity and quality of the offer.

The direct marketing strategy invites clients and potential associated customers, by e-mail, to participate in the online sales. The e-mails emphasize the exclusivity of the brand and sale, as well as their limited time characteristics. Viral marketing is another representative feature of online private sales clubs, in that recommendations from existing users are the only means to access the offers. A member who invites others likely feels that he or she is enabling friends to enjoy a special kind of consumption experience. The invited friend in turn should feel flattered and experience a lesser sense of risk in the new environment (e.g., Golan and Zaidner, 2008; Sivera, 2008).

(4) Distribution

Because of the limited availability of the products offered by these virtual outlets to a limited public (i.e., members), we assert that online private sales clubs employ an exclusive distribution strategy. The club is of use to the client only after an order gets placed. During this process, the client receives detailed information about the stages that precede their receipt of the order.

If the buyer rejects the item after receiving it (e.g., because of damage to the item, evidence that it was opened during transportation), she or he can claim a refund. Thus, online private sales clubs offer the possibility of returning orders within determined time limits and in certain conditions.

(5) Service to the client: Security and protection of online purchases

One of the main challenges of e-commerce is guaranteeing the security of transactions and ensuring that users perceive such security. Private sales clubs therefore offer a series of legal protection guidelines, compiled in their general privacy, use, and sale conditions.

All the virtual outlets we consider are governed by legislation regarding data protection in the markets in which they operate. These outlets therefore maintain files with information about members that they may use to determine informative or advertising messages, but they must commit to avoiding the loss, misuse, or unauthorized access to this information by third parties.

With regard to the sales conditions, the clubs provide similar conditions and guarantees to those offered in traditional purchase outlets, which partly determine some features of their marketing mixes.

## DISCUSSION: GROWTH OPPORTUNITIES AND FURTHER RESEARCH

The object of this investigation has been to analyze an emergent e-commerce business model, whose fast proliferation makes its study interesting from a marketing perspective.

Starting with an innovation of the traditional multibrand outlet model and adopting a novel marketing orientation, online private sales clubs maintain close relationships with their suppliers and end clients, such that their positions in the value chain demand successful relationships with clients (B2C), as well as cooperative interactions with suppliers to add value to the offer (B2B). The key thus may be the fluidity of the integral relationship we propose, namely, B2B2C. On the basis of these cordial relationships with suppliers and the advantages offered to end clients, we propose a means to understand the success of online private sales clubs.

Our detailed analysis of dominant European companies that operate in this new electronic commerce format highlights some of the key elements that characterize their strategies, in terms of relationships with both suppliers and clients. The strategies focused on suppliers demand careful selection methods, which help ensure cooperative relationships. Strategies associated with end consumers also center on strong and emotionally based relationships. Therefore, in addition to employing communication tools such as sales promotions, direct marketing, and viral marketing, online private sales clubs make effective use of services and guarantees to clients. The importance of such guarantees is great enough in this context that it emerges as a fifth element of the marketing mix strategy of these companies.

However, when designing their business strategies, online private sales clubs must recognize that any of these factors can alter their relationships with suppliers and clients. Therefore, additional study of these factors represents an important line of further research. With suppliers, the firm needs strong relationships to achieve competitive advantages. In this sense, Kandampully (2003) points out that this relationship can increase firm efficiency, in that it favors rapid and secure communication and exchanges, which minimize costs, improve customization, and enhance value.

With regard to clients, online private sales clubs should consider the impact of consumer culture and Web features (e.g., e-atmospherics) on purchasing behaviors toward a specific brand or establishment. Some empirical evidence indicates that online business development requires the consideration of possible cultural and ethnic differences. In this sense, Luna et al. (2002) and Singh et al. (2006) show that consumer responses to a Web site improve when the site offers greater adaptation to the users' culture. Furthermore, some functional aspects of e-atmospherics have noticeable influences on purchasing habits. Kervenoael et al. (2007), who define e-atmospherics as the creation, shape, and evolution of Web site design, argue that these features can enhance site stickiness and thus encourage consumers' final decision to purchase, as well as promote positive postpurchase evaluations.

## REFERENCES

Awad, N. F., & Ragowsky, A. (2008). Establishing trust in electronic commerce through online word of mouth: an examination across genders. *Journal of Management Information Systems*, *24*(4), 101–121. doi:10.2753/MIS0742-1222240404

Barthélemy, J. (2006). Opportunism, knowledge and the performance of franchise chains. *Strategic Management Journal*, *29*(13), 1451–1463. doi:10.1002/smj.719

*BuyVIP*. (n.d.). Retrieved November 18, 2008, from http://es.buyvip.com/index.jsp

Carpinter, R. (2001). *Los cinco mandamientos de la empresa en Internet. Enseñanzas para después de una crisis.* Bilbao, España: CISSPRAXIS.

Chakraborty, G., Lala, V., & Warren, D. (2003). What do consumer consider important in B2B websites*? Journal of Advertising Research*, *43*(1), 50–61.

Chiu, J. S. (2004). The antecedents of consumers royalty toward Internet service providers. *Information & Management*, *41*(6), 685–695. doi:10.1016/j.im.2003.08.006

El Observador. (2008). *Hábitos y tendencias del e-consumidor*. Retrieved November 26, 2008 from http://www.cetelem.es/banco/internet-observador/2008/pure-players.jsp

Figueras, A. (2004, September 1). Outlet más por menos. *El Mundo.*

Golan, J. C., & Zaidner, L. (2008). Creative Strategies in Viral Advertising: An Application of Taylor's Six-Segment Message Strategy Wheel. *Journal of Computer-Mediated Communication*, *13*, 959–972. doi:10.1111/j.1083-6101.2008.00426.x

Hernández, B., Jiménez, J., & Martín, M. J. (2007). Análisis del efecto de la experiencia en TIC en el uso del B2B. *Revista europea de dirección y economía de la empresa, 16*(4), 145-162.

Jeannet, J. P., Kashimi, K., Koschat, M., Read, S., & Ryans, A. (2008). Nuevas tendencias en el marketing B2B. *Harvard Deusto Marketing y Ventas*, *87*, 28–33.

Jiménez, J. (2005 July). Análisis y evolución de internet como canal de compras. *Estudios sobre consumo*, 74.

Kandampully, J. (2003). B2B relationships and networks in the Internet age. *Management Decision*, *41*(5), 443–451. doi:10.1108/00251740310479296

Keller, K. L., & Kotler, P. (2006). Holistic marketing: A broad, integrated perspective to marketing management. In J. N. Shet & R. G. Sisodia, (Eds.), *Does marketing need reform. Fresh perspectives on the future* (pp. 300-306). Armonk, NY: M. E. Sharpe.

Kervenoael, R., Aykac, D. S., & Bisson, C. (2007, January). The influence of social E-atmosphere in practice: A website content analysis perspective. In *7th International Congress, Marketing Trends*, Venice.

Kim, C., & Galliers, R. D. (2004). Toward a diffusion model for Internet systems. *Internet Research: Electronic Networking Applications and Policy*,*14*(2), 155–166. doi:10.1108/10662240410530862

Luna, D., Peracchio, L., & de Juan, M. (2002). Cross-cultural and cognitive aspects of web site navigation. *Journal of the Academy of Marketing Science*, *30*(4), 397–410. doi:10.1177/009207002236913

*Marketing Intelligence & Planning*, *18*(1), 9–23. doi:10.1108/02634500010308549

Palvia, P. (2009). The role of trust in e-commerce relational exchage: A unified model. *Information & Management*, *46*, 213–220. doi:10.1016/j.im.2009.02.003

Pérez, J. (2008). Caso Privalia, entre un club privado on line y un escaparate virtual en promoción permanente. *Sobre Pyme Cruch*. Retreived November 12, 2008 from http://pymecrunch.com/caso-privalia-entre-un-club-privado-on-line-y-un-escaparate-virtual-en-promocion-permanente

Porter, M. E. (1988) *Estrategia competitiva.* Guadalajara, México: Cecsa.

Singh, N., Fassott, G., Zhao, H., & Boughton, P. (2006). A cross-cultural analysis of German, Chinese and Indian Consumers' perception of web site adaptation. *Journal of Consumer Behaviour*, *5*, 56–68. doi:10.1002/cb.43

Sivera, S. (2008). *Marketing Viral.* Barcelona, España: Editorial UOC.

Steinfeld, C., & Whitten, P. (1999). Community level socio economic impact of electronic commerce. *Journal of computer mediated communications, 5*(2). *Secret Sales Club.* (n.d.). Retrieved November 18, 2008, from http://secretsales.com/home/

Value Retail. (n.d.). Retrieved November 18, 2008, from http://www.valueretail.com

*Vente-privee.com*. (n.d.). Retrieved November 18, 2008, from http://www. Venta-privee.com

Vilaseca-Requena, J., Torrent-Sellens, J., Meseguer-Artola, A., & Rodríguez-Ardura, I. (2007). An integrated model of the adoption and extent of e-commerce in firms. *International Advances in Economic Research*, *13*, 222–241. doi:10.1007/s11294-006-9061-z

Webb, K. (2002). Managing channels of distribution in the age of electronic commerce. *Industrial Marketing Management*, *31*, 95–102. doi:10.1016/S0019-8501(01)00181-X

Zazaya, P. (2008, May 14). Todos Ganan. *Vogue online*. Retrieved November 22, 2008 from http://www.vogue.es

Zineldin, M. (2000). Beyond Relationship Marketing: Technologicalship Marketing.

## KEY TERMS AND DEFINITIONS

**Brand:** A word, name, symbol, or combination of these elements that identifies the goods and services of a person or firm and distinguishes them from those of competitors.

**Business-to-Business (B2B):** Trading between firms (not between a business and end consumers), characterized by (1) relatively large volumes, (2) competitive and stable prices, (3) fast delivery times, and (4) often deferred payments.

**Business-to-Consumer (B2C):** Activities that commercial firms develop to reach end clients or end users directly, including electronic media.

**Cybermediaries:** Intermediaries that act in electronic markets to bring together buyers and sellers or those with particular information or service needs.

**E-Atmospherics:** The creation, shape, and evolution of Web site designs to enhance site stickiness, encourage final purchase decisions, and promote positive postpurchase feelings.

**Emotional Marketing:** A marketing orientation that tries to attract clients by using feelings and emotions that should bond the client to the firm in the long-term.

**Holistic Marketing:** "Holistic marketing is the design and implementation of marketing activities, processes, and programs that reflect the breadth and interdependencies of their effects. Holistic marketing recognizes that "everything matters" with marketing –customers, employees, other companies, competition, as well as society as a whole –and that a broad, integrated perspective is necessary" (Keller and Kotler, 2006: 300).

**Outlet:** A commercial establishment specializing in the sale of goods of popular brands, often obsolete or faulty goods.

**Paypal:** A firm in the electronic commerce sector that enables the transfer of money between users with e-mail accounts. It offers an alternative to traditional payment methods. PayPal also processes payment requests in electronic commerce and other Web services and earns a percentage of the amount transferred in each interaction.

**Viral Marketing:** A broad array of word-of-mouth strategies designed to encourage both online and peer-to-peer communication about a brand, product, or service.

# Chapter 38

# Business Model Renewal:
## The TIA–MARIA Framework for Enterprise Realignment

**Rebecca De Coster**
*Brunel University, UK*

## ABSTRACT

*Increasingly high technology firms are required to develop new products or solutions in emerging markets which are outside of their existing business operation. This may necessitate that firms realign themselves and their business model so that they are able to create value in a new and emerging market. This chapter develops a framework for business model renewal based on case study research into firms entering the emerging sector of mobile networking. The framework presented here is focused on innovation strategies and the associated enterprise realignment for managing technology and innovation. The theoretical basis for this work is from a synthesis of literature drawn from the fields of strategic management, entrepreneurship and innovation management. This framework recognises the importance of the legacy basis/expertise of firms both in terms of resources and market credibility.*

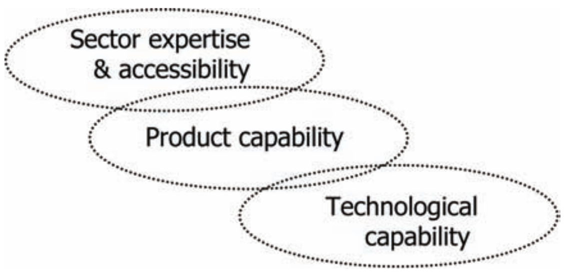
## INTRODUCTION

This chapter reports on the results of a research project concerning business model renewal within high technology firms. The challenges that high technology firms face when seeking to enter emerging markets is well recognised in the literature (Day et al, 2000). This has been the driver behind this study which looks at high technologies firms who have identified an emerging sector and asks "What must firms do?" The focus is on the realignment of the enterprise and its competitive basis through the development of unique capabilities (Ambrosini & Bowman, 2009) and business models (Chesborough & Rosenbloom, 2002).

DOI: 10.4018/978-1-61520-611-7.ch038

Mobile networking refers to wireless protocols which provide wireless connectivity between devices, for example, a laptop maybe connected wirelessly to a printer via radio using the Bluetooth standard. Mobile networking encompasses a variety of technological approaches in terms of wireless encoding, data communication and networking

*Figure 1. Enterprise realignment: the aspects of legacy*




protocols. The challenge for high technology firms seeking to enter this market is that their current organisational architecture (or business model) which has enabled success in their current markets may be a limitation for entering this emerging market.

This research takes a strategic approach and examines the business model development of high technology firms when entering emerging markets which are highly uncertain markets. The objective is to develop a theoretical framework for business model renewal based on a study which examines the organisational, management and strategic changes made by high technology firms entering an emerging sector.

## BACKGROUND

The extent literature on strategic management and how firms compete puts great emphasis on a firm's capabilities. This perspective is the resource based view (RBV) of the firm and is based around the recognition and development of core competences (Prahalad & Hamel, 1990). Firms often have a competitive advantage based on capabilities specific to the firm (Lockett et al, 2009), which has enabled them to build credibility in a given market. With the market changes that are occurring in today's Information Age firms can find themselves in a situation where they are outside of their existing expertise and product base. This requires them to alter their organisation in order to provide products and services to the new market i.e. it requires Enterprise Realignment involving regenerative dynamic capabilities (Ambrosini et al, 2009). This recognises that firms often seek to utilise their legacy which gave them credibility in the market by various means including sector expertise (Davenport et al, 2003) as shown in Figure 1.

One example from the field research of the influence of legacy on Enterprise Realignment is given by a company that was originally a technology manufacturer of high performance audio and video products requiring broadcast quality. The firm's legacy expertise has influenced their product development of Bluetooth firmware modules which are based around advanced DSPs (digital signal processors), that is derived from their technological capabilities developed in the broadcast field. In addition, their Bluetooth enabled handheld mobile devices and auxiliary devices utilises their core product capabilities of miniaturisation and ergonomically designed plastics.

The ability to renew competences in order to achieve congruence with the changing business environment is referred to as dynamic capabilities (Fahy, 2000 and Easterby-Smith et al, 2009). These dynamic capabilities are the engine which enables a firm to achieve new and innovative forms of competitive advantage (Eisenhardt & Martin, 2000). Dynamic capabilities are argued to be a key part of the rationale underpinning strategic management according to Teece et al (1997). They argue that a firm's focus should be on developing the firm's capabilities – not its products.

The focus here is on the changes made by high technology firms to enter emerging markets which are highly uncertain (Tidd & Bodley, 2002), in terms of the end product, the end user task and application. Technological uncertainty is recognised in the research literature (Veryzer, 1998), as one of the four dimensions of radical innovation - the others being technical inexperience, business inexperience and technology cost (McDermott

*Table 1. The three levels of the enterprise realignment framework*

| Level | Title of Level | Description of Level |
|---|---|---|
| One | Industry Position | The positioning of the firm in the sector to secure competitive advantage by establishing value chain leadership along with technological differentiators |
| Two | Application Provision | The value of the firm's offering to the targeted market with essential attributes being provided for the end user's context |
| Three | Technology Development | The direction of the firm's products and technology strategies |

& Connor, 2002). The strategic orientation of the firm in highly uncertain markets requires three areas of focus: customer; competitors and technological (Gatignon & Xuereb, 1997). The theoretical framework for business model renewal introduced in the next section will examine how high technology firms approach this.

## THE LEVELS OF THE ENTERPRISE REALIGNMENT FRAMEWORK

The framework presented here is focused on innovation strategies and the associated enterprise realignment for managing technology and innovation and comprises a synthesis of literature drawn from the fields of strategic management, entrepreneurship and innovation management. The approach taken is to evaluate a firm's competitive performance in the mobile networking sector on the three aspects of: resources; market position and financial performance. These factors were identified by Hunt (1999) when developing the RA (resource-advantage) theory of competition. The reasons for adopting this theoretical framework is that it combines the literature on the resource-based view (RBV) of the firm (Prahalad & Hamel, 1990) as well as the literature on strategic positioning (Kalafatis et al, 2000) or market based view (MBV).

The framework for business model renewal which has been developed is the "Technology, Industry and Application Modelling and Analytical Research into Innovation Actions" with the abbreviated name of TIA-MARIA. The TIA-MARIA framework is a conceptual framework which comprises three levels as shown in Table 1.

Within each of the three levels of the framework a number of elements are to be identified which enable conceptualisation of the evolution of enterprises during realignment. The theoretical basis of examining RBV and organisational capabilities is well established in the literature relating to technology innovation (Newey and Zahra, 2009). The literature review enabled identification of two elements for the first level. The identification of the elements within the other two levels was established through field research.

The preliminary field research of two case study firms entering the mobile networking field identified a number of elements for levels two and three. These elements were then tested during the latter part of the study which comprised mini case studies with interviews being conducted with executives familiar with the technology strategies who typically were the Managing Director of the firm, a Technology Director or an executive responsible for Business Development. The total data sample comprised case studies of seven UK firms and nine international firms to provide sufficient context (Eisenhardt, 1989). The mix of UK and international firms was selected to provide a fuller picture of what it takes to be innovative in this sector that is very globalised. The mobile networking technologies and initial user applications for the case study firms are shown in Table 2.

*Table 2. Profile of mobile networking data sample*

| Case Study Firm | Development of Mobile Networking Technologies | Initial Mobile Networking Applications |
|---|---|---|
| 1 | Initially Bluetooth products. Now also Wi-Fi products. | Portable consumer devices. |
| 2 | Previously: IP related protocols. Now: Bluetooth. | Embedded systems (targeted for resource-critical applications). |
| 3 | Previously: proprietary mesh networks. Now: ZigBee. | Robust networks for industrial monitoring systems. |
| 4 | UWB technologies only (mesh networks). | New company: short range applications. |
| 5 | Wireless RF, Bluetooth, GPS. | Components (audio & data acquisition). |
| 6 | Proprietary RF networks. Now developing Bluetooth and Wi-Fi. | Automatic meter reading (AMR) |
| 7 | Previously: DECT and GSM. Now: Bluetooth, ZigBee and UWB. | Industrial and commercial products Now: Healthcare, Automotive and others. |
| 8 | Previously: GSM. Now: Bluetooth. | Mobile devices for the telecommunications, healthcare and automobile industries. |
| 9 | Previously: IP related protocols. Now: Bluetooth. | Bluetooth network access point. |
| 10 | Previously: video broadcast protocols. Now: Bluetooth. | Mobile devices for industrial applications. |
| 11 | Plans: GSM & Bluetooth (on the same IC). Future plans: WiMax, FDM & CDMA | University spin-out: new company so no mention of applications. |
| 12 | Previously: PC protocols. Now: Bluetooth. | Cable replacement for industrial usage. |
| 13 | Software development and consultancy house specialising in Operating Systems. | Operating Systems for mobile devices (Symbian etc..) |
| 14 | Bluetooth. | Proposing industrial applications. |
| 15 | IP related protocols. | Network monitoring. |
| 16 | Previously: PC protocols. Now: ZigBee. | Proposing industrial applications. |

## Level One Elements Identified for Testing

The theoretical underpinning to this study is that of RBV and MBV which must be reflected in the choice of model to evaluate the mobile networking application systems. This is the first of the two elements which were identified for The Industry Position (Level 1) from the literature as shown in Table 3.

Element #1 is the Innovation Value Chain which will be used to scope the business activities of the case study firms (Afuah & Bahram, 1995). The research approach taken here is that of case study analysis using the innovation value chain for the mobile networking sector as a model to consider the mobile networking application and technology being implemented (De Coster, 2009).

Element #2 is the Technology Leadership approach or the positioning strategies of the firm in business markets This refers to strategic market positioning which are the product-market positions established by firms (Kalafatis et al, 2000).

*Table 3. The elements to be tested for level one*

| Element Number | Element | Description of Element |
|---|---|---|
| #1 | Innovation Value Chain | The role of the firm in the sector and the focus of its applications |
| #2 | Technology Leadership | The product and commercialisation strategy of the firm in the sector |

## Level Two Elements Identified for Testing

In this level we examine application provision which is important to end-users. The provision of applications increasingly involves products that incur "convergence" across technologies, for example, between wired and wireless, broadcasting and communication, voice and data. The elements identified from the preliminary field research for The Industry Position (Level 2) are shown in Table 4.

Element #3 is Product Attributes which will assess to what extent a firm provides superior products to their competitors. This examines the end product in terms of whether or not it provides more capabilities than the basic functionality required by the mobile networking standards.

Element #4 is Optimisation which refers to the end users' perspective and the ease of operational activities when using the provided products or solutions. The field research will assess to what extent firms are providing mobile networking solutions which are tailored to the end application.

Element #5 is Interconnectivity which refers to the ability of products to support the numerous interface standards which are prevalent not only in terms of mobile networking technologies but also, in many cases, in the end application.

Element #6 is Embedded Software Systems (ESS) which refers to the provision (by the case study firms); of software development kits which are then used by their customers (typically OEMs); to develop a software solution that is embedded in a piece of equipment.

## Level Three Elements Identified for Testing

When formulating innovation strategies the high commitment of resources for R&D is such that the complexity of R&D activities highlights the need for coordination and technology management (Pike et al, 2005). The importance of portfolio management is well recognised in the technology management literature (Cooper et al, 1999) and although not specifically referred to here it is recognised during the field research.

*Table 4. The elements to be tested for level two*

| Element Number | Element | Description of Element |
|---|---|---|
| #3 | Product Attributes | The characteristics and level of functionality of the product supplied. |
| #4 | Optimisation | The extent to which the product or solution provided to the market is tailored to the end user. |
| #5 | Interconnectivity | The extent to which the product supports various different interfaces for the sector. |
| #6 | Embedded Software Systems (ESS) | A software controller whose usage is dedicated to the equipment in which it resides (is embedded). |

*Table 5. The elements to be tested for level three*

| Element Number | Element | Description of Element |
|---|---|---|
| #7 | Architecture | The configuration of the internal elements of the product or product portfolio supplied. |
| #8 | Bespoke Development | When a firm undertakes a specific development project with a custom product or solution |
| #9 | Functionality | The extent of features and the level of engineering performance of the product or solution. |
| #10 | Collaborative Working | Partnering with other technology firms to work jointly on developing the product or solution. |

In this level we examine technology development which concerns identifying the paths available to a firm seeking to undertake product and technology innovation. The paths available to a firm need to be assessed in terms of the risks involved and the likelihood of success in exploiting that opportunity. The elements identified from the preliminary field research for The Technology Development (Level 3) are shown in Table 5.

Element #7 is Architecture which will assess to the approaches that a firm uses to configure its products in terms of technologies; hardware and software elements. This examines the platforms within the products in terms of how they are structured, for example, functional modules or on a modular basis.

Element #8 is Bespoke Development that concerns developing and providing products or solutions for customers which are purpose designed for them i.e. they are not derivative projects or incremental to the existing product portfolio. This will necessitate an appraisal of a firm's R&D assets i.e. the assets relating to product innovation including knowledge, expertise (technology; users; markets) and reputation.

Element #9 is Functionality which examines the breadth of capabilities of the product in terms of whether it provides product differentiation versus the competition.

Element #10 is Collaborative Working which refers to liaising with another business partner to develop new technologies; products or solutions. Afuah (2000) identifies co-opetitors as being "the suppliers, customers, and complementors whose very success may underpin that of the firm and with whom it must collaborate and compete." The benefits of external knowledge include higher levels of efficiency and customisation (Chen, 2004 and Harmsen et al, 2000).

## RESEARCH RESULTS AND DISCUSSION

The summary of the field results relating to the preliminary TIA-MARIA framework is given in Table 6. The lack of firms utilising elements 8 and 9 means that these elements (of Bespoke Development and Functionality), will no longer be included in the TIA-MARIA framework.

### Field Results for Level One

The field results into the elements concerning Industry Position (Level 1) confirmed that the two elements identified from the literature review were in fact employed by the mobile networking firms. Various forms of networks are employed within the case study firms and the innovation value chain allows the interaction to be identified amongst internal and external parties. It was clear that the identification of a strategic position for

*Table 6. Enterprise realignment framework: field results*

| Level | Element | Field Results |
|---|---|---|
| Industry Position | 1. Innovation Value Chain<br>2. Technology Leadership | 15 firms<br>15 firms |
| Application Provision | 3. Product Attributes<br>4. Optimisation<br>5. Interconnectivity<br>6. Embedded Software Systems (ESS) | 12 firms<br>15 firms<br>13 firms<br>6 firms |
| Technology Development | 7. Architecture<br>8. Bespoke Development<br>9. Functionality<br>10. Collaborative Working | 14 firms<br>3 firms<br>2 firms<br>9 firms |

Technology Leadership is not only dependent on environmental sensing (awareness and evaluation of external trends); it is also dependent on the organization and capabilities of the firm (Andrew and Sirkin, 2006, p.14).

## Field Results for Level Two

The majority of firms interviewed were focused on a small number of application sectors – enabling greater market knowledge leading to high results for Element #4 (Optimisation) and #5 (Interconnectivity). The field results showed that all but one of the case studies provides products and solutions which are highly optimised for the end-user application.

## Field Results for Level Three

Several of the respondents during interview commented on the split of R&D spend on product families versus other development activities. Firms with a strong emphasis on architecture approached it in various ways with four firms basing their product portfolios around product families – a traditional approach. Four other firms had established products based around a modular approach which enabled them to offer flexibility in their solutions. In contrast, one firm organised their product portfolio into "Application Families" which comprised generic products that were marketed to meet the needs of different applications. Firms have developed their mobile networking expertise in-house or externally, for example, acquiring specialist technology firms, for example, with audio recognition software which improves the audio performance of any voice-based product or system.

## FUTURE RESEARCH DIRECTIONS

Business model renewal and the associated enterprise realignment will be necessary for high technology companies as we enter the Intelligence Age comprising systems that can intelligently gather and evaluate data (e.g. the e-Home). Network nodes and devices for the Intelligence Age will be able to be "interrogated" for information to facilitate the network monitoring systems in their evaluation of system status. This extends the network node functionality beyond generating mere status reports to being able to perform partial processing of information themselves. The move to the Intelligence Age will require network nodes and devices that have M2M (machine-to-machine) connectivity.

There are also an increasing number of mobile user devices which need to be supported – both for industrial purposes and for consumer electronics.

High technology companies will see a proliferation of "always-on", battery-powered devices both in the home, the workplace and in hospitals. Further research into both of these aspects of mobile networking would be beneficial for firms understanding of innovation management.

## CONCLUSION

This chapter used cases study analysis of business model renewal to develop a framework for enterprise realignment. The framework is based on three levels which need to be addressed by high technology firms. It shows how a number of elements were identified for the framework based on literature survey and preliminary field research comprising two case studies. It also identified that the majority of the elements in the framework were supported based on further field research The supported elements for Industry Position (Level 1) are Innovation Value Chain and Technology Leadership.

The field results for Application Provision (Level 2) confirmed the strategic focus of high technology firms on this aspect. One company executive commented that hardware is becoming less and less important and that firmware and applications are key. This correlates with the trends in other high technology industries such as computing where major corporations are now providing IT services to businesses that they previously only supplied hardware to. The supported elements for Application Provision (Level 2) are Product Attributes; Optimisation; Interconnectivity and Embedded Software Systems (ESS). The supported elements for Technology Development (Level 3) are Architecture and Collaborative Working.

## REFERENCES

Afuah, A. N. (2000). How much do your co-opetitors' capabilities matter in the face of technological change? *Strategic Management Journal*, *21*(3), 397–404. doi:10.1002/(SICI)1097-0266(200003)21:3<397::AID-SMJ88>3.0.CO;2-1

Afuah, A. N., & Bahram, N. (1995). The hypercube of innovation. *Research Policy*, *24*(1), 51–76. doi:10.1016/0048-7333(93)00749-J

Ambrosini, M., & Bowman, C. (2009). What are dynamic capabilities and are they a useful construct in strategic management? *International Journal of Management Reviews*, *11*(1), 29–49. doi:10.1111/j.1468-2370.2008.00251.x

Ambrosini, M., Bowman, C., & Collier, N. (2009). Dynamic Capabilities: An Exploration of How Firms Renew their Resource Base. *British Journal of Management*, *20*(s1), S9–S24. doi:10.1111/j.1467-8551.2008.00610.x

Andrew, J. P., & Sirkin, H. L. (2006). *Payback – Reaping the Rewards of Innovation.* Boston, MA: Harvard Business School Press.

Chen, C. (2004). The effects of knowledge attribute, alliance characteristics, and absorptive capacity on knowledge transfer performance. *R & D Management*, *34*(3), 311–321. doi:10.1111/j.1467-9310.2004.00341.x

Chesbrough, H., & Rosenbloom, R. (2002). The role of the business model in capturing value from innovation: evidence from Xerox corporation's technology spinoff companies. *Industrial and Corporate Change*, (11): 529–555. doi:10.1093/icc/11.3.529

Cooper, R. G., Edgett, S. J., & Kleinschmidt, E. J. (1999). New product portfolio management: practices and performance. *Journal of Product Innovation Management*, *16*(4), 333–351. doi:10.1016/S0737-6782(99)00005-3

Davenport, S., Campbell-Hunt, C., & Solomon, J. (2003). The dynamics of technology strategy: an exploratory study. *R & D Management*, *33*(5), 481–499. doi:10.1111/1467-9310.00312

Day, G. S., Schoemaker, P. J. H., & Gunther, R. E. (2000). *Wharton on Managing Emerging Technologies.* New York: Wiley.

De Coster, R. (2009). A Business Planning Framework for WiMAX Applications. In I. Lee (Ed.), *Handbook of Research on Telecommunications Planning and Management for Business*. (pp. 433-446). New York: Information Science Reference.

Easterby-Smith, M., Lyles, M. A., & Peteraf, M. A. (2009). Dynamic Capabilities: Current Debates and Future Directions. *British Journal of Management*, *20*(s1), S9–S24. doi:10.1111/j.1467-8551.2008.00609.x

Eisenhardt, K. M. (1989). Building Theories from Case Study Research. *Academy of Management Review*, *14*(4), 532–550. doi:10.2307/258557

Eisenhardt, K. M., & Martin, J. A. (2000). Dynamic capabilities: what are they? *Strategic Management Journal*, *21*(10-11), 1105–1121. doi:10.1002/1097-0266(200010/11)21:10/11<1105::AID-SMJ133>3.0.CO;2-E

Fahy, J. (2000). The resource-based view of the firm: some stumbling-blocks on the road to understanding sustainable competitive advantage. *Journal of European Industrial Training*, *24*(2-4), 94–104. doi:10.1108/03090590010321061

Gatignon, H., & Xuereb, J. M. (1997). Strategic Orientation of the Firm and New Product Performance. *JMR, Journal of Marketing Research*, *34*(1), 7–90. doi:10.2307/3152066

Harmsen, H., Grunert, K. G., & Bove, K. (2000). Company competencies as a network: the role of product development. *Journal of Product Innovation Management*, *17*(3), 194–207. doi:10.1016/S0737-6782(00)00039-4

Hunt, S. D. (1999). *A General Theory of Competition: Resources, Competences, Productivity, Economic Growth.* London: Sage Publications.

Kalafatis, S. P., Tsogas, M. H., & Blankson, C. (2000). Positioning strategies in business markets. *Journal of Business and Industrial Marketing*, *15*(6), 16–437. doi:10.1108/08858620010349501

Lockett, A., Thompson, S., & Morgenstern, U. (2009). The development of the resource-based view of the firm: A critical appraisal. *International Journal of Management Reviews*, *11*(1), 9–28. doi:10.1111/j.1468-2370.2008.00252.x

McDermott, C. M., & O'Connor, G. C. (2002). Managing radical innovation: an overview of emergent strategy issues. *Journal of Product Innovation Management*, *19*, 424–438. doi:10.1016/S0737-6782(02)00174-1

Newey, L. R., & Zahra, S. A. (2009). The Evolving Firm: How Dynamic and Operating Capabilities Interact to Enable Entrepreneurship. *British Journal of Management*, *20*(s1), S81–S100. doi:10.1111/j.1467-8551.2008.00614.x

Pike, S., Roos, G., & Marr, B. (2005). Strategic management of intangible assets and value drivers in R&D organizations. *R & D Management*, *35*(2), 111–124. doi:10.1111/j.1467-9310.2005.00377.x

Prahalad, K., & Hamel, G. (1990, May-June). The Core Competence of the Corporation. *Harvard Business Review*, *68*(3), 79–90.

Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, *18*(7), 509–533. doi:10.1002/(SICI)1097-0266(199708)18:7<509::AID-SMJ882>3.0.CO;2-Z

Tidd, J., & Bodley, K. (2002). The influence of project novelty on the new product development process. *R & D Management*, *32*(2), 127–138. doi:10.1111/1467-9310.00245

Veryzer, R. W. (1998). Discontinuous innovation and the new product development process - Crafting a culture of innovation. *Journal of Product Innovation Management*, *15*(4), 304–321. doi:10.1016/S0737-6782(97)00105-7

## ADDITIONAL READING

Afuah, A. (2003). *Innovation Management: Strategies, Implementation and Profits*. New York: Oxford University Press Inc.

Branscomb, L. M., & Auerswald, P. E. (2003). *Taking Technical Risks: How Innovators Executives and Investors Manage High-tech Risks.* Cambridge, MA: The MIT Press.

Chesbrough, H. (2003). *Open Innovation: The New Imperative for Creating and Profiting Form Technology.* Boston, MA: Harvard Business School Press.

Chesbrough, H., Vanhaverbeke, W., & West, J. (Eds.). (2006). *Open Innovation: Researching a New Paradigm.* Oxford, UK: Oxford University Press.

Christensen, C. M. (1997). *The innovator's dilemma.* Boston, MA: Harvard Business School Press.

Cooper, R. G. (2000). Product innovation and technology strategy. *Research Technology Management*, *43*(1), 38–41.

Cooper, R. G., Edgett, S., & Kleinschmidt, E. J. (1999). New product portfolio management: practices and performance. *Journal of Product Innovation Management*, *16*(4), 333–351. doi:10.1016/S0737-6782(99)00005-3

Cooper, R. G., & Kelinschmidt, E. J. (1995). Performance typologies of new product project. *Journal of Industrial Marketing Management*, *24*, 439–456. doi:10.1016/0019-8501(95)00034-8

Dodgson, M. (1991). Technology Learning, Technology Strategy and Competitive Pressures. *British Journal of Management*, *2*(3), 133–149. doi:10.1111/j.1467-8551.1991.tb00022.x

Dodgson, M. (2000). *The management of technological innovation: an international and strategic approach.* Oxford, UK: Oxford University Press.

Eisenhardt, K. M., & Galunic, D. C. (2000). Coevolving: At Last a Way to Make Synergies Work. *Harvard Business Review*, *78*(1), 91–101.

Ernst, H. (2002). Success factors of new product development: A review of the empirical literature. *International Journal of Management Reviews*, *4*(1), 1–40. doi:10.1111/1468-2370.00075

Faems, D., Van Looy, B., & Debackere, K. (2005). Interorganizational Collaboration and Innovation: Toward a Portfolio Approach. *Journal of Product Innovation Management*, *22*(3), 238–250. doi:10.1111/j.0737-6782.2005.00120.x

Floricel, S., & Miller, R. (2003). An exploratory comparison of the management of innovation in the New and Old economies. *R & D Management*, *33*(5), 501–525. doi:10.1111/1467-9310.00313

Floyd, S. W., & Wooldridge, B. (2000). *Building Strategy from the Middle*. London: Sage Publications Ltd.

Goffin, K., & Mitchell, R. (2005). *Innovation management Strategy and Implementation with the Pentathlon Framework*. New York: Palgrave Macmillan.

Haour, G. (2004). *Resolving The Innovation Paradox: Enhancing Growth in Technology Companies.* New York: Palgrave Macmillan.

Koruna, S. (2004). Leveraging knowledge assets: combinative capabilities – theory and practice. *R & D Management*, *34*(5), 505–516. doi:10.1111/j.1467-9310.2004.00358.x

Krishnan, V., & Ulrich, K. T. (2001). Product Development Decisions: A Review of the Literature. *Management Science*, *47*(1), 1–21. doi:10.1287/mnsc.47.1.1.10668

McEvily, S. K., Eisenhardt, K. M., & Prescott, J. E. (2004). The global acquisition, leverage, and protection of technological competencies. *Strategic Management Journal*, *25*, 713–722. doi:10.1002/smj.425

Nonaka, I., & Yamanouchi, T. (1989). Managing innovation as a self-renewing Process. *Journal of Business Venturing*, *4*(5), 299–315. doi:10.1016/0883-9026(89)90003-7

Phaal, R., Farrukh, C., & Probert, D. (2004). Technology roadmapping—a planning framework for evolution and revolution. *Technological Forecasting and Social Change*, *71*, 5–26. doi:10.1016/S0040-1625(03)00072-6

Prahalad, C. K., & Krishnan, M. S. (2008). *The New Age of Innovation*. New York: McGraw Hill.

Rafinejad, D. (2007). *Innovation, Product Development and Commercialisation.* Fort Lauderdale, FL: J Ross Publishing.

Rochlin, D. (2006). *Hunter or Hunted? Technology, Innovation and Competitive Strategy*. Mason, OH: Thomson Higher Education.

Salaman, G., & Asch, D. (2003). *Strategy and Capability – Sustaining Organizational Change.* Oxford, UK: Blackwell Publishing.

Westland, C. (2008). *Global Innovation Management* (2008). New York: Palgrave Macmillan.

White, M., & Bruton, G. (2007). *Management of Technology and Innovation: A Strategic Application* (International Ed.). Mason, OH: Thomson Higher Education.

## KEY TERMS AND DEFINITIONS

**Application Provision:** the value of the firm's offering to the targeted market with essential attributes being provided for the end user's context.

**Bespoke Development:** the development of a product or solution for a specific customer contract.

**Business Model Renewal:** innovation management that goes beyond improvements to products or services but also on the way that the businesses operate including their organisational structures and business processes.

**Business Model:** the architecture of a firm including the business processes and resources that enable customer value and its competitive basis.

**Enterprise Realignment:** dynamic alterations to a firm's business model including organisational, management and strategic changes so that they are able to create value in a new market.

**Industry Position:** the positioning of the firm in the sector to secure competitive advantage by establishing value chain leadership along with technological differentiators.

**Value Chain:** the position of the firm within the value network of a sector linking suppliers and customers, including identification of potential complementors and competitors.

# Chapter 39

# Architectural Model for Supply Chain Orchestration and Management

**Marijn Janssen**
*Delft University of Technology, The Netherlands*

## INTRODUCTION

In a global economy, organizations are increasingly geographically dispersed, which means that the coordination process becomes increasingly complex and information-intensive. Conducting transactions and carrying out online business requires information sharing and supply chain coordination. An efficient and effective coordination of supply chains becomes increasingly important with competition taking place more and more at the level of supply chains, rather than at the level of individual organizations. Consequently, success in creating and maintaining a competitive advantage depends on the reconfiguration of supply chains.

Although organizations participating in a supply chain are becoming increasingly aware of the opportunities and threats of Information and Communication Technology (ICT) when it comes to improving coordination with their supply chain partners, organizations whose core business does not involve ICT and supply chain management often lack the knowledge and experience needed to coordinate of supply chains. In this respect, Supply Chain Coordinators (SCC) and Supply Chain Orchestrators (SCO) play a pivotal role in providing the means to automate and manage the coordination of supply chains (Hagel-III, Durchslag, & Brown, 2002). These specialized organizations can provide the necessary services and support to enable the creation and operation of supply chains.

Organizations increasingly find that, if they are to compete successfully in a global market and networked economy, they must rely on effective supply chains formed in networks (Hagel-III, Durchslag, & Brown, 2002). In recent decades, globalization, outsourcing and all kinds of information and communication technologies have enabled many organizations to operate solid collaborative networks in

DOI: 10.4018/978-1-61520-611-7.ch039

which each specialized business partner focuses on a limited number of key strategic activities.

From a system point of view, a complex network structure can be decomposed into individual components, which in turn need to be coordinated to operate in concert (Fan, Stallaert, & Whinston, 2003). In such a network, complimentary resources are provided by a number of cooperating and sometimes competing companies. One of the main advantages for companies cooperating in a network is the ability to deliver products by selecting the resources and appropriate companies that are able to deliver the service elements that are required. The aim of networks is to provide a range of products that individual organizations are unable to offer. In this chapter, we discuss the role of SCO, with the aim of deriving an architectural model for the integration of the activities of organizations in the supply chain. The architecture model is illustrated and evaluated using a case study.

## BACKGROUND

In literature, the concept of orchestration is discussed with great frequency, taking on a variety of different forms and names. Examples of central entities that perform coordinating tasks within networks range from 'supply chain coordinator' (Marijn Janssen, 2004), 'virtual value chain orchestration' (Hinterhuber, 2003) and 'value chain or business network orchestrator' (Hagel III, 2002) in the business domain, to 'process orchestrator' (Marijn Janssen, Gortmaker, & Wagenaar, 2006) and 'Network Administrative Organizations' (NAO) (Milward & Provan, 1995) in the public domain. Dhanaraj and Parkhee (2006) use the term 'network orchestration', which they define as "the set of deliberate, purposeful actions undertaken by the hub firm as it seeks to create value (expand the pie) and extract value (gain a larger slice of the pie) from the network". In essence, orchestration is aimed at connecting to consumers by coordinating the interdependent activities of (semi-)autonomous departments or agencies.

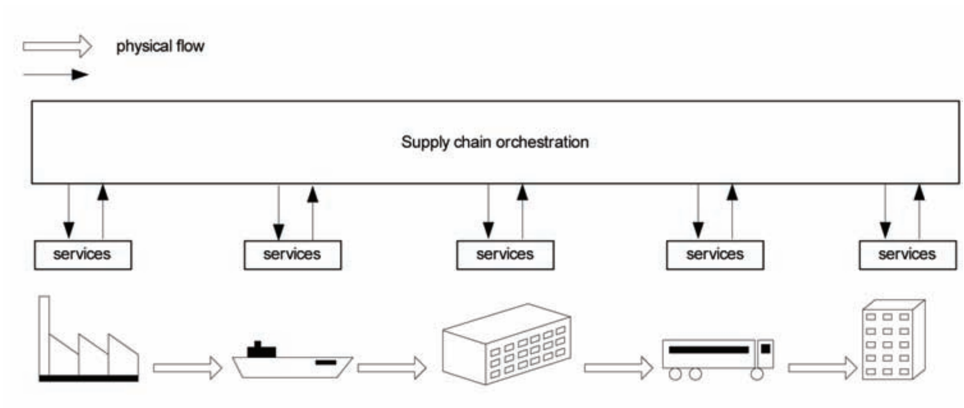
Because SCO is a continuously changing field, its roles and functions are not clear, but several attempts have been made to define a set of organizational roles. Hagel et al. (2002) identify seven roles: 1) select and recruit partners, 2) create incentives for participation and specialization, 3) define standards, 4) compose tailored supply chain processes, 5) take responsibility for the end product, 6) create feedback loops for learning, 7) cultivate understanding of processes and practices to improve quality. while Janssen et al. (2006) distinguish eight roles: (1) initiator and enabler, (2) developer, (3) standardization, (4) control and progress monitoring, (5) facilitator, (6) service and product aggregator, (7) accountability and (8) process improvement. Typically, these roles can be translated into functions and tasks that are necessary to orchestrate a supply chain. Typically, the introduction of orchestration requires a reengineering of business processes and a transformation of the supply chain structure.

Nowadays, many organizations use web services to provide customers access to their information. Web services are self-contained and encapsulate some kind of functionality (Fremantle, Weerawarana, & Khalaf, 2002). The interaction pattern among services is a known as Service-Oriented Architecture (SOA), in which a service is a well-defined and self-contained function that does not depend on the context or state of other services. Web service technology uses a loosely-coupled integration model that enables a flexible integration of heterogeneous systems in a variety of domains.

Web service orchestration is a viable technology when it comes to automating supply chains and can be used to create alliances among partners and connect organizations to the loosely coupled business processes of network partners (Tewoldeberhan & Janssen, 2008).

Figure 1 shows the position of the SCO and the use of services. Creating a supply chain begins

*Figure 1. Supply chain orchestration*

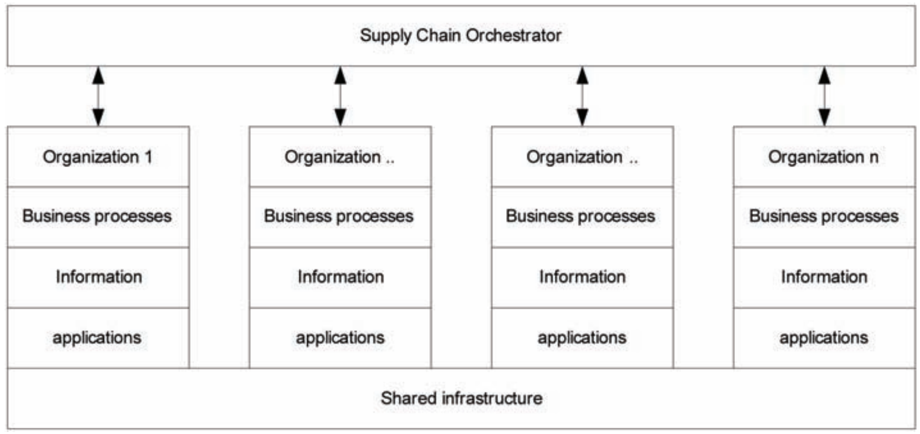



by selecting the organizations and their services, followed by an invocation of these services. The orchestration layer should contain the roles mentioned in the previous paragraph. Web service orchestration (WSO) coordinates the sequence of web service invocations (Zhao & Cheng, 2005). WSO and web service technology makes it much easier to create loosely coupled supply chain processes compared to previous technologies. Orchestrating the activities of the independent organizations in a business network leads to the temporary formation of a 'chain', designed to manufacture products as a 'virtual' set of pooled skills and resources to fulfill orders. Because larger numbers of business systems can be accessed using web services, research emphasis is shifting away from the technological level towards the process-related and information-sharing level and the orchestration of supply chains.

## ARCHITECTURAL MODEL FOR ORCHESTRATION AND MANAGEMENT

Although the invocation of web services is a necessary element, it is not sufficient to create a supply chain. Other elements, including contracts and agreements are necessary, insight into the quality of the products and potential contribution to the supply chain, also play a crucial role. Creating supply chains requires an architecture that covers a range of aspects involving technology, information, process and organization, which is why the architecture model presented in this chapter is based on a layered approach that is aimed at dealing with the complexity involved (e.g. Stallings, 2006), in accordance with the principles of SOA. When using an SOA, the basic idea is to decompose a system into parts that are made accessible by services, to design these services individually and to construct new systems using these individual services (e.g. Cherbakov, Galambos, Harishankar, Kalyana, & Rackham, 2005). Adopting a service orientated provides organization with various benefits, making it possible to create services that are "modular, accessible, well-described, implementation-independent and interoperable" (Fremantle, Weerawarana, & Khalaf, 2002, p. 80), including business services and low-grained software services. The types of services that can be offered can be categorized and distributed among the various layers. We use the organizational layer to describe the responsibilities for the relevant roles and functions, the business process layer to create supply chains, the information layer to identify the informational assets and information needed to operate a supply chain

*Figure 2. Architectural model for the orchestration of supply chains*




effectively, the application layer to include the many software systems and applications and the shared infrastructure layer to enable the technological connectivity. An example of the latter is the Internet. As such, this layer is visualized as a layer providing the shared foundation that is used by many organizations. Together, these layers create an architectural model for supply chain orchestration, as depicted in Figure 2.

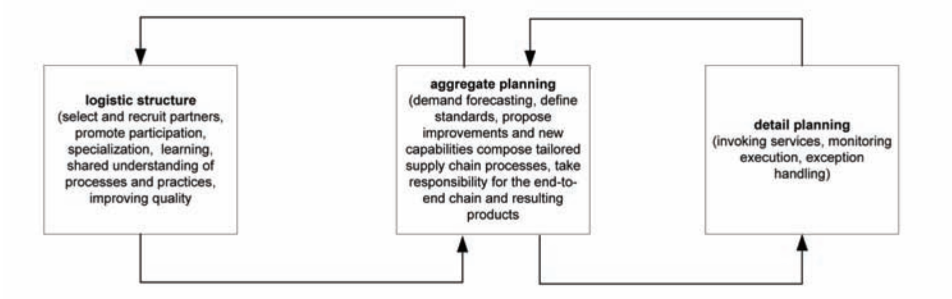
## Issues, Controversies, Problems

Romme and Hoekstra (1992), and Janssen (2004), among others, describe *logistic control* models that can be used to describe the coordination of logistical activities within a supply chain. A logistic control model can be used to describe activities that need to be supported by a supply chain orchestrator. These activities can be distributed among three areas: 1) the logistical structure, 2) the aggregate planning and control and 3) the detail planning and control of the physical goods flow. In Figure 3, the roles and activities of SCO, as discussed in the background section, are mapped on to the logistic control model. Many of the activities are related to the creation of the logistical structures, because this involved fostering and creating a network of organizations that are or can be used in a supply chain.

The *logistic structure* contains the roles that are required to create value from a network of organizations that allows them to remain competitive. When changes occur in the configuration of the supply chain partners, they may have to negotiate their positions. *Aggregate planning* involves long-term planning aimed at ensuring the supply chain partners possess the capabilities required to deliver their products. In addition, it involves making long-term reservations for scarce resources based on expected demand. On a practical level, this involves, for instance, negotiations between shippers and carriers about the prices and quantities of resources that need to be reserved. *Detailed planning* involves the invocation of services and incorporates the day-to-day operations, including the daily scheduling of resources.

Mapping the SCO roles on to the logistic control model provides some interesting insights. While the roles identified by Hagel et al. (2002) and Janssen et al. (2006) focus primarily on the left of Figure 3, SOA and web services technology focus primarily on the right, which indicates that most research in this area tends to look at the more strategic level, while at the same time there is a technology push that results in the adoption of technology aimed at easing the creation of loosely coupled supply chains.

*Figure 3. Orchestration roles distributed among control levels*




## Solutions and Recommendations

There are many solutions available for web service orchestration, which can be positioned in the 'detail planning' level in Figure 3. They help invoke services, monitor and trace their execution and deal with exceptions. This type of software can be built from software provided by the main software vendors like Microsoft and Oracle. At the moment, there is a lack of readily available solutions to deal with supply chain orchestration in an effective way at the aggregate planning and logistic structure levels. The problems involved transcend technological interoperability and involve organizational issues and strategic choices that need to be addressed. Taking into account the limited experiences, examples and research in this area, the lack of readily available solutions is not surprising.

## FUTURE RESEARCH DIRECTIONS

Service-oriented architectures, web services and web service orchestration provide the basic technologies for creating and executing supply chains. It is expected that SOA will be used to standardize process orchestration in supply chains. As more and more business systems can be accessed using web services, research emphasis is shifting from enhancing interoperability at the data exchange level towards the semantic and pragmatic levels. At the semantic level, all kinds of standards are being developed, which need to be translated into software solutions that may result in the rapid adoption and diffusion of these technologies. The most important obstacles to the rapid creation of new supply chains are not merely technological in nature. In fact, organizational, legal, political, and social aspects may prove a much greater challenge (Janssen & Scholl, 2007). As such, research efforts should focus more on the pragmatic level.

The architectural model and roles need to be worked out in greater detailed based on case studies, making it possible to create a detailed reference model that can used by SCO and other organizations to create supply chains and that will identify the various issues that need to be addressed in supply chain orchestration.

## CONCLUSION

Because businesses increasingly compete at the level of supply chains, the effective coordination and management of supply chains has become a key success factor. Often, Supply Chain Orchestrators (SCO) often coordinate supply chains by taking deliberate actions to create value from those supply chains. In this chapter, we have presented an architectural model aimed at integrating the activities of organizations taking part in a supply chain. The architecture model consists of a number of layers that are needed to create interoperable and agile supply chains. The main goal of this reference architecture is to enable the orchestration of cross-organizational processes by overcoming interoperability-related problems. The architectural model emphasizes the individual layers (organization, business process, information, application and shared infrastructure) and addresses the integration of the supply chain at all levels.

Next, we mapped the SCO roles on to the logistic control model, providing insight into the roles that are relevant in carrying out logistical functions. Because this is a research are that is still under development, more research is needed to work out the architectural model presented in this chapter in greater detail. Nevertheless, the model presented here provides SCO's and other organizations insight into the various issues that need to be addressed in order to make their supply chain as effective and competitive as possible in a global economy.

## REFERENCES

Cherbakov, L., Galambos, G., Harishankar, R., Kalyana, S., & Rackham, G. (2005). Impact of service orientation at the business level. *IBM Systems Journal*, *44*(4), 653–668.

Dhanaraj, C., & Parkhe, A. (2006). Orchestrating Innovation Networks. *Academy of Management Review*, *31*(3), 659–669.

Fan, M., Stallaert, J., & Whinston, A. B. (2003). Decentralized Mechanism Design for Supply Chain Organizations Using an Auction Market. *Information Systems Research*, *14*(1), 1–22. doi:10.1287/isre.14.1.1.14763

Fremantle, P., Weerawarana, S., & Khalaf, R. (2002). Enterprise services. Examine the emerging files of web services and how it is integrated into existing enterprise infrastructures. *Communications of the ACM*, *45*(20), 77–82.

Hagel, J. III. (2002). Leveraged Growth - Expanding Sales Without Sacrificing profits. *Harvard Business Review*, 69–77.

Hagel, J., Brown, J. S., & Durchslag, S. (2002). *Orchestrating Loosely Coupled Business Processes: The Secret to Successful Collaboration*.

Hagel-III. J., Durchslag, S., & Brown, J. S. (2002). *Orchestrating Loosely Coupled Business Processes: The secret to successful business collaboration*. Unpublished manuscript.

Hinterhuber, A. (2003). Value Chain Orchestration in Action and the Case of the Global Agrochemical Industry. *Long Range Planning*, *35*(6), 615–635. doi:10.1016/S0024-6301(02)00160-7

Janssen, M. (2004). Insights from the Introduction of a Supply Chain Co-ordinator. *Business Process Management Journal*, *10*(3), 300–310. doi:10.1108/14637150410539704

Janssen, M., Gortmaker, J., & Wagenaar, R. W. (2006). Web service orchestration in public administration: Challenges, roles and growth stages. *Information Systems Management*, *23*(2), 44–55. doi:10.1201/1078.10580530/45925.23.2.20060301/92673.6

Janssen, M., & Scholl, J. (2007). *Interoperability of Electronic Governance.* Paper presented at the International Conference on Electronic Governance (ICEGOV 2007), Macau, China.

Milward, H. B., & Provan, K. G. (1995). A preliminary theory of network effectiveness: A comparative study of four community mental health systems. *Administrative Science Quarterly*, *40*(1), 1–33. doi:10.2307/2393698

Romme, J., & Hoekstra, S. (1992). *Integral logistics structure: developing customer oriented goods flows*. London: McGraw-Hill.

Stallings, W. (2006). *Data and Computer Communications.* Upper Saddle River, NJ: Prentice Hall.

Tewoldeberhan, T., & Janssen, M. (2008). Simulation-based experimentation for designing reliable and efficient web service orchestrations in supply chains. [ECRA]. *Electronic Commerce Research and Applications*, *7*(1), 82–92. doi:10.1016/j.elerap.2006.11.007

Zhao, J. L., & Cheng, H. K. (2005). Web services and process management: a union of convenience or a new area of research? *Decision Support Systems*, *40*(1), 1–8. doi:10.1016/j.dss.2004.04.002

## ADDITIONAL READING

Ballou, R. H. (1992), *Business Logistics Management*. Englewood Cliffs, NJ: Prentice-Hall

Checkland, P. (1981). *Systems Thinking, Systems Practice*. Chichester, UK: Wiley.

Fawcett, S.E. (1995). Using Strategic Assessment to Increase the Value-added Capabilities of Manufacturing and Logistics. *Production and Inventory Management Journal,* 33-37.

Gill, L. E., & Allerheiligen, R. P. (1996). Co-operation in Channels of Distribution: Physical distribution leads the way. *International Journal of Physical Distribution & Materials Management*, *26*(5), 49–63.

Hinterhuber, A. (2003). Value Chain Orchestration in Action and the Case of the Global Agrochemical Industry. *Long Range Planning*, *35*(6), 615–635. doi:10.1016/S0024-6301(02)00160-7

Hoekstra, S., & Romme, J. (1992). *Integral Logistic Structures: Developing customer oriented goods flows*. London: McGraw-Hill.

Hoogewegen, M. R. (1997). *Modular Network Design: Assessing the Impact of EDI*. Doctoral Dissertation, Erasmus University, Rotterdam, The Netherlands.

In Lee. (2008). E-business models, services, and communications. Idea Group Inc (IGI).

Janssen, M. (2001)' *Designing Electronic Intermediaries. An agent-based approach for designing interorganizational coordination mechanism.* Doctoral Dissertation, Delft University of Technology, Delft, The Netherlands.

Janssen, M., & Joha, A. (2008). Emerging Shared Service Organizations and the Service-Oriented Enterprise: Critical Management Issues. *Strategic Outsourcing. International Journal (Toronto, Ont.)*, *1*(1), 35–49.

Janssen, M., & Klievink, B. (2009). The Role of Intermediaries in Multi-channel Service Delivery Strategies. [IJEGR]. *International Journal of E-Government*, *5*(3), 36–46.

Janssen, M., & Verbraeck, A. (2008). The Strengths and Weaknesses of Internet-Based Matching Mechanisms for the Transport Market. *Transportation research Part E (TRE), Logistics and transportation review, 44*(3), 475-490.

JS Brown, S Durchslag, J Hagel III (2002). Loosening up: How process networks unlock the power of specialization. *The McKinsey Quarterly*, 59-69.

Kambil, A., & Short, J. E. (1994). Electronic Integration and Business Network Redesign: A roles-linkage perspective. *Journal of Management Information Systems*, *4*(10), 59–83.

Kettinger, W. J., Teng, J. T. C., & Guha, S. (1997). Business Process Change: A study of methodologies, techniques, and tools. *MIS Quarterly*, *21*(1), 55–79. doi:10.2307/249742

Lee, H. L.(20004). The triple supply chain. *Harvard Business Review*, *82*(10), 102–121.

Lim, B., & Wen, H. J. (2003). Web Services: An analysis of the technology, its benefits and implementation difficulties. *Information Systems Management*, *20*(2), 49–57. doi:10.1201/1078/43204.20.2.20030301/41470.8

Linthicum, D. S. (2004). *Next Generation Application Integration: From Simple Information to Web Service*: Addison Wesley.

Pramatari, K. (2007). Collaborative supply chain practices and evolving technological approaches. *Supply Chain Management: An International Journal*, *12*(3), 210–220. doi:10.1108/13598540710742527

Riggins, J. F., & Mukhopadhyay, T. (1994). Interdependent Benefits from Interorganizational Systems: Opportunities for business partner reengineering. *Journal of Management Information Systems*, *11*(2), 37–56.

Rosenschein, J. S., & Zlotkin, G. (1994). *Rules of Encounter: Designing conventions for automated negotiation among computers*. Cambridge, MA: The MIT Press.

Shapiro, C., & Varian, H. R. (1999). Information Rules: A strategic guide to the network economy. *Harvard Business School Press.*

Tewoldeberhan, T., & Janssen, M. (2008). Simulation-based experimentation for designing reliable and efficient web service orchestrations in supply chains. [ECRA]. *Electronic Commerce Research and Applications*, *7*(1), 82–92. doi:10.1016/j.elerap.2006.11.007

van Goor, A. R., Ploos van Amstel, M. J., & Ploos van Amstel, W. (1994), *Fysieke distributie: denken in toegevoegde waarde*. Houten, The Netherlands: Stenfert Kroese.

Weerakkody, V., Currie, W. L., & Ekanayake, Y. (2003). Re-engineering business processes through application service providers: Challenges, issues and complexities. *Business Process Management Journal*, *9*(6), 776–794. doi:10.1108/14637150310506693

Wigand, R. T., Picot, A., & Reichwald, R. (1997). *Information, Organization and Management. Expanding markets and corporate boundaries*. Chichester, UK: John Wiley & Sons.

Zhao, J. L., & Cheng, H. K. (2005). Web services and process management: a union of convenience or a new area of research? *Decision Support Systems*, *40*(1), 1–8. doi:10.1016/j.dss.2004.04.002

## KEY TERMS AND DEFINITIONS

**Middleware:** Technology that enables the exchange of information between information systems and that encapsulates implementation details

**Network Orchestration:** The set of deliberate, purposeful actions undertaken by the SCO firm to create value from the organizations that are part of the network

**Service Oriented Architecture (SOA):** An architectural style, in which application functionality is not provided by one large monolithic application, but by services that can be combined to create the required functionality.

**Supply Chain Management (SCM):** The management process involving the planning, implementing and controlling of a portfolio of assets (human, equipment, components, etc.) and relationships (customers, suppliers, staff, etc.) to transform a customer's product from raw material to finished product as efficiently and effectively as possible.

**Supply Chain Orchestrator (SCO):** The entity responsible for managing and orchestrating the activities needed to create, execute and improve supply chains

**Supply Chain:** The distribution channel of a product, from its sourcing to its delivery to the end-user (also known as the value chain).

**Web Service Orchestration:** The process of invoking internal and external web services from a predefined process flow that is executed by an orchestration engine (www.w3c.org).

**Web Service:** A technology that enables the provisioning of functionality, at an application level or at a business level, by means of a standardized interface in such a way that it is easily invoked via Internet-protocols.

# Chapter 40
# Ambient E-Service:
## A Bottom-up Collaborative Business Model

**Yuan-Chu Hwang**
*National United University, Taiwan*

## INTRODUCTION

The e-services have introduced a significant wave of change in communication patterns around the world. Such e-services are capable of intelligent interaction and are able to discover and negotiate with each other, mediate on behalf of their users and reconfigure themselves into services that are more complex.

In this chapter, the author explores the future opportunities and its applications of ambient e-service. Contrast to traditional e-business service delivery method, their proposed service focus on the bottom-up collaborative approach that enables e-business participants to cooperate with nearby users and encourage information sharing and experience co-creation. The notion of ambient e-service is defined to identify a new scope of mobile e-service, which address dynamic collective efforts between mobile users (enabled by Mobile Peer-to-Peer technology), dynamic interactions with ambient environments (envisioned by Location-Based Service), the moment of value (empowered by wireless technologies), and low cost service provision. Several ambient e-service application scenarios will be introduced in the following sections.

The author will present an ambient e-service framework that characterizes ambient e-services with three dimensions (value stack, environment stack and technology stack). Several ambient e-service applications are also exemplified, which rest on the mobile peer-to-peer technology and ambient context aware sensors environments. Ambient e-service make a ubiquitous e-business user not only connect to dynamic ambient environments but also cooperate with other mobile users in the nearby surrounding environment, capitalizing dynamic environmental values as well as dynamic social values.

DOI: 10.4018/978-1-61520-611-7.ch040

## BACKGROUND

Mobile commerce promises to deliver the real potential of Internet for commercial purposes to a significantly expanded market of existing and new users. A four-level integrated mobile commerce framework has been proposed (Varshney & Vetter, 2002), that discusses how to successfully define, construct, and implement the necessary hardware/software infrastructures in support of mobile commerce. Wireless technology and mobile networks make it possible for mobile users to connect to the Internet, and mobile-service applications have become popular. With the appearance and penetration of mobile devices such as notebooks, PDAs, and smart phones, ubiquitous systems are becoming increasingly popular these days.

Examples of mobile commerce applications include: mobile financial applications such as m-banking, m-brokerage services that allow the mobile device to become the financial medium, mobile advertising applications that attempt to transform the wireless environment into a new marketing battlefield, and mobile shopping services. In other words, mobile commerce has ushered in a slew of new opportunities and new applications in e-commerce and e-business. However, the applications reviewed in Varshney & Vetter (2002) were grounded in the client/server architecture where the interactions involved are between a services provider and a mobile user, and did not including possible interactions between the mobile user and the environment or other nearby mobile users.

## OVERVIEW OF AMBIENT E-SERVICE

The improved portability and battery life make it possible for mobile users can make use of almost the same range of services as desktop users. Emerging ubiquitous computing that utilizes and integrates pervasive, wireless, embedded, wearable and/or mobile technologies to bridge the gaps between the digital and physical worlds. Ubiquitous computing envisions a world of fully connected devices, with cheap wireless networks everywhere. The ambient e-services are similar to applications on mobile ad-hoc networks, which are a collection of autonomous peers or terminals that communicate with each other over relatively bandwidth-constrained wireless links. Ambient intelligence is a way of subtly gathering information from an environment and acting on it (Curtis et.al, 2009).

Although mobile commerce grown in a remarkable fashion, most existing mobile services and applications were designed based on client/server architecture. The notion of ambient e-service is defined to identify a new scope of mobile e-services (Hwang & Yuan, 2007). In the foundational mobile commerce framework, mobile users were essentially standalone users due to the lack of technology functions and communication channels that enabled mobile users to interact with each other. Interactions between mobile users were not considered an important issue in mobile service scenarios. Consequently, the collective value generated from a peer group of mobile users (or multiple peer groups) cannot be realized.

Peer-to-Peer (P2P) computing is a networking and distributed computing paradigm which allows the sharing of computing resources and services by direct, symmetric interaction between computers. The latest P2P technology (e.g., JXTA) enables mobile e-services to take the next step. This technology makes it possible for individual mobile peers to communicate with each other and wirelessly exchange information under sensor-enabled environments. Collaborative interactions between mobile users create a new paradigm for mobile telecommunications. This new framework for mobile applications, its dynamic environments, and the collective efforts of mobile users, are deserving of investigation.

P2P computing has increasingly emerged at the forefront of Internet computing. A concept involving cooperative computing and resource sharing (i.e., collective efforts), has been around for quite a while (Kant, Iyer, & Tewari, 2002). P2P has opened up possibilities of very flexible web-based information sharing based on the fixed Internet foundation. Applying the notion of P2P to mobile environments, mobile P2P (M-P2P) seeks to enable the power of collective effort in the mobile world. Supporters argue that mobile users can exchange their own experiences, eliminating the barrier of asymmetric information. That is, collaboration between mobile users better empowers a mobile user than the situation where the user is standalone.

On the other hand, ambient intelligence refers to the vision that technologies become invisible, embedded in our natural surroundings, present whenever we need them, enabled by simple and effortless interactions attuned to all our senses, adaptive to users and context and autonomous acting (Lindwer et al., 2003). In other words, ambient intelligence embeds information representation in everyday objects (lights, pens, watches, walls and wearable, etc.), making the physical environment an interface with the digital one. In this paper, the author envisions this idea as mobile e-services built with the M-P2P technology, exploiting the idea of ambient e-services.

Mobile connectivity is a prerequisite for the development of true ambient intelligence system. The concept of ambient intelligence requires the interaction of a variety of devices, appliances, sensors, and processors with persons who should not feel constrained in their movement when using the system (Aarts, 2009). Wireless e-services can potentially be personal, timely and relevant, or even integrated with other services in a near-seamless way (Katz-Stone, 2001). Within ambient environments, wireless handheld devices are personal to a user and carried by the person; the context of the user (e.g., time and place) can be measured and interpreted; services can be provided at the point of need; and applications can be highly interactive, portable and engaging. The key to wireless e-service is the moment of value -- according to the dynamic surrounding environment, is this moment the correct moment for what the user is trying to do?

## Collaborative Bottom-Up Service Innovation

We are entering the era called bottom-up economy which emphasis the co-creation of value by all participants. As the Internet's influence grows, we are seeing its intrinsic egalitarianism and tendency to empower the small start to change many aspects of modern life. All participants within ambient environment achieved the collaborative e-services jointly. Ambient e-service users could enable the information value-added process through the autonomous collaboration and interactions with nearby users.

Ambient e-services go a step further than sensor network environments. In a sensor network environment, peers within the range may not know who other peers are (i.e., social context is confidential and presumed to be retained privately). But ambient e-services are capable of leveraging the private social context of peers or past interactive experience, diversifying the potential opportunities for dynamic collective effort. For instance, mobile users may exchange their own experiences of certain items in a shopping mall. Social connections between mobile users, collaborative relationships and the trust or reputation basis for mobile user interactions cannot be realized in a sensor network environment.

In short, there are two distinguishing characteristics that make the P2P design more appropriate for ambient e-services than client/service architecture. Social connections based on the context aware environment provide trustworthy linkages, while keeping sensitive data from others. How is sensitive data handled? The social context is retained solely in the personal devices. Otherwise, the prospect of seeing their sensitive data stored in a central server will make users less willing to participant in such services. Further, by comparison with client/server architecture, P2P design makes the connection numbers grow in rapid progression, especially in an open space. This diversifies information source heterogeneity.

Ambient e-service can be treated as a new scope of ubiquitous e-services that highlight the collective effort of nearby participants within its environment. Ambient e-service focuses on the lightweight computation and short-range interactions within the e-service environment. Based on the MP2P architecture, ambient e-Service highlights interactions with the environment and nearby users. Unlike the global reach of the internet architecture, all available users may be found only within a limited range. All available data are not only acquired from nearby users but also the latest experiences within surrounding environment. Users may obtain real-time experiences with nearby users and share the moment of value.

The ambient e-service can be viewed as a collaborative bottom-up service innovation. The collective effort of individuals is gathered through ambient e-service. The valuable information is widely exchanged within ambient e-service environment. Participants of ambient e-service can utilize the power of collective efforts and achieve certain objectives.

## THE FRAMEWORK OF AMBIENT E-SERVICE

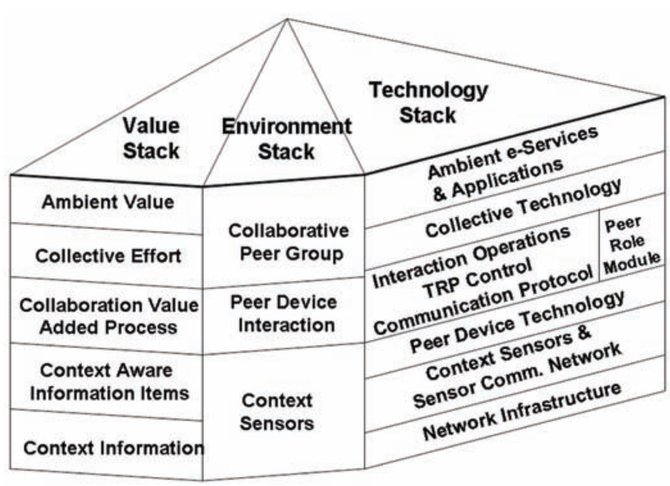
The notion of ambient e-service identifies a new scope of mobile e-service, which addresses dynamic collective efforts between mobile users (enabled by Mobile Peer-to-Peer technology), dynamic interactions with ambient environments (envisioned by Location-Based Service), the moment of value (empowered by wireless technologies), and low cost service provision.

The author presents the ambient e-service framework in Figure 1, which identifies some possible deliverable values of ambient e-service and addresses the technologies required to support the applications of ambient e-service. The framework is composed of three dimensions: the value stack, the environment stack and the technology stack. Descriptions of each stack are given below.

### The Value Stack

The ambient value stack comprises five layers representing the supporting value layers for ambient e-service. The deliverables of higher levels requiring the provision of deliverables of lower levels that presents the bottom-up approach collaboration. The ambient value stack is shown in Figure 2.

*Figure 1. The ambient e-service framework*



The basic layer of ambient value stack is the "Context Information", which is derived from the ambient sensor environments. A mobile user can interact with the environment (for example, when entering a room) and the context sensors then communicate with the device the user carries (informing the user of his/her location). Examining the user's profile, the second layer "Context aware Information Items" sends to the user information that matches his/her preferences. The information received from the environments may be useful to the user, but some of it may be irrelevant. Using its communication abilities, a mobile peer can collaborate with another mobile peer and exchange information stored in their mobile devices. Through these collaborative interactions, the user may discover someone whose information is valuable and thus exchange or trade with them using a micro payment or barter process. This is called the "Collaboration Value Added Process".

A peer may also interact with a peer group of multiple peers. Aiming at the same goals or interests, a peer group may combine the abilities of individual members, or explore their collective knowledge to accomplish goals that are impossible for a single peer to attain. In other words, "collective effort" represents the power of a peer group (or multiple peer groups). The ambient value would then be generated by the collective efforts of peer interactions or peer group interactions.

## The Environment Stack

The environment stack consists of three layers indicating the supporting environment layers for ambient e-service (environments of higher levels comprising those lower levels). The sketched stack diagram is shown in Figure 3.

"Ambient Context Sensors" form the bottom layer, which includes three categories of environment. Schilit, Adams and Want argue that the important aspects of context are: where the user is, who the user together with, and what resources are nearby (Schilit, Adams, & Want, 1994).

The user environment includes the user context, the activity context and the social context. The user environment represents the profile of a user, including peer identification, where the user is, who the user is, user preferences, user privacy concerns, user social situation and relations with others, and so forth. The physical environment includes the physical context and the device context. The physical environment refers to things like temperature, noise and lighting level, along with the device context. The computing environment includes the network context and the services context. The computing environment represents the network connectivity, available processors, cost of computing, bandwidth, and available nearby services, and similar information.

The layer "Peer Device Interaction" represents environments (featuring peer-to-peer interac-

*Figure 2. The ambient value stack*

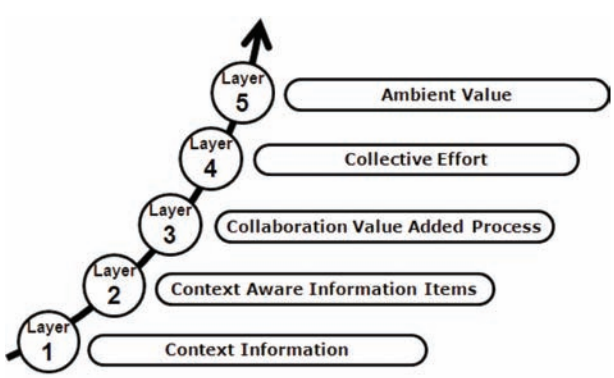
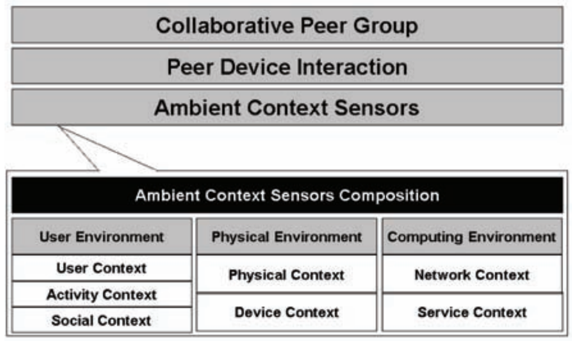


*Figure 3. The ambient environment stack*




tions) in which mobile users may exchange their experiences and trade information with nearby peers. The "Peer Device Interaction" layer rests on the "Ambient Context Sensors" layer; that is, all peer information originally derives from interaction with the dynamic environments of the bottom layer.

The top layer of the environment stack represents environments featuring peer group interactions and collaboration. The peer group is capable of combine the power of every peer in the group for certain objectives, including collective purchases, forming a task-oriented workforce group, or collaborative filtering)

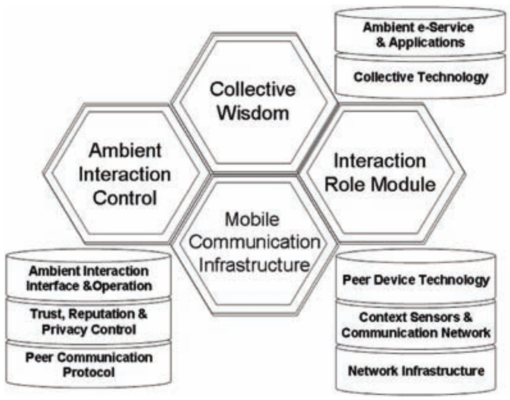
## The Technology Stack

The ambient technology stack is displayed in Figure 4 below. The combinative hexagon diagram represents the conceptual technology stacks, while the individual hexagon diagrams can be further elaborated into the detailed stacks. The technology stack can be categorized into four highly correlated major parts. The hexagon named "Mobile Communication Infrastructure" represents the fundamental technologies for ambient e-service environment communications, which include the network infrastructure layer, context sensors and communication network layer, and peer device technology layer. The "Ambient Interaction Control" hexagon represents technologies involved in enabling mobile devices to interact with other devices within the ambient e-service environment. This layer includes the peer communication protocol layer, the trust, reputation, and privacy control layer, and the ambient interaction interface and operation layer. The "Interaction Role Module" hexagon is related to the technology for various roles involved in the ambient e-service environment. Both the Ambient Interaction Control hexagon and the Interaction Role Module hexagon are based on the Mobile Communication Infrastructure hexagon. The Collective Wisdom hexagon is the uppermost of the three conceptual technology hexagons. It represents related collective technology that facilitates various ambient e-service applications. Advanced introduction of these ambient technology stacks is described below.

Network infrastructure is the fundamental basis of all ambient technology stacks. The wired and wireless hybrid network provides the basic communication infrastructure for context sensors and peer devices. Above the network infrastructure layer, context sensors interact with the surrounding peers via the sensor communication network. Peer Devices Technology lies atop the sensor communication network layer, which includes the hardware, operation systems and software platforms of the mobile device.

The layer above the peer device technology layer has two folds: (1) For peers to interact with

*Figure 4. The ambient technology stack*




each other, a peer communication protocol is required (similar to that used in web services). (2) In ambient environments, peers may know nearby peers for only a short period of time. How can a peer trust nearby peers? Is it possible to build a reputation system that enables peer trust? Similarly, privacy control should be addressed in an ambient e-service. With trust, reputation, and privacy control as the basis of communication, mobile users then can engage ambient interactions to handle operations between nearby mobile peers. These operations include such activities as "discovery", "request", "respond", "bargain", "transact" and "delivery".

Since a mobile user plays different roles in different interactions, the peer role module can be applied to the peer in response to the dynamic roles rendered. Mobile users who have information required by other users, play the seller role by applying the seller module. Surrounding peers (who have obtained various kinds of information) then play the broker role by applying the broker module. Mobile users who need information from others apply the buyer module and play the buyer role (they can trade or barter with other mobile users).

Beyond peer to peer interactions, a peer group's collective effort is the communal power for everyone. Technologies that support peer and peer group distributed collaboration constitute a key feature of ambient e-service. Collective aspects of ambient e-service will be discussed in the next section.

## Ambient E-Service Applications

It is useful to begin by making a distinction between two kinds of ambient e-services, services for distributed trading, and services for distributed collaboration. The social context and the rapid growth of connections are the major incentives for using the ambient e-service design. These two characteristics are not mutually exclusive; of course, a particular scenario may apply to either or both of the ambient characteristics.

This section aims to identify several important ambient e-service application scenarios (as shown in Table 1) on the assumption that ambient environments for mobile commerce have been provided. Without loss of generality, the physical context of location is referenced and considered in the ambient environments addressed in the following scenarios, naturally relating to the LBS (Location-Based Service) research. As mentioned previously, ambient e-services aim to identify a new scope of mobile e-services that primarily address dynamic collective efforts between mobile users (enabled by Mobile Peer-to-Peer) and dynamic interactions with ambient environments (envisioned by LBS) and low cost service provision.

LBS has been categorized into four major types: transaction services, information services, navigation and tracking services, and security services (Lim & Saiu, 2003), in this chapter the author identify selected ambient service application scenarios that reflect the four LBS categories, as well as exhibit dynamic collective efforts based on M-P2P.

The shopping mall scenario can easily be modified to represent ambient security services. An information distribution cooperation scenario is then offered as an exemplar of ambient information service provision. The ambient location information acquisition scenario may be considered

*Table 1. Ambient e-service applications*

| Scenario | Details |
|---|---|
| Ambient Shopping Mall | E-service applications in which a mobile peer can receive ambient shopping mall information from a shopping mall broadcast station based on its location. Peers can then trade information with other nearby peers (who may have received other information from other shopping mall locations). |
| Information Distribution Cooperation | E-service applications which enabled a mobile peer to barter information with nearby peers coming from different ambient environments, speeding the diffusion of information. |
| Ambient Location Information Acquisition | E-service applications in which a mobile peer can acquire information on needed locations from nearby peers, when the location information is required for using certain location-based services, but local environments and devices cannot provide it. In that case, such location information becomes a valuable asset. |
| Peer Group Cooperation | E-service applications which enable collaborative peer group interactions. In this scenario autonomous peers work cooperatively to realize a collective effort or goal. |

either instance of ambient information services or of ambient navigation and tracking services. Finally, a peer group cooperation scenario is presented, with reference to ambient navigation and information services.

This chapter use the shopping mall scenario as the representative case for the collective wisdom illustration, categorized as a distributed collaboration application. In the shopping mall scenario, mobile users may not recognize most of the participants, and the uncertainty level of the environment is higher than in all other scenarios. A user may depend on the collaboration of peers and peer groups to diminish the risks involved in transactions with unfamiliar peers. Detailed elaboration of each scenario could be found in Hwang and Yuan's work. (Hwang & Yuan, 2007, pp. 54-60).

Collective efforts of mobile users are not possible in the current mobile services framework that deploys services using the client/server architecture. These applications differ from previous mobile e-services in addressing dynamic collective efforts between mobile users and dynamic interactions with ambient environments. Moreover, mobile devices in ambient e-services applications are personal to the users. The social contexts retained in personal devices (e.g., the social relationships in the vicinity) can thus generate the e-services of much higher complexity and security than the social contexts in sensor networks. E-services using a social context environment render ambient e-services capable of providing enhanced collaborative power for mobile users whenever needed.

## FUTURE RESEARCH DIRECTIONS

Different from the past mobile e-services, ambient e-services address dynamic collective efforts of mobile users and dynamic interactions within ambient environments. It makes mobile commerce become a new paradigm and will develop certain revolutionary business models.

In general, ambient e-services bring two important issues, the social and economic issues. The social issues include the user interaction behaviors, intellectual property rights problems, and security issues, etc. For ambient e-service implementation, user behavior and their interactions are very complex. Not only have the security issues that influence the user's willingness to join in an e-service, the legal issue is also troublesome. How do we protect intellectual property in ambient e-services? Since the user interface and the usability of ambient e-services are quite different from the primal mobile commerce. Those issues should also be concerned as a vital social issue awaiting future studies.

The economic issues include the pricing issues of e-services, the bargain and payment issues, and the collaboration and utility issues. Regarding the economics issues, one of the most important issues is the pricing utility issue. Ambient e-services require several kinds of supporting infrastructures, such as sensor networks, wired/wireless network infrastructures, broadcast stations and service providers. The ambient value is delivered with the combined efforts of the supporting infrastructures. Accordingly, how to price ambient e-services and how to divide the revenue between the infrastructure providers will also become an important issue.

## CONCLUSION

Ambient e-services address dynamic collective efforts of mobile users dynamically engaging interactions in the ambient environments, rendering a new paradigm of mobile commerce promising revolutionary business models. This paper presents an ambient e-services framework characterizing three supporting stacks. The ambient value stack describes the value process in ambient environments. The ambient technology stack identifies the technology process to ensure connectivity and security in ambient interactions and cooperation between peers and then realize powerful collective efforts. The environment stack then represents the ambient basics for the collaborations.

Ambient e-services applications can be divided into two types. One is for the distributed trading; another is for the distributed collaboration. However, social context and significant rapid growth of connections enabled by P2P are the two major incentives for applying ambient e-service to such revolutionary business models. This chapter exemplifies several ambient e-service applications. Those applications differ from existing mobile e-services (grounded on client/server design) in terms of the focus of the dynamic interactions between peers in dynamic ambient e-service environments.

## REFERENCES


Aart, E. H. L. (2009). *True Visions-The Emergence of Ambient Intelligences*. New York: Springer-Verlag.

Curtis, D. W., Bailey, J., Pino, E. J., Stair, T., Vinterbo, S., & Waterman, J. (2009). Using ambient intelligence for physiological monitoring . *Journal of Ambient Intelligence and Smart Environments*, *1*(2), 129–142.

Hwang, Y. C., & Yuan, S. T. (2007). A Roadmap for Ambient e-Service: Applications and Embracing Model. *International Journal of E-Business Research*, *3*(1), 51–73.

Kant, K., Iyer, R., & Tewari, V. (2002). A framework for classifying peer-to-peer technologies. [Electronic version]. In *2nd IEEE/ACM International Symposium on Cluster Computing and the Grid, 2002* (pp. 368-368).

Katz-Stone, A. (2001). *Wireless revenue: Ads can work*. Retrieved from http://www.Wirelessauthority.Com.au/r/article/jsp/sid/445080

Lim, E., & Saiu, K. (2003). *Advances in mobile commerce technologies*. Hershey, PA: Idea Group Publishing.

Lindwer, M., Marculescu, D., Basten, T., Zimmennann, R., Marculescu, R., Jung, S., et al. (2003). Ambient intelligence visions and achievements: Linking abstract ideas to real-world concepts. In *Design, Automation and Test in Europe Conference and Exhibition, 2003* (pp. 10-15).

Schilit, B., Adams, N., & Want, R. (1994). *Context-aware computing applications.*

Varshney, U., & Vetter, R. (2002). Mobile commerce: Framework, applications and networking support. [Electronic version]. *Mobile Networks and Applications*, *7*, 185–198. doi:10.1023/A:1014570512129

## ADDITIONAL READING

Baida, Z., Gordijn, J., Akkermans, H., Saele, H., & Morch, A. Z. (2005). Finding e-Service Offerings by Computer-Supported Customer Need Reasoning. *International Journal of E-Business Research*, *1*(3), 91–112.

Hwang, Y. C., & Yuan, S. T. (2007). A Roadmap for Ambient e-Service: Applications and Embracing Model. *International Journal of E-Business Research*, *3*(1), 51–73.

Lee, I. (Ed.). (2008). *Electronic Business: Concepts, Methodologies, Tools, and Applications*. Hershey, PA: Information Science Reference, IGI Global.

Lee, I. (Ed.). (2008). *E-Business Models, Services, and Communications. Advances in E-Business Research Series* (Vol. 2). Hershey, PA: Information Science Reference, IGI Global.

Paternò, F. (2003). Understanding interaction with mobile devices. *Interacting with Computers*, *15*(4), 473–478. doi:10.1016/S0953-5438(03)00041-9

## KEY TERMS AND DEFINITIONS

**Ambient E-Service:** a new scope of mobile e-service, which address dynamic collective efforts between mobile users, dynamic interactions with ambient environments, the moment of value, and low cost service provision.

**Context:** Context is the set of environmental states and settings that either determines an application's behavior or in which an application event occurs and is interesting to the user.

**LBS:** Location-based services employ knowledge of the user's location to enable the provision of new or enhanced services to a user via a wireless handheld device

**M-P2P:** With the advance in mobile wireless communication technology and the increasing number of mobile users. M-P2P involves applying p2p principles and supporting p2p applications in mobile wireless networks.

**P2P:** (Peer-to-Peer) Files can be shared directly between systems on the network without a central server. Each peer becomes a file server as well as a client on the P2P network.

**Sensor Network:** A sensor network is a group of specialized transducers with a communications infrastructure intended to monitor and record conditions at diverse locations. The sensors could be hard-wired or wireless, and they are used to cooperatively monitor environmental conditions.

# Chapter 41
# Online Auctions:
## Pragmatic Survey and Market Analysis

**James K. Ho**
*University of Illinois at Chicago, USA*

## A SURVEY OF ONLINE AUCTIONS

The Internet is a new medium of communication connecting potential partners in trade worldwide. The initial frenzy over its promises led to grossly exaggerated valuations of business models that were mere transplantations of existing processes to the alternative channel. Now that the bubble has burst, more sensible and critical thoughts can be turned to true transformations that are creating and nurturing markets of the future. Online auction is one of the very few cases that has held a steady course, as evidenced in the success to date of eBay.com. Founded in September 1995, eBay has become a global trading platform with presence in 39 markets where on any given day, there are more than 113 million listings across 50,000 plus categories. In 2009, at least 86 million people will buy and sell well over $2000 worth of goods every second (www.ebay.com). To survey the state of development of online auctions apart from eBay, on a pragmatic rather than theoretical basis, we examine variations in auction mechanisms, and give examples of implementation online at this writing. The commonly used terminology and definition of auction models can be found in e.g. McAfee and McMillan (1987). For conciseness and consistency, the www prefix and .com suffix are omitted from the URL of corresponding companies, and all lowercase is used throughout.

### Auction Mechanisms

#### Open Bid, Fixed Deadline, Second Price Auctions With Proxy Bidding

This is ebay's model which has become the de facto standard because of its market dominance. Buyers submit bids at any time before a fixed deadline. The current high bid is publicly displayed. An acceptable

DOI: 10.4018/978-1-61520-611-7.ch041

bid is any value at or above the current high bid plus an increment prescribed by the auctioneer. For example, suppose the current high bid is $100 and the increment is $1. Bidder W submits a bid of $110. A new high bid of $101 is displayed. If there is no higher bid before the deadline, W wins the auction at $101. If another bid, say at $105 comes in before the deadline W's bid will be raised automatically by the auctioneer with a proxy bid to $106, and so on if necessary until the limit of $110 is exhausted.

**Examples:** auctionfire, ebay, onlineauction-exchange, plunderhere, upperbid, usiff.

## Flexible Deadline

The fixed deadline and second price mechanism promote the strategy of "sniping" where buyers withhold their bids until the very last seconds before the deadline both to disguise interest in the item and to prevent further counter bids. This tends to favor buyers, and not sellers who can benefit from more competitive bidding. An alternative is to extend the deadline automatically by some prescribed duration (e.g. 5 minutes) whenever there is a bid within some other threshold (e.g. 15 seconds) of the current deadline. This will give buyers the opportunity to raise their bids against so called "snipers".

**Examples:** auctions.samsclub, bidz, ubid.

## Fixed Deadline, Lowest Bid, Reverse Auctions

A buyer starts the reverse auction by listing precisely what he or she wants to buy. Sellers bid against each other and the lowest bidder by the fixed deadline wins the auction. Optionally, the buyer may have the provision to select (or invite) a subset of sellers from a database to bid, or eventually to choose a different seller than the winning bidder from among the participants if so desired.

**Example:** oltiby, sorcity.

Since this model features a single buyer soliciting bids from multiple buyers, it fits the procurement or sourcing function of supply chain management in the B2B environment particularly well. Therefore, instead of general purpose, public trading platforms, it is expected that private reverse auction sites (really e-business versions of the Request for Bids process in procurement) will be the growth area. Actually, a plethora of software vendors and platform builders (e.g. ariba, k2sourcing, ketera, usanetcreations, just to name a few) have already sprung up to provide related services.

## Unique Bid Auctions

Bidders may place bids that do not necessarily reflect any valuation of the item being auctioned. Rather, for a bid to be eligible to win, it has to be unique in the sense that no other bidder has made a bid for the same amount. Bidders are generally allowed to place multiple bids and the current number of bids at each amount is typically kept secret.

There are two major variants of unique bid auctions:

i) Highest unique bid:

The highest and unmatched bid when the auction closes is the winning bid. To assure bidders that they may indeed win the item at a lower price, a maximum bid value may be set at a much lower level than the actual value of the item.

**e.g.** yourbidzone.com, auctions4acause.com.

ii) Lowest unique bid:

The lowest and unmatched bid when the auction closes is the winning bid.

**Examples:** bassabids, esuga, globalbidders, golowbids, kcbidz.

The unique bid mechanism, though commonly presented as an auction model since it is the allocation of goods through a bidding process, is actually more of a lottery or strategy game. The typical purpose is not for selling the goods for profit, but rather for product promotion or mail-list collection, where the costs are borne by sponsors. The listed items are actually giveaways. Bidders are lured to try their luck and perhaps strategies in order to win at costs way below the value of the items. For this reason, certain unique bid auctions are legally classified as skill-based prize competitions.

### Dutch Auctions

There are two distinct definitions for this term. The first originated from tulip markets in the Netherlands and hence the name. From a given start, the price is reduced either by steady decrements or by other prescribed rules until it is accepted by a bidder who then wins the item, or stopped at a reserve minimum.

**Examples:** dubli, weeda.

Instead of requiring bidders to monitor the price drop in real time, a proxy scheme analogues to the case of increasing prices can be implemented online. For instance, at the Victoria, BC-based stamps dealer weeda, the price for an item goes down twice a month. On any given day, a buyer can accept the current price, or reserve a lower price at a future date by e-mail, on a first-come-first-served basis. At dubli, the price drop is not automatic, but triggered by bidders. The current price is not displayed. Bidders can only check it for a fee, which also triggers a price drop (by a prescribed amount substantially less than the checking fee).

The second definition of Dutch auctions is used by ebay for multiple quantities, say n, of the same item offered in a single listing. Buyers can bid for from one to the maximum quantity available. The top n bids (inclusive of bids for multiple quantities from the same buyer) win, but pay only the lowest among those bids. For instance, suppose the lot has 5 of the same item. Buyer A bids $105 for one, B bids $102 for two, C bids $101 for one, and D bids $100 for three. Then the winning bid is $100, with A getting one, B two, C one, and D one at that same price.

**Examples:** ebay, jrcigars.

## Fee Structures

An online auction site provides a trading platform for either or both buyers and sellers from public Internet users. Its source of revenue is typically from fees charged to the participants. The fee structure is therefore a critical component of its business model.

### Listing Fees

This is charged to sellers for having their items for sale listed as an online auction. This fee may depend on the starting price set by the seller as an indication of the actual value of the item. If a seller is confident that there is interest among buyers to attain fair market value for an item, the seller may set the starting price to the lowest possible, e.g. $0.01, to save on such listing fee. Other fees may be charged for additional features, e.g. gallery pictures, highlighted listings, reserve price, duration of auction, etc.

### Commission Fees

This is commonly known as the Final Value Fee (FVF) which is charged to the seller at a prescribed rate on the closing price if the item is sold. Typically, no FVF is charged if the item is not sold due to lack of any bids, or reserve price not met.

### Subscription Fees

While most auction platforms adopt the above two kinds of fees, other smaller upstarts use variations such as a monthly fee to cover all listings, a one-time life membership fee, fees for special features only, or no fees at all to attract sellers.

**Examples:** bid-a lot, webidz, onlineauction-exchange, qxbid.

### Bidding Fees

Since auctions sites benefit directly from bidding activities, buyers are usually not charged any fees for their participation. They pay only indirectly through the final purchase price to the sellers, who then pay the auctioneers. Exceptions occur with one of the Dutch auction mechanisms. Here the current bid is not disclosed. Buyers pay a fee (e.g. \$0.80) to check it and at the same time reduce the price by some prescribed amount (e.g. \$0.25). The buyer may accept the current price and end the auction, decide to check again at a later time, or abandon the auction. Why would a buyer pay \$0.80 to have the price lowered by only \$0.25? It is in the hope that other bidders would also have acted to drop the current price significantly.

**Example:** dubli.

Since many unique bid auctions are really lotteries, strategy games or prize competitions, they charge an entry fee for buyers to participate, or they charge a fee per bid placed. In such cases, each bid is really the purchase of a ticket, and the bid amount is only a lottery number.

**Example:** esuga, globalbidders.

### Market Specialization

Online auction services may be general purpose like ebay, or specialized to cater to specific types of users. Specialization can be by merchandise, source of suppliers, location, or affiliation. Examples are shown in Table 1.

## MARKET CONDITIONS FOR BUYERS AND SELLERS

Having surveyed the state of development of online auctions, we seek to provide further insight into existing market conditions. In particular, we wish to be able to discern whether actual markets are favorable to buyers or sellers.

### Topological Model of Online Auction Markets

In Ho (2004) the intriguing question of what 'shape' a given online auction market is in at a

*Table 1. Specialization of online auction markets*

| Merchandise | Suppliers | Location | Affiliation | Examples |
|---|---|---|---|---|
| cigars | commerical | | | jrcigars |
| jewelry | commerical | | | bidz |
| aquarium | commerical | | | aquabid |
| firearms | commerical | | | gunbroker |
| surplus | commerical | | | ubid.com |
| general | commerical | | Sams Club | auctions.samsclub |
| surplus | gov/com | | | liquidation |
| surplus | government | | | govdeals, |
| surplus | government | Wisconsin | | wisconsinsurplus |
| assets | government | | General Services Admin | gsaauctions.gov |
| confiscated | police depts | | | propertyroom |
| general | non-profit | | Goodwill Industries | shopgoodwill |

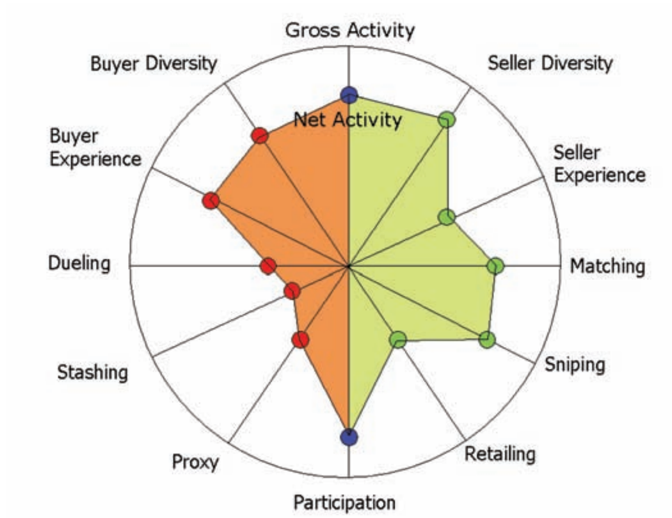
particular moment of its development was posed. Using the Star Plot method of high-dimensional data visualization a topological model was developed, based only on operational data, without any expert knowledge of the specific auction market, or financial details from the transactions. Twelve dimensions (i.e. attributes) are identified as follows.

1. NET ACTIVITY (auctions with bids)
2. PARTICIPATION (average number of bids per auction)
3. SELLER DIVERSITY (distribution of offers)
4. SELLER EXPERIENCE (distribution of sellers' ratings)
5. MATCHING (auctions ending with a single bid)
6. SNIPING (last minute winning bids)
7. RETAILING (auctions ending with the Buy-It-Now option)
8. BUYER DIVERSITY (distribution of bidder participation)
9. BUYER EXPERIENCE (distribution of buyers' ratings)
10. DUELING (evidence of competitive bidding)
11. STASHING (evidence of stock-piling)
12. PROXY (use of proxy bidding as evidence of true valuation)

## A Buyer-Seller Dichotomy

To discern whether particular market conditions are favorable to buyers or sellers, we divide the dimensions into a buyer-seller dichotomy. The seller profiles, in terms of diversity and experience, are buyer dimensions. For diversity, we make the assumption that dominance in market share by relatively few sellers does not provide as much sourcing opportunities for buyers as when there are more different sellers. Single-bid matching, though not an indicator of the vitality of a true auction market, does work in the favor of buyers. It meets their demand at opening bid prices. The success of winning bids by sniping also put buyers at an advantage as the winning bid prices can be expected to be undervalued. Buy-It-Now options, if acceptable to buyers, necessarily reflect favorable prices, and so can be ruled a buyer

*Figure 1. Topology of online auction markets [Ho (2004)]*



dimension. After suitable normalization, these five buyer dimensions are mapped in the right hemisphere in Figure 1.

The buyer profiles, in terms of diversity and experience, are seller dimensions. Analogues to the buyer dimensions we make the assumption that diversity in participation and an even distribution in experience among buyers are favorable to sellers. Proxy bidding helps elicit true valuation from buyers. Dueling indicates head-to-head competition, while stashing signals collecting as opposed to shopping behavior among buyers. All three tend to raise the final bids and hence are seller dimensions. The five dimensions on the seller side of the buyer-seller dichotomy are mapped in the left hemisphere in Figure 1.

## Maximum Resolution Topology

In general, a multi-attribute dichotomy is any multi-dimensional dataset in which the dimensions can be partitioned into two groups, each contributing to one part of the dichotomy. Given the star glyph of a multi-attribute dichotomy, as exemplified in Figure 1, a methodology was developed in (Ho, Chu and Lam 2007) so that the areas covered by the two parts can be used as a meaningful aggregate measure of their relative dominance. A larger area on the left side of the glyph means dominance by the left part, and vice versa. In the case of online auction markets, this asymmetry can be interpreted as market conditions being advantageous to either buyers or sellers. The approach exploits the degrees of freedom allowed by the topology of the glyph, namely, the configuration of the attributes, and the angles between adjacent pairs thereof.

In particular, a diverse subset of the data instances was used to derive a topology with maximum resolution in discerning dominance with respect to the reference subset. Subject to the constraints of preserving the prejudged dominance in the reference subset of dichotomies, an optimal topology (configuration of attributes and angles between adjacent pairs) is sought in a goal programming optimization model to maximize the discriminating power, or resolution, as measured by the sum of absolute differences in left and right areas for the reference subset. Such an optimal configuration is called a maximum resolution topology (MRT). For instance, using 34 data sets with the bidding records of approximately 500 auctions each as the reference subset (where the market categories comprise automobiles, business software, camcorders, coffee tables, coins, cordless phones, desktop PCs, digital cameras, gift certificates, handbags, laptop PCs, lodging, necklaces, personal digital devices, rings, travel and vacation packages, and wristwatches), the MRT for the optimal configuration of the twelve dimensions in the topological model for online auctions is shown in Figure 2.

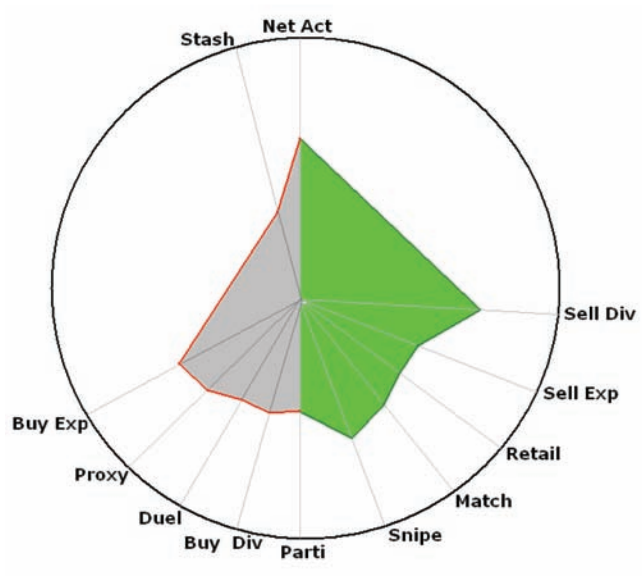
## Applications of MRT to Online Auction Markets

To illustrate the robust application of MRT to the buyer-seller dichotomy in online auction markets, the results of various published studies are summarized below.

## Global Comparative Study

As exploratory data mining, 34 data sets with the bidding records of approximately 500 auctions each are used as the reference subset. The market categories comprise automobiles, business software, camcorders, coffee tables, coins, cordless phones, desktop PCs, digital cameras, gift certificates, handbags, laptop PCs, lodging, necklaces, personal digital devices, rings, travel and vacation packages, and wristwatches. The optimal configuration of the twelve dimensions in the topological model for online auctions is shown in Figure 2. In (Ho, Chu and Lam 2007), a comparative study of four markets in five countries was conducted. The results are summarized here for illustrative purposes. The countries are Australia

*Figure 2. Maximum resolution topology for online auction markets [Ho et al (2007)]*




(AU), Canada (CA), France (FR), United Kingdom (UK), and United States (US). The markets are: classical CDs, Star Wars toys and games; diamond rings, and digital cameras. The star plots for the twenty cases are shown in Figure 3.

The seven cases boxed in Figure 3 are classified as "right-dominant" (buyer's market). The other thirteen cases are classified "left-dominant" (seller's market). It was observed that online auction markets for digital cameras, a hi-tech product of common value, tend to be favorable to buyers across nations. By contrast, the other markets of particular items catering to more subjective preferences and tastes tend to favor sellers on eBay.

## Online Auction Markets in Tourism

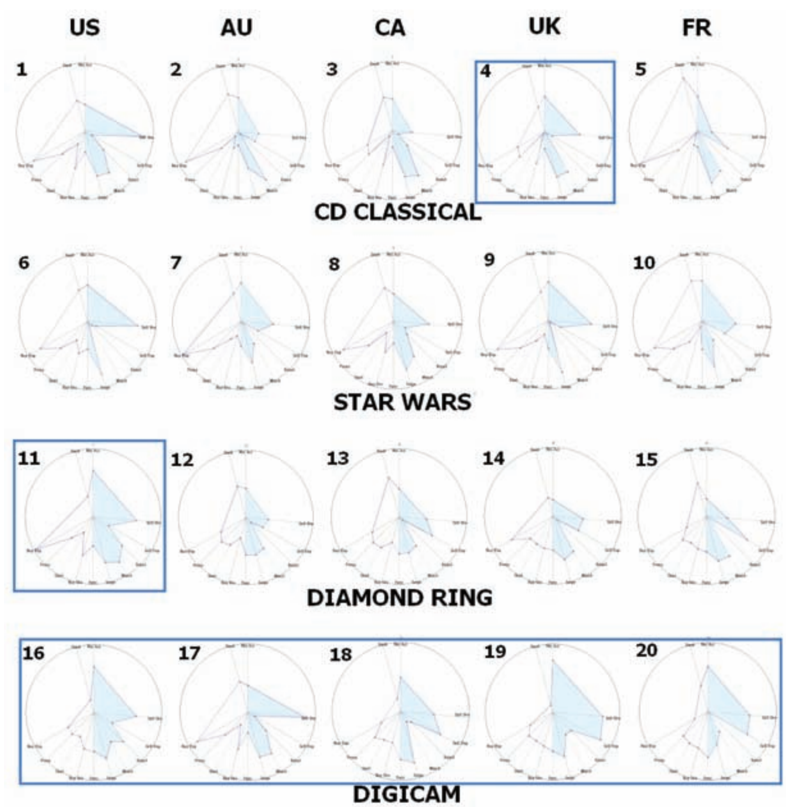
Since the value of an empty seat on an airliner vanishes once the flight takes off, just as an empty hotel room by check-out time, most travel and tourism related services can be regarded as perishable commodities. As such, the concept of dynamic pricing to balance supply and demand in a free market appeals to both economists and consumers. To the former, this means market efficiency. To the latter, it suggests potential bargains as expiration looms. However, suppliers must overcome the stigma of brand dilution if they let known that lower than set prices are acceptable. In (Ho, 2008a), a comprehensive, though by no means exhaustive survey found online auction markets in travel and tourism in a fledgling stage of development. On eBay.com, for example, there were around 2000 active listings in December 2006, while the comparable number was over 190,000 for Antiques, and over 390,000 for Consumer Electronics. Yet there is already significant data available for formal analysis to track the growth of markets in travel and tourism.

The MRT methodology was applied to the Travel categories on eBay in early 2006. The subcategories of Vacation Packages and Lodging were used. Under Lodging, we have Vacation Rental, Hotel, and Bed and Breakfast. The last two were grouped as one.

As quantitative measures, we can use an index:

$I_B$ = (Right Area - Left Area) / (Right Area + Left Area)

*Figure 3. MRT plots of 20 markets in comparative study [Ho et al (2007)]*




which is positive for a buyer's market, and negative for a seller's market. This index ranges from -0.29 to +0.43 with an average of 0.11 for the 34 cases in the reference set. For the three Travel cases, we have the indices in Tables 2 and 3.

Our results show that actual conditions are also favorable to buyers, and to extents that are above the reference average index of 0.12. In particular, Vacation Packages, with an index of 0.64 is remarkable.

## Inter-Brand Comparisons

In (Ho, 2008b), the MRT methodology was applied to four brands of digital cameras on eBay in the first quarter of 2006. The specific auction categories used were:

Cameras & Photo> Digital Cameras> Point & Shoot> 4.0 to 4.9 Megapixels> *Brand*; where *Brand* was Nikon, Sony, Kodak, and Canon, respectively.

It should be apparent that with the high number of dimensions and their categorical measures, inter-brand comparison of subtle differences will be rather difficult. This is where our maximum resolution dichotomy methodology can become useful for gaining further insight into such market data. For the four brands of digital cameras, we have the indices in Table 3.

All four MRTs exhibit a right-dominant topology, indicating that market conditions are favorable to buyers for these brands. On a relative scale, Nikon ranks the highest at 0.55, closely followed by Kodak at 0.53. Even at 0.39 and 0.20, respectively, both Canon and Sony are significantly above the average of 0.1 for the reference set used to derive the MRT. This is consistent with more general and extensive observations that for

*Table 2. Online auction market indices*

| Market | VacRental | Hotel+B&B | VacPack |
|---|---|---|---|
| $I_B$ | 0.18 | 0.21 | 0.64 |

*Table 3. Online auction market indices in inter-brand comparison*

| Brand | Sony | Canon | Kodak | Nikon |
|---|---|---|---|---|
| $I_B$ | 0.20 | 0.39 | 0.53 | 0.55 |

hi-tech consumer products of so-called common values, eBay auctions tend to be buyer's markets. Cost of entry and operation being low compared to brick-and-mortar stores, competition is keen among sellers. They must compete on price and service to establish credibility and gain market share.

## REFERENCES

Ho, J. K. (2004). Topological analysis of online auction markets. *Electronic Markets*, *14*(3), 202–213. doi:10.1080/1019678042000245128

Ho, J. K. (2008a). Online auction markets in tourism. *Information Technology & Tourism*, *10*(1), 19–29. doi:10.3727/109830508785059002

Ho, J. K. (2008b). Inter-brand comparison of online auction markets. *Electronic Commerce Research*, *8*, 103–114. doi:10.1007/s10660-008-9012-2

Ho, J. K., Chu, S. C. K., & Lam, S. S. (2007). Maximum resolution topology for online auction markets. *Electronic Markets*, *17*(2), 164–174. doi:10.1080/10196780701296485

McAfee, R. P., & McMillan, J. (1987). Auctions and Bidding [American Economic Association]. *Journal of Economic Literature*, *25*(2), 699–738.

## KEY TERMS AND DEFINITIONS

**Dutch Auction:** i) Auction where the price drops until accepted by a bidder, or stopping at reserve minimum; ii) Auction of multiple quantities of same item on eBay.com where top bidders pay lowest bid among them.

**Proxy Bidding:** Auctioneer bids on behalf of a bidder to counter incoming bids up to maximum specified by the bidder.

**Reverse Auction:** Buyer lists item wanted for sellers to bid on offer. Lowest bid wins.

**Second Price Auction:** Auction where winner pays second highest bid plus a nominal increment.

**Sniping:** Bidding strategy to withhold bid until last seconds of a fixed deadline, second price auction.

**Topological Analysis:** Online auction market modeling and analysis methodology using only operational data without expert knowledge of specific markets or details of financial transactions.

**Unique Bid Auctions:** Auctions where only unique bid amounts are eligible to win. Often used as lottery or strategy game for product promotion or advertising.

# Section 6
# E-Business Management

# Chapter 42
# Configurators/Choiceboards:
## Uses, Benefits, and Analysis of Data

**Paul D. Berger**
*Bentley University, USA*

**Richard C. Hanna**
*Northeastern University, USA*

**Scott D. Swain**
*Northeastern University, USA*

**Bruce D. Weinberg**
*Bentley University, USA*

## INTRODUCTION AND DEFINITION

This article discusses the uses and benefits of configurator/choiceboard systems, and how analysis of data from its use can be useful to the company having such a system. Dell and other companies have greatly improved, if not perfected, the art of product customization by using a system of choiceboards or configurators (used here as interchangeable terms) that allow consumers to customize their products. A popular term for what is being accomplished by the use of choiceboards is "mass customization," a term that not long ago may have been thought of as an oxymoron. We always had "job shops" that produced to order for individual consumers or companies. However, relatively speaking, individual customization did not occur on a large-scale basis, and was quite distinct from what was called mass production, and surely, was not routinely available online even when there was first an "online."

A choiceboard is essentially interactive online software that enables customers to choose a basic product and then customize it by selecting from a set of product features. For example, on Dell.com, the consumer chooses a basic computer system such as the E510 and then customizes it by specifying an operating system, memory capacity, monitor, video card, keyboard, etc. Each of these choices has an incremental price that increases or decreases the overall price. The base price combination is not necessarily the least expensive possible combination of features. If the consumer chooses a less costly feature than the option included in the base price/feature combination, the overall price indeed goes

DOI: 10.4018/978-1-61520-611-7.ch042

down. The price is continually updated as the choices are made. Several choices offer only a yes-or-no response, with "*no*" indicating a choice of the default option. Features also may include services options such as shipping and warranty. Clearly, the choiceboard system does not offer an infinite number of possibilities. For example, Dell.com offers from two to five levels of hard-drive capacity.

Other companies that have made good use of this choiceboard approach include Travelocity.com and VermontTeddyBears.com along with many others, including automakers. Indeed, although the vehicle is generally purchased from the dealer, automakers report that the vehicle configurators and model pages are the most used sections on their Web sites. Configurators are also in frequent use in Business to Business (B2B) contexts when one business is ordering from another. In B2B, far more numerous options are presented and the Website design is too complex to be cost-effective in a B2C context.

Choiceboards can differ greatly in terms of what they offer. Some allow consumers to actually experience different options; a well-known example (although not usually thought of as a choiceboard by the consumer) is choosing a cell-phone ringtone. The consumer can sample each tone option for ten seconds or more. Lands' End lets customers create custom clothing by providing pictures of clothing options and measurement information.

## USES AND BENEFITS

A choiceboard system serves many purposes. First, it lets consumers customize their products or services. At one time, such customization was possible only for high ticket items like automobiles. Rather than buying a car off the dealer's floor, customers have long been able to select a color along with other options—air conditioning, automatic or manual transmission, sunroof, etc. There is clear evidence that consumers enjoy the opportunity to customize their products as long as the process is painless—ideally offering perfect orders and super service (FastCompany, 2000). A perfect order "…gets shipped on time and complete, and arrives at a customer's desired location within a precise time window and in excellent, ready-to-use condition." Super service has the flexibility to handle last-minute customer changes and still provide the same level of service. Consumers can balance priorities, deciding whether they care most about price, delivery time, or various special options.

A second use for, and benefit from, a choiceboard system is relatively invisible to the consumer: inventory control. Dell, for example, uses a pull-based system, in which customers initiate orders and only then do order processing, inventory decisions, and production kick in. This compares favorably to a push-based system in which a company decides what consumers are likely to want and delivers that merchandise to distributors and retailers months in advance of actual sales. This can leave stores with large inventories that end up moving only after the distributor offers rebates, dealer incentives, and giveaways. Dell's pull-based approach has allowed it to integrate its production line with its suppliers, so that neither Dell nor its suppliers get overburdened—or underprovided—with inventory (Slywotsky and Morrison, 2000; Bharati and Chaudhury, 2004).

A third use and benefit of choiceboards is that they save money on labor costs. They also, by definition, eliminate most transcription (e.g., order taking) and other human errors. A seller's Web site can potentially generate thousands of customer quotes per day, which can be delivered instantly, 24 hours/ day, 365 days per year.

All these are significant pluses. However, developing a choiceboard system is expensive, so the benefits must justify the cost. People who can write for the Web cannot necessarily construct choiceboard systems. All but the largest companies have to outsource that task, and it may not be worth it. Lane Bryant, for instance, once had a choiceboard system. However, they suspended the service, possibly because the cost of its maintenance or improvement was not warranted by the benefits it provided.

Finally, there may be a long-run benefit to having a choiceboard/configurator system. Companies can use choiceboard data to measure—and perhaps to predict—consumer buying patterns and preferences. This, in turn, may support the implementation of superior marketing strategy. All of this can be done through the use of conjoint analysis.

## CONJOINT ANALYSIS OF CONFIGURATOR / CHOICEBOARD DATA

Conjoint analysis is a technique used to determine the utility values that consumers place on various levels of a product's attributes. Usually consumers are shown different product scenarios (i.e., product configurations), each a combination of levels of its different attributes. At a typical Dell Web site, visitors can choose among at least three levels of processors and three levels of operating systems. Going more deeply into sub-menus then allows choices of levels of many other attributes.

Consider three attributes of a product—price, warranty duration, and degree of customer-support services. The company is interested in the purchase intent that accompanies different combinations of levels of these attributes. If the customer can consider five prices, four warranty durations, and four levels of customer support, there are 5x4x4 = 80 scenarios possible. If demand for each combination could be predicted, a cost/benefit analysis would tell the company which configuration is most profitable. This might seem to imply that the company wants to choose one scenario, but that is not necessarily the case. The cost/benefit analysis might lead the company to eventually give the consumer a set of special bundled choices—probably not an 80-option choiceboard, but maybe four popular combinations.

The usual mechanism for conducting a conjoint analysis is to gather a set of respondents—ideally representative of the target market—ask them to examine and evaluate different scenarios, and then indicate their purchase intent for the one they choose. The precise methodology of a conjoint analysis is not clearly defined; there are several methodological variations lumped together under the term, conjoint analysis. The company can ask respondents to rank-order the scenarios shown,[1] producing ordinal data. Alternatively, respondents can be asked to indicate purchase intent for every scenario (i.e., possible combination). The most popular rating method is the 11-point Juster Scale: 0 indicates no chance at all that the responder would purchase the product in that form, 1 indicates a 10 percent chance, 2 a 20 percent chance, and so on up to 10, which indicates a >99% chance, virtual certainty. This is generally considered a superior method to simple ranking. However, self-reported purchase intents do need to be rescaled,[2] since it is well known that self-reported purchase intent values are overstated. For example, perhaps only 80% of those who check off "10" actually would actually make the purchase, and perhaps only 62% of those indicating "9" would actually make the purchase, etc. Many companies have proprietary data concerning how these adjustments should be made for their product category. Nevertheless, the resulting information is rightfully treated as interval-scale data and offers a richer set of appropriate statistical tools for data analysis than does rank data.

This "full-profile" technique allows an assignment of a "utility," or relative value, to each level of each attribute. It is referred to as "full profile," since each evaluation by the consumer is made with his/her seeing a product that has *some* level of *every attribute in the choice set* – in essence, a "complete" or "full" profile of the product.

How can a company use the principles of conjoint analysis to analyze configurator/choiceboard

*Table 1. Simplified choiceboard*

| | |
|---|---|
| ATTRIBUTE 1 – MONITOR* | |
| 1) monitor A | ($-150) |
| 2) monitor B | ($0) |
| 3) monitor C | (+$300) |
| 4) monitor D | (+$500) |
| 5) monitor E | (+$800) |
| ATTRIBUTE 2 – PRINTER** | |
| 1) no printer | ($0) |
| 2) printer A | (+$200) |
| 3) printer B | (+$300) |
| 4) printer C | (+$550) |
| ATTRIBUTE 3 – RECOVERY BACKUP CD | |
| 1) none | ($0) |
| 2) include | ($10) |
| ATTRIBUTE 4 – VIDEO CARD | |
| 1) card 1 | ($0) |
| 2) card 2 | ($75) |
| 3) card 3 | ($125) |

*Note that monitor B comes with the system, but the customer can choose a more or a less expensive monitor.
**"No printer" is the default: the base price does not include a printer.

information and determine consumer buying habits and preferences in a way that enhances profit? Consider:

1. Typically, a company using a configurator/choiceboard has a large amount of data on actual customer-choices, which means that the data indicating these preferences are very accurate.
2. Typically, a customer has been exposed to all available choices, which means that there is no need to choose only a subset of the possible attributes.

## Example

The Dell case can be simplified for illustration purposes. Suppose for a certain basic computer configuration, customers are presented with four features (see table 1), one at a time, each incorporating a certain number of choices and each choice's associated incremental price:

Let us assume that customers see these four sets of choices if they begin with a certain basic computer configuration. There are 5 x 4 x 2 x 3 = 120 possible combinations. However, the choices are not presented as full profiles. Full profiles would have to appear as 120 specific combinations. For example, one profile might combine Monitor 1 (i.e., "A") + Printer 1 (i.e., no printer) – no backup CD + Video Card 1; this combination (i.e., "profile") would reduce the base price by $150. Another profile could combine Monitor 5 (i.e., "E") + Printer 4 (i.e., "C") + the backup CD + Video Card 3, raising the base price by $1485. If the customers were asked to evaluate all 120 scenarios, the scenarios would be shown in random order.[3]

Under a full-profile scenario, each option offers one choice for each feature (printer, CD, etc.). In an actual choiceboard, each choice set appears "monadically," i.e., one feature at a time. Still, by going back and forth among the choices, the customer can technically consider all 120 scenarios.[4]

So how can an analysis of configurator/choiceboard data enhance company profit? In this example, Dell has actual behavioral data, which is far superior to intentional data. The relative frequencies of purchase for a particular configuration reflect the purchase probabilities. Suppose that Dell finds that all three video card choices are equally popular. This implies that the pricing of the different cards is appropriate. Suppose that 95 percent of the customers choose to include the backup CD. That indicates that Dell may be "leaving money on the table," and could increase profits by raising the price above $10. In any case, it strongly indicates that Dell should conduct some marketing research to determine the demand curve for the backup CD.

This concept extends to other features such as the monitor. Suppose that the default is a 15-inch flat-panel monitor and the other options, in order of increasing price, are a 15-inch wide-screen flat panel, a 17-inch flat panel, a 15-inch sharper-vision flat panel, and a 17-inch sharper-vision flat panel. What if many customers choose to upgrade to a 15-inch wide-screen flat panel, but relatively few choose the 17-inch flat panel? In that case, maybe Dell may want to raise the price of the 15-inch wide-screen flat panel and/or reduce the price of the 17-inch flat panel—or both. Naturally, optimal prices depend on the production costs of each option. The choiceboard data could also lead to profit-enhancing bundle pricing for the most popular combinations. Indeed, there are probably several significant correlations among the various choices.

Clearly, analysis of configurator/choiceboard data can also be a great boon to Dell's suppliers in terms of inventory needs and order quantities. This cost savings to suppliers should be passed on, at least in part, to the focal company, that is to say, Dell.

## FUTURE RESEARCH DIRECTIONS

Future research should investigate two primary issues. One is the proverbial cost/benefit issue. As noted, it can be quite expensive to construct a configurator/choiceboard system that is sufficiently user-friendly to both the consumer and different members of the supply chain. Further investigation and refining of the configuator/choiceboard process may lead to a large increase in the benefit/cost ratio. The second primary area for further investigation is the additional potential benefit of superior marketing decision-making that can accrue from selected, perhaps more complex, analyses of configurator/choiceboard data, especially if the buyer's demographics can be captured and related to purchase choices.

## CONCLUSION

The use of a configurator/choiceboard approach makes the purchase process easier for the consumer and more beneficial to the vendor. In addition, an analysis of configurator/choiceboard data can suggest pricing strategies, promotional strategies, determination of the customer lifetime value for each of several different customer segments, and applications for CRM and other key management information-systems, as well as a whole host of other marketing decisions.

## REFERENCES

Bharati, P., & Chaudhury, A. (2004). Using Choiceboards to Create Business Value. *Communications of the ACM*, *47*(12), 77–81. doi:10.1145/1035134.1035137

Hammonds, K. (2000). Value Propositions. *FastCompany*, *37*(1), 38.

Slywotsky, A., & Morrison, J. (2000). *How Digital Is Your Business?* New York: Crown Business.

## ADDITIONAL READING

Addis, M., & Holbrook, M. (2001). On The Conceptual Link between Mass Customization and Experiential Consumption: An Explosion of Subjectivity. *Journal of Consumer Behaviour*, *1*(1), 50–66. doi:10.1002/cb.53

Dahan, E., & Hauser, J. (2002). The Virtual Customer. *Journal of Product Innovation*, *19*(5), 332–353. doi:10.1016/S0737-6782(02)00151-0

Delbert, B., & Stremersch, S. (2005). Marketing Customized Products and Striking a Balance Between Utility and Complexity. *JMR, Journal of Marketing Research*, *42*, 219–227. doi:10.1509/jmkr.42.2.219.62293

DeShazo, J., & Fermo, G. (2002). Designing Choice Sets for Stated Preference Methods: The Effects of Complexity on Choice Consistency. *Journal of Environmental Economics and Management*, *44*, 123–143. doi:10.1006/jeem.2001.1199

Duray, R. (2002). Mass Customizations Origins: Mass or Custom Manufacturing? *International Journal of Operations & Production Management*, *22*, 314–328. doi:10.1108/01443570210417614

Duray, R., & Milligan, G. (1999). Improving Customer Satisfaction Through Mass Customization. *Quality Progress*, *32*(8), 60–66.

Fiori, A., Lee, S., & Kunz, G. (2004). Individual Differences, Motivation, and Willingness to Use a Mass- Customized Option for Fashion Products. *European Journal of Marketing*, *38*(7), 835–849. doi:10.1108/03090560410539276

Fogliatto, F., & da Silveira, G. (2008). Mass Customization: A Method of Market Segmentation and Choice Menu Design. *International Journal of Production Economics*, *3*, 606–622. doi:10.1016/j.ijpe.2007.02.034

Franke, N., & Schreier, M. (2008). Product Uniqueness as a Driver of Customer Utility in Mass Customization. *Marketing Letters*, *19*, 93–107. doi:10.1007/s11002-007-9029-7

Goldstein, D., Johnson, A., & Heitmanm, M. (2008). Nudge Your Customers Toward Better Choices. *Harvard Business Review*, *86*(2), 99–105.

Huffman, C., & Kahn, B. (1998). Variety for Sale: Mass Customization or Mass Confusion. *Journal of Retailing*, *74*(4), 491–514. doi:10.1016/S0022-4359(99)80105-5

Liechy, J., Ramaswamy, V., & Cohen, S. (2001). Choice Menus for Mass Customization: An Experimental Approach for analyzing Customer Demand with an Application to a Web-based Service. *JMR, Journal of Marketing Research*, *38*, 183–196. doi:10.1509/jmkr.38.2.183.18849

Michel, S., Kreuzer, M., Kuhn, R., & Stringfellow, A. (2006). *Mass-Customized Products: Are they Bought for Uniqueness or to Overcome Problems with Standard Products?* Working Paper, Garvin School of International Management.

Ogawa, S., & Piller, F. (2006). Reducing the Risk of New Product Development. *Sloan Management Review*, *47*(2), 65–71.

Peppers, D., & Rogers, M. (1997). *Enterprise One to One*. New York: Currency/Doubleday.

Pine, B. (1999). *Mass Customization*. Cambridge, MA: Harvard Business School Press.

Pine, B., Victor, B., & Boynton, A. (1993). Making Mass Customization Work. *Harvard Business Review*, *71*(5), 108–122.

Prahalad, C., & Ramaswamy, V. (2000). Co-opting Customer Competition. *Harvard Business Review*, *78*(1), 79–87.

Randall, T., Terwiesch, C., & Ulrich, K. (2007). User Design of Customized Products. *Marketing Science*, *26*(2), 268–280. doi:10.1287/mksc.1050.0116

Schreier, M. (2006). The Value Increment of Mass-Customized Products: An Empirical Assessment. *Journal of Consumer Behaviour*, *5*, 317–327. doi:10.1002/cb.183

Simonson, I. (2005). Determinants of Customers' Responses to Customized Offers. *Journal of Marketing*, *69*, 32–45. doi:10.1509/jmkg.69.1.32.55512

Slywotsky, A. (2000). The Age of the Choiceboard. *Harvard Business Review*, *78*(1), 40–41.

Terwiesch, C., & Loch, C. (2004). Collaborative Prototyping and the Pricing of Custom-Designed Products. *Management Science*, *50*(2), 145–158. doi:10.1287/mnsc.1030.0178

Ulrich, K., & Ellison, D. (1999). Holistic Customer Requirements and the Design-Select Decision. *Management Science*, *45*(5), 641–658. doi:10.1287/mnsc.45.5.641

Wind, J., & Rangaswamy, A. (2001). Customization: The Next Revolution in Mass Customization. *Journal of Interactive Marketing*, *15*(1), 13–32. doi:10.1002/1520-6653(200124)15:1<13::AID-DIR1001>3.0.CO;2-#

## KEY TERMS AND DEFINITIONS

**Choiceboard:** An interactive online-software that enables customers to choose, for a variety of features, a single option from a list of options. Used during online purchase, a customer can take a basic product and then customize it by selecting from a set of product features.

**Configurator:** Another word for Choiceboard

**Conjoint Analysis:** A set of statistical technique used in market- and marketing research to determine how people value different features that make up an individual product or service.

**Full Profile:** In conjoint analysis, a product combination being evaluated that has *some* level of every attribute in the choice set (vs. a *partial profile*: a product combination being evaluated with only a subset of attributes in the choice set being specified).

**Mass Customization:** A term used in marketing and manufacturing, representing the use of flexible, computer-aided manufacturing systems to produce custom output. In other words, it combines mass production processes with individual customization.

**Self-Reported Purchase Intent:** Respondents provide their best estimate for their likelihood of purchase in the future.

## ENDNOTES

[1] It is very likely that the scenarios evaluated are not all possible combinations, but only a carefully selected subset chosen by applying principles of experimental design. See, for example, Berger, P. & Maurer, R. (2002). *Experimental Design with Applications in Management, Engineering, and the Sciences.* Pacific Grover, CA: Duxbury Press.

[2] Self-reported purchase intent values are widely agreed to be exaggerated, the degree of exaggeration differing for different product categories. For example, for a particular product category, experience may indicate that only 72 percent of those who indicated virtual certainty actually bought the product,

only 59 percent who indicated a 90 percent purchase probability actually bought, and so on. Marketing research firms often consider information about these conversion values to be proprietary.

3 As a practical matter, the order would be random, equivalent to a shuffle of a deck of cards. It would be impossible to rotate through all orders, since the number of orders is $120! = 6.69 \times 10^{198}$.

4 There may or may not be a significant difference in what an analysis concludes depending on the difference in presentation. The authors do not know of any study that has focused directly on this issue. The key aspect of any difference in analysis would probably lie in the validity of inferences about interaction effects.

# Chapter 43
# E-CRM:
## A Key Issue in Today's Competitive Environment

**María Pilar Martínez-Ruiz.**
*University of Castilla-La Mancha, Spain*

**María Rosa Llamas-Alonso**
*University of León, Spain*

**Ana Isabel Jiménez-Zarco**
*Open University of Catalonia, Spain*

## INTRODUCTION

As competition and the cost of acquiring new customers continue to increase, the need to build and enhance customer relationships has become paramount for businesses. The building of strong customer relationships has been suggested as a means for gaining competitive advantage (Mckenna, 1993) so, in today's marketplace, a growing number of firms seek to develop profound, close and long-lasting relationships with their customers since it is much more profitable to keep and satisfy current customers than to manage an ever-changing customer portfolio (Reinartz & Kumar, 2003; Ross, 2005; Llamas-Alonso et al. 2009).

This one is a consequence of many paradigmatical changes in the marketing field during the past decades, such as a transition from a focus on the product, transactional marketing, acquiring clients (responsive marketing approach) and market share towards a customer centric approach, relationship marketing, two-way communication, retaining customers (proactive and holistic marketing approaches) and share of customer. Thus, in this fast-moving and highly competitive scenario Customer Relationship Management (hereafter referred to as CRM) emerges as a business philosophy devoted to enhance customer relationships and consequently create value for both the company and the customer.

CRM has become a cornerstone issue not only in off-line buyer-seller relationships, but also in on-line customer-supplier relationships. The impact of information technology in the fields of marketing and management has emphasized the importance

DOI: 10.4018/978-1-61520-611-7.ch043

of re-arranging a new plan for marketing that gets benefited from new technologies. With the rise of e-business applications and the use of electronic channels, CRM has expanded the capacity of the organizations to interact with their customers and suppliers using e-technologies such as the Internet, which is termed as e-CRM. The availability of information on real time, interactivity and personalization, as characteristics of the Internet as well as of other e-technologies, are furthering e-CRM functions fostering a closer interaction between customers and business organizations (Chandra & Strickland, 2004).

The aim of this chapter is to highlight the importance of e-CRM as a key business process for global companies, gaining a better understanding of its benefits from different managerial perspectives, emphasizing key factors for effective implementation and pointing out challenges and future directions in the field.

## CUSTOMER BASED ADVANTAGES AND NEW MARKETING ORIENTATIONS: PROACTIVE AND HOLISTIC APPROACHES

The development of competitive advantages based on the continuous creation and offer of value to customers, contributes significantly to the business success. Thus, firms that aim to achieve these advantages need a market oriented corporate culture which boosts customer knowledge and learning, as well as customer communication and cooperation (Slater & Narver, 1999) in order to: (1) give an effective response to customers' needs (Matthing et al., 2004) and (2) gain a competitive positioning in the market.

Customers can exhibit two types of needs: manifest and latent. Manifest needs are defined as those ones that the customer is aware of, and they are clearly and directly manifested while latent needs are those that are not expressed by the customer, either because he/she has never previously experienced them or because he/she has never planned on responding to them (Matthing et al., 2004). In this context, marketing oriented firms can implement two types of actions with the aim of meeting customer demands. The first type, called **responsive marketing orientation**, focuses on understanding the manifest needs of customers in order to develop products and services to meet them (Slater & Narver, 1999). The second behaviour, termed as **proactive marketing orientation**, seeks to learn about and understand customers' latent needs with the goal of offering them proper and satisfactory solutions (Slater & Narver, 1999; Matthing et al., 2004).

Some studies highlight the direct and positive relationship between proactive marketing orientation and business success (e.g., Kuada & Buatsi, 2005; Slater et al., 2006). A proactive marketing orientation will help the firm to get to know the customer's needs (both latent and manifest) and so, it will be able to offer products and services that increase the value that the customer receives (Grönroos, 2000), providing the firm with a sustainable competitive advantage and improving business results in the long term.

No doubt that, as suggested by Dipak et al. (2002), among others, marketing needs to evolve quickly, especially in order to provide customers with adequate responses to their requirements. This will increase the success of the firm, considering the current scenario characterized by globalization, new technologies –especially the Internet – and hyper competence. In this context, the holistic marketing implies to take an step further in the marketing field (Keller & Kotler, 2006). Thus, in order to create and deliver value, the firms seek to interact in all potential areas with all agents (clients, employees, partners, stakeholders and communities). As pointed out by Dipak et al. (2002), this new marketing approach makes it necessary to the firm: (1) adapt a more holistic perspective regarding the customers needs, trying to offer more than a specific product or service; (2) develop a more holistic perspective about how its behaviour affects customer satisfaction; and (3) develop a more holistic view about the sector –especially taking into account emergent developments, representing new opportunities and drawbacks –.

The latter two marketing approches constitute the foundation of CRM initiatives. In this scenario, CRM emerges as a business approach that combines strategy and technology with the aim of managing knowledge about the customer and establishing two-way communication and effective interaction between the firm and the customer in order to improve the efficiency and effectiveness of the business processes. This focus involves a win-win approach by increasing value for both, customer and firm, since it helps to improve customer retention and loyalty, cross-sell and up-sell solutions, reduce operating costs, and increase sales revenue (Llamas-Alonso et al., 2009).

The wide deployment of the Internet and other e-technologies during the last decades has encouraged firms to take steps towards the development of marketing strategies in an e-world. In most of the cases, technologies like mobile phones, game consoles or web sites have been used with commercial purposes. Nowadays, a high number of companies use applications below the line, such as product placement, advergaming (and advergaming 2.0) as communication tools, drawing the attention of their customers (Moore, 2006). Thus, with the shift of business applications towards the Internet and other e-technologies (e.g., mobile phones, PDAs, customer call and contact centers, voice response systems, etc.), CRM has enhanced organization's capabilities by providing access to its customers and suppliers via the Web. This business strategy using these e-channels is termed as e-CRM –*electronic CRM* –. Through the integration of both technological and marketing elements, e-CRM covers all aspects of the customer's online experience throughout the entire transaction cycle (Lazakidou, Ilioudi & Siassiakos, 2008).

E-technologies have become a key touch point in the interaction between customers and companies, so the interest in managing customer relationships through these applications has grown parallel with the rise of e-CRM as a sub-field embedded into the general discipline of CRM. No doubt that the Internet is furthering e-CRM functions since it provides features that are attractive to both customers and organizations (Chandra & Strickland, 2004). E-CRM intertwines traditional CRM solutions with e-business applications. In this vein, Bradway and Purchia (2000) suggest that e-CRM is the intersection between paramount shifts like the growing Internet market and the prevailing focus on customer-centric strategies.

Therefore, e-CRM strategy involves taking advantage of the revolutionary impact of the Internet and other e-technologies to expand the traditional CRM techniques by integrating technologies and new electronic channels such as web sites, wireless, and voice technologies and combining it with e-business applications into the overall CRM strategy (Pan & Lee, 2003). Hence, the main differences between CRM and e-CRM are related to the underlying technology and its interfaces with users and other systems. In this particular respect, it is important to highlight that the additional capabilities that e-CRM systems provide to customers (e.g., self-service browser-based window to place orders, check order status, request information, etc.), offer them freedom in terms of place and time. All e-CRM applications are designed with customers in mind, giving them a complete experience on the e-technologies. Each different user has a different view of the array of information, goods, and services available to him/her (Chandra & Strickland, 2004) according to his/her individual profile.

In addition, it is important to outline that e-CRM is not the same as web-enabled CRM. On the one hand, while web-enabled CRM is usually designed around one department or business unit, e-CRM applications are built for the whole company, including customers, suppliers and partners

(Chandra & Strickland, 2004). On the other hand, e-CRM can also include other e-technologies and channels, such as mobile phones, customer call and contact centers as well as voice response systems. The use of these technologies and channels means that companies are managing customer interactions with either no human contact at all, or involving reduced levels of human intermediation on the supplier side (Anon, 2002).

Finally, e-CRM helps on-line businesses to better manage interactions with their customers using the Internet as the focal touchpoint. The web can represent the initial means through which CRM business actions, like targeted cross-selling and personalized product offers based on analysis of a customer's behaviors and preferences, take place but other channels are also appropriate to get in touch with current customers and prospects, enhancing their loyalty in the first case and attracting their interest for the company in the latter one (Dyché, 2001).

## E-CRM OBJECTIVES AND BENEFITS

The main objective of an e-CRM system is to establish a double-way communication between the company and its customers via the web and other e-technologies driving to a close and long-lasting relationship. These technologies enable the improvement of the customer service, by providing analytical capabilities within the organization (Fjermestad & Romano, 2003) and so, retaining valuable customers.

Two of the key words defining society today are mobility and flexibility. The contact between customers and companies is no longer limited to a personal contact or a contact through a computer, instead a wide range of tools can serve the customer to interact with firms. In this regard, e-CRM applications foster customer focused philosophy since they provide firms with completely new avenues to maintain and attract customers, improve transaction and service capabilities, and develop integrated, customer-centric infrastructures that enable businesses to provide the customer with a level of valuable end-to-end service impossible to achieve less than a few years ago.

Due to the additional possibilities that the use of e-technologies provides, in contrast to CRM, e-CRM allows the organization to dynamically change its marketing efforts to adapt them to market demands. It means for example that, as business conditions change, an organization with e-CRM capabilities implemented can design and release specific campaigns to targeted customer segments (Chandra & Strickland, 2004). In order to do this, it is important that the information obtained through the web site is integrated with the information from the rest of the channels to provide the managers with a holistic view of the customer.

As a managerial tool, e-CRM is a sound platform for putting into practice relationship marketing, even if some limits still (and will) continue to exist for engaging firms into individual on-line relationships with innumerable customers. E-CRM goes an step forward from CRM initiatives since it allows:

- Do (real-time) personalisation to degrees it is not possible with CRM.
- Interact with customers in ways, at speeds and through channels that it is not possible through CRM.
- Track behavioural trends in ways it is not possible with CRM.
- Empower customers in ways it is not possible with CRM.
- Exploit the benefits of an internet-based rather than client/server technical architecture.

E-CRM can be viewed as a business process in which customer equity is continuously created, enhanced and managed by interacting with customers through electronic touch points fostering close relationships with customers, improving customer retention and loyalty rates, creating opportunities for cross-selling and up-selling operations and generating benefits for both the company and the customers.

According to Kimiloglu and Zaralihigher (2009) e-CRM implementation involves high levels of improvements in customer satisfaction, transaction amounts and frequency, brand image, effective database management and customer targeting, efficient business processes, technology utilisation, excellence and innovation in services, improved sales, profitability and decreased service support costs.

## KEY FACTORS IN A SUCCESSFUL E-CRM IMPLEMENTATION

The infrastructure supporting e-CRM requires knowledge of customer data capture, storage, selection and distribution. While several tools may be employed to capture data, the approach to what data are collected, stored and used in reporting and analysis requires skills and techniques similar to those used in the offline world (King & Tang, 2002).

Many companies are currently working on the implementation of e-CRM systems. To efficiently do this they should understand and respond to the following critical success factors for e-CRM initiatives (King & Tang, 2002):

- Accurately assess e-CRM needs: Prioritize e-CRM initiatives based upon a gap analysis between the current and the future states and use this road map to plot progress over the next several years. Spending several weeks upfront understanding the current situation may reveal areas where the need for traction in e-CRM is great, and the rewards for progress in these areas will be commensurate.
- Understand customer requirements: Some efforts to understand customer requirements are necessary. To prioritize e-CRM projects, the firm needs to understand which changes will be enthusiastically welcomed by customers and which ones will not place the company any closer to better fulfilling customer´s needs.
- Don’t view e-CRM as a technology initiative: Every e-CRM initiative has technology components, but e-CRM is not a technology initiative. It is a business initiative requiring the project discipline of technology groups during implementation and the process focus of the business teams throughout the initiative.
- Quantify expected returns from e-CRM: Given current market conditions, no firm would embark upon an initiative with the scope of an e-CRM project without quantifying expected returns. At least, that would seem to make good business sense. With any large-scale initiative, the measurement of returns should include interim reviews of expenditures and cost savings along with monthly tracking of revenue changes. Quantify expectations upfront and maintain constant vigilance of results constitute a critical aspect.
- Make e-CRM an enterprise-wide initiative: Whether the firm opts to take a comprehensive journey or a series of targeted road trips, an e-CRM road map for the firm should exist. With an e-CRM road map, each road trip can be seen in the context of an enterprise-wide initiative and be treated as part of a larger whole. If the firm truly views e-CRM as enterprise-wide, even minor successes exclusive to a single channel will be communicated and celebrated widely.
- Ensure integration across all distribution channels: In the same way, whether the firm is involved in a comprehensive or targeted implementation, integration plans must take into account all distribution channels.

- Employees will make or break e-CRM efforts: e-CRM efforts are people initiatives. The smallest e-CRM effort incorporates changes to technology, processes and people, with people as the variable with the greatest range in the equation. People changes may include the need to learn new skills, to work with different functions or even to eliminate positions entirely. Clear communication in the beginning about potential outcomes for each individual as well as their department and the firm can lead to greater buy-in and higher likehood of a succesful implementation.
- Be willing to change the processes: Business processes are the third leg in the technology-process-people triangle that is affected by an e-CRM implementation. Many firms do not take full advantage of the benefits of newly implemented technology because they are unwilling or unable to change their business processes. A true e-CRM implementation will result in changes to three; and, often, the process change has a greater impact on cost savings than the introduction of new technology.
- Recognize that e-CRM is a change effort: e-CRM implementation involves a change effort with all the cross-functional team meetings, corporate communications and multiyear planning of any enterprise-wide attempt a reformulating the business approach.

## CHALLENGES AND FUTURE DIRECTIONS IN E-CRM

E-CRM is understood as managing relationships with customers through the web site and other e-technologies. A key issue is to integrate the information about the customer obtained from these channels with the information from the rest of the channels in order to provide the managers with a holistic view of the customer and his/her relationship with the firm. A 360° customer view constitutes the foundation to understand customer needs so that the company can manage a cost-effective system that contacts the right customers at the right time with the right solutions to meet their needs.

The use of e-CRM tools and systems yields in an improvement of the marketing performance by introducing new opportunities to companies to enhance their effectiveness and to deliver customer value (Scullin et al., 2004). It offers additional opportunities to lower die costs involved in communicating with customers, optimize work flows as a result of the integration with other enterprise systems, facilitate better market segmentation and enable optimal customer interactions, relationship and customization opportunities (Adebanjo, 2003).

One of the main challenges in adopting e-CRM initiatives comes from managing the myriads of interactions taking place in a network firm, dealing with all the information holistically, and using that information in a dynamic, flexible, effective and interactive way to provide customers with a close and personalized treatment. The first step is to record and store the logs regarding the customer trackings but the true challenge is to be able to analyze all these logs and transform these data into knowledge. This in-depth knowledge should be the base for a customized relationship with every customer.

Another challenge comes from the need of a holistic cross-functional integration of processes, people, operations, and marketing capabilities that is enabled through information, technology and applications. According to Harrigan, Ramsey & Ibbotson (2008), e-CRM should move on to a more strategic and integrated level particularly in SMEs. Only if the e-CRM implementation takes place on a company-wide level the pay of will be optimal. Future trends point in this direction.

Finally, the adoption of an e-CRM approach implies a high level of involvement, a great challenge for the firm, since it means a different way of understanding the marketing strategy, the market and the approach to the customer and communicating and aligning the organization around this strategy. It also requires an important investment in ICTs and an intensive use of these ICTs, in order to improve the efficiency of the internal processes and the management of the relationships with customers.

## REFERENCES


Adebanjo, D. (2003). Classifying and selecting e-CRM applications: an analysis-based proposal. *Management Decision*, *41*(6), 570–577. doi:10.1108/00251740310491517

Anon., (2002, February). Unravelling e-CRM. *CRMMarket Watch*, *8*(28), 12–13.

Atuahene-Gima, K., Slater, S. F., & Olson, E. M. (2005). The Contingent Value of Responsive and Proactive Market Orientatations for New Product Program Performance. *Journal of Product Innovation Management*, *22*, 464–482. doi:10.1111/j.1540-5885.2005.00144.x

Baker, W. E., & Sinkula, J. M. (2005). Market Orientation and the New Product Paradox. *Journal of Product Innovation Management*, *22*, 283–502. doi:10.1111/j.1540-5885.2005.00145.x

Bradway, B., & Purchia, R. (2000). *Top 10 strategic IT initiatives in e-CRM for the new millennium*. Retrieved from http://www.financial-insights.com

Brown, S. A. (2000). A case study on CRM and mass customization. In S. A. Brown (Ed.), *Customer relationship management- a strategic imperative in the world of e-business*. Toronto: John Wiley and sons, Canada.

Chandra, S., & Strickland, T. J. (2004). Technological differences between CRM and E-CRM. *Issues in Information Systems*, *2*, 408–413.

Chen, Q., Chen, H. M., & Kazman, R. (2007). Investigating antecedents of technology acceptance of initial eCRM users beyond generation X and the role of self-construal. *Electronic Commerce Research*, *7*(3-4), 315–339. doi:10.1007/s10660-007-9009-2

Dyché, J. (2001). Getting ready for CRM: A pre-Implementation checklist. *CRM Guru.* Retrieved from http://www.crmguru.com/features/ect/jdyche.html

Fjermestad, J., & Romano, N. C. (2003). Electronic customer relationship management: revisiting the general principles of usability and resistance: an integrative implementation framework. *Business Process Management Journal*, *5*(9), 572–591. doi:10.1108/14637150310496695

Franke, N., von Hippel, E., & Schreier, M. (2006). Finding commercially attractive user innovations: A test of lead-user theory. *Journal of Product Innovation Management*, *23*(4), 301–315. doi:10.1111/j.1540-5885.2006.00203.x

Frishammar, J. (2005). Managing Information in New Product Development: A Literature Review. *International Journal of Innovation and Technology Management*, *2*(3), 259–275. doi:10.1142/S021987700500054X

Grönroos, C. (2000). Relationship Marketing: Interaction, Dialogue and Value. *Revista Europea de Dirección y Economía de la Empresa*, *9*(3), 13–24.

Harrigan, P., Ramsey, E., & Ibbotson, P. (2008). e-CRM in SMEs: an exploratory study in Northern Ireland. *Marketing Intelligence & Planning*, *26*(4), 385–404. doi:10.1108/02634500810879296

Hult, G. T., Ketchen, D. J., & Slater, S. F. (2005). Market Orientation and Performance: An Integration of Disparate Approach. *Strategic Management Journal*, *26*, 1173–1181. doi:10.1002/smj.494

Keller, K. L., & Kotler, P. (2006). Holistic marketing: A broad, integrated perspective to marketing management. In J.N. Sheth & R.G. Sisodia (Eds.), *Does marketing need reform? Fresh perspectives on the future* (pp. 300-306). Armonk, NY: M. E. Sharpe Editor.

Kimiloglu, H., & Zarali, H. (2009). What signifies success in e-CRM? *Marketing Intelligence & Planning*, *27*(2), 246–267. doi:10.1108/02634500910945011

King, R., & Tang, T. (2002, January 18). E-CRM in the Post Dot-Com Age: Nine Critical Factors to Success. *DM Direct Newsletter*. Retrieved from http://dmreview.com/article_sub.cfm

Kuada, J., & Buatsi, S. N. (2005). Market Orientation and Management Practices in Ghanaian Firms: Revisiting the Jaworski and Kholi Framework. *Journal of International Marketing*, *13*(1), 58–88. doi:10.1509/jimk.13.1.58.58539

Lazakidou, A., Ilioudi, S., & Siassiakos, K. (2008). Electronic Customer Relationship Management Applications and Consumer Trust in E-Commerce. *International Journal of Electronic Customer Relationship Management*, *2*(3), 262–275. doi:10.1504/IJECRM.2008.020411

Lee-Kelley, L., Gilbert, D., & Mannicom, R. (2003). How e-CRM can enhance customer loyalty. *Marketing Intelligence & Planning*, *2*(4), 239–248. doi:10.1108/02634500310480121

Liu, Y., Zhou, C., & Chen, Y. (2006). Determinants of E-CRM in influencing customer satisfaction. In *Proceedings of the 9th Pacific Rim International Conference on Artificial Intelligence* (LNCS 4099, pp. 7-776). Berlin: Springer.

Llamas-Alonso, M. R., Jiménez-Zarco, A. I., Martínez-Ruiz, M. P., & Dawson, J. (2009). Designing a Predictive Performance Measurement and Control System to Maximize Customer Relationship Management Success. *Journal of Marketing Channels*, *16*(1), 1–41. doi:10.1080/10466690802147896

Matthing, J., Saden, B., & Edvardsson, B. (2004). New Service Development: Learning from and with Customers. *International Journal of Service Industry Management*, *15*(3), 479–498. doi:10.1108/09564230410564948

McKenna, R. (1993). *Relationship Marketing: Successful strategies for the age of the consumer.* Boston: Harvard School Business Press.

Moore, E. (2006). *Advergaming and the on line marketing on food to children*. Fundacion Kaiser Familia.

Padmanabhan, B., Zhiqiang, Z., & Kimbrough, S. O. (2006). An empirical analysis of the value of complete information for e-CRM models. *MIS Quarterly*, *30*(2), 247–267.

Pan, S. L., & Lee, J. N. (2003). Using E-CRM for a unified view of the customer. *Communications of the ACM*, *46*(4), 95–99. doi:10.1145/641205.641212

Reinartz, W. J., & Kumar, V. (2003). The impact of customer relationship characteristics on profitable lifetime duration. *Journal of Marketing*, *67*(January), 77–99. doi:10.1509/jmkg.67.1.77.18589

Richard, J. E., Thirkell, P. C., & Huff, S. L. (2007). An Examination of Customer Relationship Management (CRM) Technology Adoption and its Impact on Business-to-Business Customer Relationships. *Total Quality Management & Business Excellence*, *18*(8), 927–945. doi:10.1080/14783360701350961

Ross, D. F. (2005). E-CRM from a supply chain management perspective. *Information Systems Management*, 37–44. doi:10.1201/1078/44912.22.1.20051201/85737.5

Scullin, S., Fjermestad, J., & Romano, N. C. (2004). E-relationship marketing: changes in traditional marketing as the outcome of electronic customer relationship management. *The Journal of Enterprise Information Management*, *17*(6), 410–415. doi:10.1108/17410390410566698

Slater, S. F., & Mohr, J. J. (2006). Successful Development and Commercialization of Technological Innovation: Insights Based on Strategy Type. *Journal of Product Innovation Management*, *23*, 26–33. doi:10.1111/j.1540-5885.2005.00178.x

Slater, S. F., & Narver, J. D. (1999). Market-Orientated is More than Being Customer-Led. *Strategic Management Journal*, *20*, 1165–1168. doi:10.1002/(SICI)1097-0266(199912)20:12<1165::AID-SMJ73>3.0.CO;2-#

Srivastava, R. K., Shervani, T. A., & Fahey, A. L. (1998). Market-based assets and shareholder value: A framework for analysis. *Journal of Marketing*, *62*(January), 2–18. doi:10.2307/1251799

Zehrer, A., & Fenkart, S. (2008). Electronic customer relationship management, a new approach to self-evaluate a tourism destination. *Journal of Technology Marketing*, *3*(2), 169–182. doi:10.1504/IJTMKT.2008.018863

## KEY TERMS AND DEFINITIONS

**Advergaming:** The product placement in video games (advergaming) objective is to enhance the familiarity of the customer with the brand. The placement, the role, the scene and all the details related to the appearance of the brand in the video game are important since they contribute to position the brand in the mind of the customer. Una evolución del concepto es lo que se conoce con el nombre de advergaming 2.0. It takes a step forward achieving a high degree of customization of the advertising on real time. This is a dynamic formula which adapts to the user and to several characteristics of the game such as the time of the day or the profile of the customer.

**CRM:** CRM (Customer Relationship Management) is both a business approach and a management tool concerned with the generation and maintenance of long-lasting relationships between the firm and its customers by increasing knowledge about customers and establishing two-way cooperative relationships between the firm and its customers.

**E-CRM:** Since e-CRM (electronic customer relationship management) relates to selling, serving or communicating to customers via the Web, e-CRM can be regarded as a subset of CRM, meaning that e-CRM is one channel through which a company can deploy its CRM strategy.

**Holistic Marketing:** "Holistic marketing is the design and implementation of marketing activities, processes, and programs that reflect the breadth and interdependencies of their effects. Holistic marketing recognizes that "everything matters" with marketing –customers, employees, other companies, competition, as well as society as a whole –and that a broad, integrated perspective is necessary (Keller & Kotler, 2006, p. 300).

**Proactive Marketing Orientation:** Proactive marketing orientation, seeks to learn about and understand customers' latent needs with the goal of offering them proper and satisfactory solutions

**Responsive Marketing Orientation:** Responsive marketing orientation focuses on understanding the manifest needs of customers in order to develop products and services to meet them.

# Chapter 44
# Effective Virtual Project Management Using Multiple E-Leadership Styles

**Margaret R. Lee**
*Capella University, USA*

## INTRODUCTION

The field of organizational behavior defines leadership as "the ability to influence a group toward the achievement of goals" (Capella, 2005, p. 294). Leadership styles have been well studied and researched. Early leadership studies were developed using traditional, co-located work arrangements in mind. Later studies expanded to include traditional project team environments. In the current business environment, however, nontraditional virtual work arrangements are becoming more popular. Virtual project teams are increasing in business today and will continue to become more common in the future (Martins, Gilson, & Maynard, 2004).

Managing nontraditional work involving virtual teams is becoming a necessity in the current business environment. The type of leadership e-managers must demonstrate for successful virtual team management is different from traditional project team management (Konradt & Hoch, 2007). Understanding appropriate leadership styles for virtual project teams and the transition toward new leadership styles is an important part of managing human resources in organizations and successful virtual project management. Emerging e-leadership roles and management concepts for virtual teams include multiple leadership models, and their application is an important part of our evolving virtual organizational behavior.

This paper reviews management concepts for virtual teams that include leadership styles such as control-related models, transformational and transactional leadership styles, leadership that empowers team members to self-manage, and situational and contingency leadership styles. In the virtual project environment, the effective manager needs to use

DOI: 10.4018/978-1-61520-611-7.ch044

as many different styles as needed to bring the project to a successful completion.

## BACKGROUND

### Introductory Definitions

Virtual teams reflect the ever-increasing non-traditional work environments of the 21st century, with members collaborating from geographically distant locations (Lee, 2009). Ariss, Nykodym and Cole-Laramore (2002) define virtual teams as a group of skilled individuals who "communicate via computer, phone, fax and video-conference" (p. 22). Virtual teams involve individuals who are geographically distributed and use technology to communicate and produce results (Duarte & Snyder, 1999).

The term e-leadership describes leadership in today's nontraditional virtual business environment. The need for e-leadership in virtual project teams has become increasingly relevant as businesses move toward more non-traditional work. Virtual project teams are increasing in business today, and understanding e-leadership styles of virtual teams is an important part of e-business. E-leadership styles for virtual project team managers may be different from traditional project team managers, and how they might be different is still an emerging study. E-leadership styles is an expanding topic for developing the knowledge and practices necessary to determine the most effective leadership styles for virtual project managers.

### Leadership Styles

#### Control-Related Leadership

Control-related leadership is defined as leading by tasks and includes motivating, providing role clarity, setting clear goals and priorities, and by giving good directions. Control-related leadership has been linked to effective virtual team management. Konradt and Hoch (2007) examined leadership roles and showed that the task leadership function was "rated as significantly more important to virtual team effectiveness than people leadership function" (p. 25) and "that managers in virtual teams viewed control-related roles as more appropriate for virtual team success and performance than non-control-related roles" (p. 26).. Similar goal-related concepts can be found in management by objectives (MBO) studies. Previous studies found that control-related leadership strategies were positively related to virtual team success (Hertel, Konradt, & Orlikowski, 2004). Control often has a negative connotation when linked to management behaviors, but leadership involves some degree of responsibility for influencing the behavior of workers (Hersey, Blanchard, & Johnson, 2001, p. 17).

#### Transformational and Transactional Leadership Styles

Transformational and transactional leadership characteristics are common management styles for virtual teams. Transformational leaders are defined as leaders who inspire followers to work (Capella, 2005). Transactional leaders are defined as leaders who motivate followers to complete goals by clearly identifying roles and setting vision (Capella, 2005). In a study by Hambley, O'Neill and Kline (2007) to determine virtual team leadership behaviors, the results were divided into five major behaviors closely related to transactional leadership characteristics: (1) ability to provide role and expectation clarity and good communications, (2) working along with the team; (3) relationship building skills; (4) effective team meetings; and (5) strong project management. Many of the e-leadership behaviors identified in the Hambley, O'Neill and Kline study (2007) can be linked to the transformational and transactional leadership styles. They found that leaders setting goals for virtual teams reflected the transformational style motivational skills. Providing role and expectation clarity for virtual teams reflected the contingent reward factor of transactional style leadership.

## Leadership through Empowerment

Effective leadership through empowerment involves self-management within virtual teams. Bell and Kozlowski (2002) report that virtual leaders need to implement a system that will allow virtual project team members to self-manage. Self-managed work teams are defined as teams that "take on many of the responsibilities of their former supervisors" (Capella, 2005, p.234). It is important for virtual team leaders to distribute leadership functions to the team itself, making it self-managing (Bell & Kozlowski, 2002). Bell and Kozlowski suggest that many virtual teams are composed of individuals who already have virtual team experience and expertise in their area of work. Leadership roles can be shared by team members who are not co-located (Pearce & Conger, 2002). Similar to empowerment, the leader-participation theory "provides a set of rules to determine the form and amount of participative decision making in different situations" (Capella, 2005, p. 309) and could be applied to e-leadership. However, a truly empowered leadership style will free the virtual team from organizational constraints and encourage proactive action and accountability (Hersey, Blanchard, & Johnson, 2001).

## Situational Leadership Styles

The situational school of leadership models assume that effective leaders can develop and adopt certain styles or behaviors. Tannebaum and Schmidt (1958) presented a framework to help explain an effective leader in their continuum of leadership behavior. Their theory analyzed the different patterns of leadership behavior and how this range of behaviors determined the type of leadership, leadership pattern, and effect on short- and long-range objectives. Blake and Mouton (1964) proposed a behavioral management theory that suggested that many behaviors and motivations affected leadership. They established five key managerial styles: do nothing, country club, task/production, mundane/middle of the road, and team. However, Blake and Mouton's main limitation was that their model assumed that there is one consistently sound style of leadership across all situations. Hersey and Blanchard (1969) contributed to the emerging situational school of leadership, proposing that effective leaders adopt certain styles or behaviors to be successful. Hersey and Blanchard proposed a life-cycle theory of leadership suggesting that leadership could be adjusted to the maturity of the subordinate. They used multiple dimensions - task/production oriented and people-oriented – and the variable "maturity" scaled from most mature to most immature. Building on existing research, they developed a situational style leadership model (telling, selling, participating, delegating) dependent upon workers' maturity.

## Contingency School of Leadership

The contingency school of leadership models further developed situational leadership ideas to encourage matching the leadership style to the activity or work. In Fiedler's (1967) seminal book, he identified three major variables – leadership trust, clarity of task, and leadership power/authority – that match the style to the situation. Fiedler identifies two basic styles of leadership – task oriented and relationship-oriented (participative). He suggests that by using a least-preferred coworker scale, workers can be assigned to task oriented or participative leaders to achieve maximum effectiveness. Fiedler re-conceptualized existing leadership studies, theories and research to determine that task oriented leaders perform best in situations that are very favorable or very unfavorable to the leader and that relationship-oriented leaders perform best in situations that are intermediate in favorableness. His significant contribution to leadership theory was his focus on situational variables as moderating influences.

House (1971) presents a path-goal theory based upon motivation theory. House's leadership effectiveness theory, part of the contingency school, suggests that the leader influences (motivates) the team to find the path to their goals by using an appropriate leadership behavior (directive, supportive, participative and achievement-oriented). The leader adapts leadership behaviors to environmental factors (such as task structure, authority system, and work team) and subordinate factors (locus of control, experience, ability) resulting in more effective and satisfying team performance. House's theory suggests that the leaders diagnose the situation before attempting a leadership intervention. During the 1970s, Hersey and Blanchard (1974) developed a contingency theory that suggested a situational leadership style where the leader is flexible in what type of leadership behavior is used dependent upon the needs of the team.

The common thread for these approaches is that the leader should be flexible and be able to adapt and apply the appropriate leadership style as necessary. Later, Vroom (2003) suggested a contingency theory model that relates leadership style to the task at hand or situation. The Vroom Decision Tree Approach (Vroom, 2000) prescribes leadership styles appropriate for the situation. It uses five leadership styles that are dependent upon the subordinate participation to determine the degrees of being autocratic, consultative, or group oriented when making leadership decisions. Situations shape how leaders behave and influence the consequences of leader behavior (Vroom & Jago, 2007).

## Project Management Leadership Research

The seminal contributions of these scholars shaped subsequent research for leadership theory for work teams and project teams. In the body of knowledge for project management leadership, these theories identify leadership styles for traditional project management. Determining whether different leadership styles are appropriate at different stages of the project life cycle and with different team structures has been explored and research conducted in the project management context, with the general conclusion that leadership styles theory can be appropriately applied to project management leadership. Applying these theories and research, then, to virtual project management could be the next step in exploring how leadership styles for virtual project teams are different than traditional leadership styles and traditional project management leadership.

### Traditional Project Management Research

Slevin and Pinto (1991) challenged the complexity and often-contradictory research on leadership and the perception that the process of project leadership is confusing. They attempted to describe a cognitive approach to leadership to help project managers consciously select the correct leadership style. They proposed a two-dimensional leadership model (information input and decision authority) on which leadership style can be plotted using percentile scores that it is practical, simple and recognizes three main leadership decision styles (participative, delegation, and pressured). Shenhar's (1998) research also explored a two-dimensional model for management and determined differences in management style based upon a classification system of project type. Results indicated that fit between project leadership style and type of project are important to the success of the project. Turner and Muller's (2006) study attempted to develop guidelines on selecting the appropriate project manager for projects dependent upon leadership style. They found that leadership style was positively correlated with project success and that different combinations of leadership competencies were positively correlated with project success.

### Virtual Project Management Research

Lee-Kelley (2002) suggested in her study of virtual project teams that Fielder's (1967) identification of the key situational variables influence a leader's style, and her study included Fiedler's leadership instrument and least preferred co-worker (LPC) scale. The theory that a manager's ability to control and influence the team or situation impacts his or her management style was confirmed by the study, as was Fiedler's proposal that task-motivated managers perform best when situational control is high as well as in situations where control is low. Konradt & Hoch's (2007) work is important in establishing virtual managers' perceptions of roles. They also questioned if men used more directive leadership styles (indicating a control-related leadership role) than women leaders to manage virtual teams. Hambley, O'Neill and Kline (2007) explored virtual team leadership behaviors in six different experimental conditions and connected virtual team leadership to transformational and transactional leadership styles.

## APPLICATION OF THEORETICAL CONCEPTS FOR LEADERSHIP STYLES TO VIRTUAL PROJECT MANAGEMENT

### Application of Control-Related Leadership

Konradt and Hoch (2007) research results showed that control-related leadership roles correlated to virtual team success and performance, A field study of two large companies in Germany by Hertel, Konradt, and Orlikowski (2004) showed that effective virtual team management practices included setting clear goals, tasks, and outcome interdependencies. They found that the higher the quality of goal setting processes and task interdependence, the more effective the virtual team. Hertel, Konradt, and Orlikowski suggest that e-leaders focus on high quality goal setting, high task interdependence and use team-based rewards to produce the best results from virtual teams. Hooijberg and Choi (2000) found that the goal achievement role, (attainment of goals, setting clear goals, and coordinating work) had a strong relationship with the perception of leadership effectiveness. Lee-Kelley's (2002) study indicates that the task-motivated leadership style for shorter projects would appear to be effective. Implications for the organization are the need to know the tenure of their projects and ensure that the project leaders' styles are appropriately matched to the term of the projects.

### Application of Transformational and Transactional Leadership Styles

Motivation can be enhanced by providing challenges, recognition, and rewarding responsibility and creativity (Project Management Institute, 2001). Communicating the vision can be achieved through a well-developed project charter, developing emotional buy-in and ownership of the vision within the team, and using the vision to guide and direct the work (Kliem, 2004). Inspiring followers to work and motivating followers to complete goals by clearly identifying roles and setting vision are skills that can be learned. Training on transformational and transactional leadership skills and when each style is appropriate can provide an opportunity to apply these skills in real work situations. Hambley, O'Neill and Kline (2007) suggest developing training programs for virtual leaders and virtual project team members to increase team performance. Leaders can be taught skills (Capella, 2005) and learn the leadership techniques that can be most effective in virtual team management.

## Application of Leadership Through Empowerment

Bell and Kozlowski (2002) suggest that virtual team leaders need to be proactive in providing clear direction and specific goals to encourage each team member to monitor their own performance and self-regulate their work to be successful. To do this, they suggest the leader develop rules, guidelines and habitual routines for the team. Self-managing teams, usually 10-15 people, usually report higher levels of job satisfaction (Capella, 2005), but the team norms and organizational culture can be influences on the success for teams that self-manage. It is often necessary for a virtual leader to provide motivational incentives, set objectives and mission, and develop an appropriate climate or tone for the virtual team (Bell & Kozlowski, 2002). Day (1999) suggests that empowerment is dependent upon a company cultural attitude that includes education about the organization and what is really happening in the organization, operational consistency, a proven process, loyalty, and trust. Increasing these company cultural behaviors may increase the success of leadership through empowerment. Wickham and Walther (2007) imply that the emergence of more than one leader may be the result of the situation or environment of the virtual team, and project managers must recognize this fact.

## Application of Situational and Contingency Leadership Styles

The situational leadership style assumes that effective leaders can develop and adopt certain styles or behaviors dependent upon the needs of the project and team, analogous to the contingency school of leadership that emphasizes matching leadership style to the leadership situation. Tannebaum and Schmidt's (1958) situational leadership theory would provide the opportunity for the project manager to analyze the different patterns of leadership behavior, and how this range of behaviors could determine the type of leadership needed to affect short- and long-range objectives. Determining the degree of authority used by the project manager and the degree of freedom experienced by the virtual team members, the continuum could help determine the behaviors needed. Hersey and Blanchard's (1969) life-cycle theory of leadership would assist the project manager in adjusting to the maturity of the team member, and become more flexible in what type of leadership behavior is needed dependent upon the needs of the individual. Adopting this model would help control any loss of mature, experienced virtual team members from the team.

The Vroom Decision Tree Approach (Vroom, 2000) could help the project manager understand the team members' level of participation to determine the degree of autocratic, consultative, or group oriented leadership necessary. An overview of this theory would be valuable to the project manager in understanding the relationship between the need for participation and the need for leadership with both the on-site and virtual team members and assist in balancing the team relationships and work. Slevin and Pinto's (1991) model plots four extremes of leadership style with the level of participation by project team members and could be used as a day-to-day working framework for project managers. Turner and Muller (2006) conclude that the project manager's leadership style and competencies contribute to project success and make suggestions for appointment and deployment of project managers based upon their findings.

## Moving toward Multiple E-Leadership Styles

### Benefits of Multiple Leadership Styles in Virtual Projects

By understanding control-related leadership roles (Konradt & Hoch, 2007), using transformational and transactional leadership styles

*Table 1. Effective leadership concepts for virtual teams*

| Leadership Concept | Description | Application |
|---|---|---|
| Control-related | Leads by tasks<br>Motivates<br>Provides role clarity<br>Sets clear goals and priorities<br>Gives good directions | Use a high quality goal setting processes<br>Encourage task inter-dependence<br>Lead by task for shorter projects |
| Transformational | Inspires followers to work | Clearly identify roles<br>Set the project vision |
| Transactional | Motivates followers to complete goals<br>Clearly identifies roles<br>Reinforces the vision | Use a well-developed project charter<br>Develop emotional buy-in and ownership of the vision<br>Use the vision to guide and direct the work |
| Empowerment | Leads self-managed work teams<br>Distributes leadership functions | Develop rules, guidelines and habitual routines<br>Provide motivational incentives<br>Set strong objectives and mission<br>Develop an appropriate climate or tone |
| Situational | Adopts certain styles or behaviors<br>Adjusts to the maturity of the subordinate | Be skilled in multiple leadership styles<br>Adopt the appropriate style dependent upon the experience and needs of the team member |
| Contingency | Matches leadership style to the activity/work<br>Assigns workers to task oriented or participative leaders<br>Adapts to environmental factors<br>Leads dependent upon the needs of the team | Be trained on multiple leadership styles<br>Remain flexible<br>Adapt and apply the appropriate leadership style as necessary |

(Hambley, O'Neill, & Kline, 2007), empowering virtual project teams to self-manage (Bell & Kozlowski, 2002), and incorporating situational and contingency leadership styles, those managing virtual teams will be able to offer benefits to the organization by providing positive, successful leadership, resulting in better project deliverables (see Table 1).

Virtual project management has become increasingly important and a necessity as the trend in virtual work teams continues. Leadership styles for managing virtual project teams are different from leadership roles for managing traditional, co-located teams. Understanding emerging e-leadership styles for virtual project teams and their application is an important part of our evolving virtual organizational behavior.

## FUTURE RESEARCH DIRECTIONS

The literature reviewed may provide scholar-practitioners research topics related to the relationship between leadership orientation and adaptability for virtual project managers. Shenhar (1998) indicates that more research is needed to explore the role of contingencies in project management. Lee-Kelley and Loong (2003) recommend that there needs to be more evidence that the project manager can change leadership styles in response to altered circumstances.

Little research has been done to determine if situational and contingency theories of leadership can be applied to e-leadership of virtual project teams. The goal of future quantitative or qualitative research could be to determine if situational and contingency leadership style theories are applicable and increase the effectiveness of virtual project manager leadership. How leadership functions in virtual project teams evolve throughout the project and the best way(s) the project manager can adapt to these changes to lead the team to a successful deliverable - on time, in scope, with quality, and on budget – is vital to the future of e-leadership.

## CONCLUSION

This paper provides a review that could be used as a starting point for defining successful management styles for virtual project team leaders. For each style, there are leadership skills that managers can use to ensure success. As we move toward virtual organizations, we need to understand more clearly leadership roles in the virtual environment.

The general conclusion, also supported by Turner & Muller (2005), is that multiple leadership styles can be appropriately applied to project management leadership. Applying these theories and research to virtual project management provides an improved approach for managing human resources. The application to human resource management is that this flexibility in leadership style can provide the key to profitable project work, satisfied team members, and continued organizational growth through successful virtual project deliverables.

## REFERENCES

Ariss, S., Nykodym, N., & Cole-Laramore, A. A. (2002). Trust and technology in the virtual organization. *S.A.M. Advanced Management Journal*, *67*(4), 22–25.

Bell, B. S., & Kozlowski, S. W. (2002). A typology of virtual teams: Implications for effective leadership. *Group & Organization Management*, *27*(1), 14–49. doi:10.1177/1059601102027001003

Blake, R. R., & Mouton, J. S. (1964). *The managerial grid*. Houston, TX: Gulf Publishing Company.

Capella University. (2005). *Managing and organizing people*. Boston: Prentice Hall Custom Publishing.

Day, J. (1999). Getting the edge: The attitude of ownership. *Super Vision*, *60*(6), 3–6.

Duarte, D., & Snyder, N. (1999). *Mastering virtual teams.* San Francisco: Jossey-Bass.

Fiedler, F. E. (1967). *A theory of leadership effectiveness*. New York: McGraw Hill.

Goman, C. K. (2004). *This isn't the company I joined: How to lead in business turned upside down.* Berkley, CA: KCS Publishing.

Hambley, L., O'Neill, T., & Kline, T. (2007). Virtual team leadership: Perspectives from the field. *International Journal of e-Collaboration*, *3*(1), 40–63.

Hersey, P., & Blanchard, K. (1969). Life cycle theory of leadership. *Training and Development Journal*, *23*(5), 26–34.

Hersey, P., & Blanchard, K. (1974). So you want to know your leadership style? *Training and Development Journal*, *28*(2), 22–37.

Hersey, P., Blanchard, K., & Johnson, D. (2001). *Management of organizational behavior: Leading human resources.* Upper Saddle River, NJ: Prentice Hall.

Hertel, G., Konradt, U., & Orlikowski, B. (2004). Managing distance by interdependence: Goal setting, task interdependence and teambased rewards in virtual teams. *European Journal of Work and Organizational Psychology*, *13*(1), 1–28. doi:10.1080/13594320344000228

Hooijberg, R., & Choi, J. (2000). Which leadership roles matter to whom? An examination of rater effects on perceptions of effectiveness. *The Leadership Quarterly*, *11*(3), 341–364. doi:10.1016/S1048-9843(00)00044-8

House, R. J. (1971). A path-goal theory of leader effectiveness. *Administrative Science Quarterly*, *16*(3), 321–339. doi:10.2307/2391905

Kliem, R. L. (2004). *Leading high performance projects*. Boca Raton, FL: J. Ross Publishing.

Konradt, U., & Hoch, J. E. (2007). A work roles and leadership functions of managers in virtual teams. *International Journal of e-Collaboration*, *3*(2), 16–34.

Lee, M. R. (2009). E-ethical leadership for virtual project teams. *International Journal of Project Management*, *27*(5), 456–463. doi:10.1016/j.ijproman.2008.05.012

Lee-Kelley, L. (2002). Situational leadership: Managing the virtual project team. *Journal of Management Development*, *21*(5/6), 461–476. doi:10.1108/02621710210430623

Lee-Kelley, L., & Loong, K. L. (2003). Turner's five functions of project-based management and situational leadership in IT services projects. *International Journal of Project Management*, *21*(8), 583–591. doi:10.1016/S0263-7863(02)00100-X

Martins, L. L., Gilson, L. L., & Maynard, M. T. (2004). Virtual teams: What do we know and where do we go from here? *Journal of Management*, *30*(6), 805–835. doi:10.1016/j.jm.2004.05.002

Pearce, C., & Conger, J. (2002). *Shared leadership: Reframing the hows and whys of leadership*. Thousand Oaks, CA: Sage Publications.

Project Management Institute. (2001). *People in projects.* Newton Square, PA: Project Management Institute.

Shenhar, A. (1998). From theory to practice: Toward a typology of project-management styles. *IEEE Transactions on Engineering Management*, *45*(1), 33–48. doi:10.1109/17.658659

Slevin, D. P., & Pinto, J. K. (1991). Project leadership: Understanding and consciously choosing your style. *Project Management Journal*, *12*(1), 39–47.

Tannebaum, R., & Schmidt, W. H. (1958). How to choose a leadership pattern. *Harvard Business Review*, *36*(2), 95–101.

Turner, J. R., & Muller, R. (2005). The project manager's leadership style as a success factor on projects: A literature review. *Project Management Journal*, *36*(2), 49–61.

Turner, J. R., & Muller, R. (2006). *Choosing appropriate project managers: Matching their leadership styles to the type of project*. Newton Square, PA: Project Management Institute.

Vroom, V. (2000). Leadership and the decision-making process. *Organizational Dynamics*, *28*(4), 82–94. doi:10.1016/S0090-2616(00)00003-6

Vroom, V. (2003). Educating managers for decision making and leadership. *Management Decision*, *41*(10), 968–978. doi:10.1108/00251740310509490

Vroom, V. H., & Jago, A. G. (2007). The role of the situation in leadership. *The American Psychologist*, *62*(1), 17–24. doi:10.1037/0003-066X.62.1.17

Wickham, K. R., & Walther, J. B. (2007). Perceived behaviors of emergent and assigned leaders in virtual groups. *International Journal of e-Collaboration*, *3*(1), 1–17.

## KEY TERMS AND DEFINITIONS

**Contingency Style Leadership:** Leading by matching the leadership style to the situation

**Control-Related Leadership:** Leading motivating, providing role clarity, setting clear goals and priorities, and by giving good directions to complete tasks

**E-Leadership:** The term e-leadership describes leadership in today's non-traditional virtual business environment.

**Empowerment Leadership:** Leading by allowing self-managed work teams to take on the responsibilities of traditional management

**Situational Leadership:** Leading by developing and adopting different styles or behaviors as necessary

**Transactional Leadership:** Leading by motivating followers to complete goals by clearly identifying roles and setting vision

**Transformational Leadership:** Leading by inspiring followers to work

**Virtual Team:** Virtual teams are groups of skilled individuals collaborating from geographically distant locations and linked by technology that communicate electronically to achieve the goals of a project or work together on solving problems.

# Chapter 45
# On-Line Credit Card Payment Processing and Fraud Prevention for E-Business

**James G. Williams**
*University of Pittsburgh, USA*

**Wichian Premchaiswadi**
*Siam University, Thailand*

## ABSTRACT

*As the volume of purchases for products and services on the Internet has increased and the chosen method of payment is a credit or debit card, e-commerce merchants must be capable of accepting such payment methods. Unfortunately, cyber-criminals have found ways to steal personal information found on credit cards and debit cards and fraudulently use this information to purchase products and services which costs merchants lost revenue and fees for chargebacks. This article discusses the process by which credit card payments are processed beginning with the e-commerce merchant's web site to a credit card processor or service gateway to the credit card company's network to the issuing bank's network with an accept or decline response being returned to the merchant's shopping cart system via the same networks. The article addresses the issue of credit card fraud in terms of how the cyber-criminals function and the potential solutions used to deter these attempts by the cybercriminals. A list of preventive measures that should be used by e-commerce merchants is provided.*

## INTRODUCTION

Consumers in the United States spend nearly 1 trillion dollars each year using a credit card over the internet (Woolsey and Schulz, 2009). Accepting credit cards is essential for any e-commerce Web site. Processing credit cards over the Internet is one of the fastest growing segments of business transactions today. This type of transaction or "card-not-present" transaction requires a special type of merchant account. In the early days of credit card usage, to accept credit cards, a merchant needed a merchant account through a bank. But today there are a number of services, generally referred to as credit card processors or merchant account services, which will permit a merchant to accept credit card payments online without their own merchant account. There are actually three different methods for

DOI: 10.4018/978-1-61520-611-7.ch045

processing credit card payments using a merchant account service. These are:

1. **Real-Time Processing:** Real-time processing allows e-commerce merchants to link their e-commerce shopping cart with a gateway merchant service which will automatically process credit card payments.
2. **Virtual Terminal (Online Interface):** An e-commerce merchant can also process credit card transactions, manually, 24 hours a day by logging in online and submitting a secure form through a merchant account interface. A merchant can use this to process credit card payments while taking the customer's information over the phone if the merchant is able to access the Internet at high speed while talking to the customer.
3. **Automated Recurring Billing (ARB):** Some e-commerce merchant services need to charge customers on a monthly or account threshold basis. Some merchant account services allow the merchant to set the time interval or account threshold level and some services allow a merchant to upload multiple subscriptions using a batch file like Microsoft Excel.

PayPal is generally accepted as the most widely used online merchant account service with more than 150 million users across the world. VeriSign operates a competing service called Payflow that is typically used by merchants with a high volume of transactions each month. Although the number of merchant account service providers continues to increase, some of the more popular one are listed below (TopTenReviews, 2009):

- Flagship Merchant Services
- Gomerchant Merchant Accounts
- Merchant Accounts Express
- MerchantWarehouse
- Electronic Transfer Inc.
- E-Commerce Exchange
- NorthAmericanBancard
- Total Merchant Services
- Charge
- Merchant Credit Card
- Free AuthNet
- Merchant Credit Card

Companies that sell merchandise and services over the Internet are referred to as e-tailers or e-commerce merchants. These credit card processing services make it easy for e-tailers to start accepting credit cards for purchases of their products and services.

## BACKGROUND

### Who are the Participants in On-Line Credit Card Purchases?

#### Consumers and Merchants

The consumer is an individual or organization that has the intent of making a purchase. They have money or credit and they desire goods and services. The merchant is the one with the goods and services and is looking to sell them to consumers. Consumers are motivated to select a particular merchant by things such as price, service, selection or preference. But the merchant's primary motivation is to make money by selling the goods or services for more money than they paid for them. This money between what they bought it for and what they sold it for is called their margin. There are several different methods to exchange money for products and services such as bartering, cash, checks, debit cards, installment payments or credit cards. When credit cards are used, the consumer and the merchant both have banks that they are working with that process the credit card payment transactions.

## Issuing Bank

Consumers get their credit cards from a bank or credit union, called the "issuing bank." Sometimes an issuing bank is simply called an "issuer." An issuing bank may not just be associated with major credit card brands such as American Express, MasterCard and Visa, but also with credit cards called "private label credit cards." These are the ones that department stores or shops offer, such as Sears and Target credit cards. Issuing banks are lending institutions that support these credit cards by granting and managing extended credit. Some examples of these are Bank of America, Citibank, MBNA, Household Financial, GE and Wells Fargo. The purpose of the issuing bank is to grant credit directly to a consumer. They, typically, have a consumer fill out an application, check the applicant's credit history and maintain their account. The issuing bank is the one that decides what a consumer's credit limit is, based on credit history and current debt load. There are thousands of issuing banks in the United States. In Canada and the United Kingdom as well as most other countries in the world there are far fewer banks, so the number of issuing banks is much smaller. Issuing banks make money on the interest the consumer pays on outstanding balances from previous purchases, and they get a portion of every purchase a consumer makes with the credit card from a merchant.

## Acquiring Bank

The acquiring bank represents the e-commerce merchant. The acquiring bank processes all of the merchant's credit card payments with the associations (American Express, MasterCard, Visa, etc.), and provide the merchant with reconciliation data and other financial tools. The acquiring bank also makes money on every transaction a merchant processes. There are many acquiring banks in the United States and abroad, and merchants are free to move from one acquirer to another. Merchants typically select their acquiring bank based on the amount of money, called basis points, they charge per transaction.

## Payment Processors and Gateway Services

In theory, e-commerce merchants can connect directly to their acquiring bank, but there are a number of reasons why they may not want, or be able, to do so. There are technical and business requirements for conducting the payment process for credit cards and most merchants don't want to deal with these requirements. As an alternative, they use a third party to process credit card payments for them and their acquiring bank. These third parties are called credit card payment processors and gateway services. Credit card payment processors offer the physical infrastructure for the merchant to communicate with the acquiring banks and the credit card associations. They connect all the credit card payment participants together. This permits even very small banks to offer merchant services that they could not provide otherwise. Credit card payment processors make their money by charging a flat transaction fee or by charging basis points to the e-commerce merchant. Some credit card payment processors also provide acquiring bank services directly to the merchant.

Gateway services provide merchants physical infrastructure as well. They generally offer technology and integration services among all the participants. The gateway service providers charge the merchant a transaction fee or basis points for their services. These fees are in addition to the credit card payment processor fees the merchant is already paying. If a merchant decides to use a gateway service provider they have to set up accounts with an acquirer. The acquirer can be an acquiring bank or a credit card payment processor that offers acquiring bank services.

### Credit Card Associations

The credit card associations such as Visa, MasterCard International, American Express, Discover, etc. are responsible for establishing the procedures and policies for how credit card transactions, services and disputes are handled. They are bound by national banking laws and provide the money that covers some of the fraud that occurs within their membership. Each of the credit card associations operate somewhat differently and even within the same association they may operate differently in different parts of the world.

For example, Visa has regions that operate somewhat autonomously. There is Visa U.S.A., Visa Europe, Visa Asia, etc. Each of these regions has slightly different rules, tools and services. Visa does not actually issue credit cards to consumers; they use issuing banks to issue credit cards that are branded as "Visa." MasterCard International is somewhat different from Visa in that there is one association for the entire world with all regions using the same basic structure, policies, and management procedures. MasterCard International also uses issuing banks to issue credit cards to consumers that are branded as "MasterCard." American Express differs by acting as the issuer for all American Express branded credit cards. American Express is one global organization with regional coverage. American Express also differs from Visa and MasterCard in permitting merchants to set up direct connections for performing the acquiring functions. Each of these credit card associations has their own network of systems, policies for use and payment processing. Each of these associations also develops fraud-prevention tools and attempt to get merchants to utilize them.

## HOW THE ON-LINE CREDIT CARD PAYMENT PROCESS WORKS

When a merchant makes a sale over the internet; the card number, the amount of the sale, and the merchant identification (ID) are transmitted from the merchant's establishment or the internet Web site over the credit card processor's computer network. The credit card processor can either be a bank or a merchant account service company called a credit card processor that does nothing but provide credit card processing services as discussed above (Quick Start GA Dept. of Technical and Adult Education, 1996).

From the credit card processor's network the transaction is transmitted to the credit card company's computer network. If the customer is using MasterCard, for example, the transaction will go to MasterCard's computer network. Then, the electronic transaction is sent to the bank that issued the credit card to the customer. The bank's computer system checks the account and verifies that the customer has adequate credit to cover the purchase. The bank's computer system then sends the merchant an authorization over these same networks. Although the sale is complete, the transaction is not complete since no actual money has been exchanged.

At the end of the business day the merchant account service (credit card processor) sends that day's charges to the credit card network, e.g. MasterCard, for processing. The transactions are transmitted via the merchant's credit card processor service to the credit card network, e.g. MasterCard. Individual transactions are then extracted and sent back to the individual cardholders' banks. The issuing banks then debit the cardholders' accounts and make appropriate payments to the merchant's credit card processor through the Federal Reserve Bank's Automated Clearing House.

The credit card processor then credits the merchant's bank account for the transaction amount, minus its fees for the transaction. Those fees are also used for paying transaction fees to the issuing bank and the credit card network. Despite the use of computers, it can take two business days before the merchant's account is credited (Bank of America, 2009).

## Opening a Merchant Account

In order to accept credit cards, a merchant can open a merchant account with a bank. However, many banks have gotten out of the credit card processing business, and those that remain are often reluctant to service small businesses, particularly ones with limited operating histories. Many small businesses must therefore go through a specialized credit card processor or an independent sales organization, commonly referred to as an "ISO." Whether a merchant uses a bans, ISO or a credit card processor, they need a merchant account before they can accept credit card payments.

An ISO or an Independent Sales Organization is an entity that acts more or less as a middle man, helping formulate a Bank or Bank/Credit Card Processor alliance. Within such an arrangement, an ISO has an agreement to sell the services of the Bank or Bank/ Credit Card Processor alliance, and is allowed to mark up the Fees and sign up merchants. ISOs are also known as Member Service Providers (MSP). ISOs solicit new merchant relationships for a specific bank. Most merchants buy their processing services from an ISO and the ISOs buy their processing services from a backend credit card processor. However, depending on the situation there can be significant differences between the responsibilities of the ISO and the backend processor. Each ISO is classified depending on how much of the responsibility they take for covering risk:

**Tier I - ISO:** Also known as a Super ISO, Wholesale ISO, Full Liability ISO, and a Full Service ISO, a Tier I - ISO always does their own underwriting and risk-assessment and assumes full chargeback liability for their merchants and provide full technical support.

**Tier II - ISO:** These are shared liability ISOs. Usually, they do not do their own underwriting, or require underwriting approval from the ISO or credit card processor with which they are contracted. They provide technical support capabilities and they also have the support from the ISO or credit card processor with which they are contracted. They are referred to as a shared-risk ISO because they usually are responsible for a portion of the chargeback risk of their merchants.

**Tier III - ISO:** These are usually comprised of a few salespeople with no technical support to provide to their merchants, Tier III - ISOs also do take any responsibility for any chargeback risk. Since they do not assume any chargeback risk, they are subject to the underwriting guidelines of the ISO or credit card processor with which they have contracted

Although businesses can contact credit card processors directly for a merchant account, banks unable or unwilling to process credit card transactions often refer customers to an ISO to help them find a credit card processor and get the necessary equipment and training to begin accepting credit cards

## Typical Information Required for a Merchant Account

Getting the required information together before applying for a merchant account can save time during the application process. Although different merchant account providers have different requirements typically what follows are required in order to obtain a merchant account:

1. Business checking account (some providers will create one for the merchant)
2. A copy of a voided check (if merchants use their own business checking account for funds to be deposited in)
3. A copy of the company's Articles of incorporation, business license or reseller license. (A 'Certificate of Assumed Name' from the county's Register of Deeds office may be all that is required and are relatively inexpensive, e.g. under $10.00) The purpose of this is to prove the applicant is a legitimate business.

4. Pictures of business office and location (this may save the merchant money in credit card processing costs)
5. Have a web site and URL (for real-time processing)
6. Photocopy of the merchant's return policy
7. Provide business references
8. Photocopy of recent tax returns (depends on monthly sales volume expected through the merchant account)
9. Site inspection (pictures of your inventory). Only a few providers require this.
10. A photocopy of the applicant's drivers license (Secondary verification of ID)

## TECHNOLOGY REQUIREMENTS FOR PROCESSING CREDIT CARDS ON WEB SITES

The following are considered to be the technology requirements and best practices for e-commerce Web Sites that accept credit card payments (Authorize.com, 2009).

**Create a Secure Payment Web Site.** This is needed to protect credit card data and other sensitive information from hackers during the credit card transaction process. Identity theft and credit card fraud are occurring more frequently on the Internet, and merchants must ensure that their customers are protected from internet criminals. Many consumers will not buy from a site that does not provide secure transactions. Merchants can help secure their site by having a secure socket layer certificate, or SSL. SSL encrypts information being entered on the merchant site as it is sent across the Internet. Merchants can purchase their own SSL certificate, or the merchant's Web host may allow a merchant to use their SSL certificate as a part of its service.

**Utilize a compatible shopping cart application.** This is required to make sure the merchant's shopping cart application can communicate with the merchant's credit card payment-processing gateway. There are several different types of credit card payment gateways, and each has a set of standards that must be followed. Many of the free shopping cart application software packages do not support all of the available credit card payment gateways. A merchant should check with their merchant account provider or their shopping cart documentation to make sure that all the components will work together. Shopping cart applications fall into two basic categories namely: Local shopping carts that merchants can install on their own Web servers, and third-party shopping carts that run on a provider's site. If a merchant decides to install his own shopping cart software, he will have a variety of software packages from which to choose. Three of the more popular ones are Miva Merchant, OSCommerce, and Agoracart.

Miva Merchant is a shopping cart that many Web hosting companies include with their hosting packages. If a merchant's host doesn't offer it, the merchant will be required to pay a licensing fee before the package can be installed. Miva offers a variety of different options for small businesses, and the application is considered highly user-friendly.

OSCommerce is a free, open source shopping cart program that contains many features and a reputable development community. It is considered relatively easy to install and customize. Because OSCommerce is open source, support and improvements are readily available.

Agoracart is a simple, free, and basic functionality shopping cart application. If a merchant doesn't require a lot of features, this is a useful package to be utilized on a merchant's shopping cart site.

If a merchant would rather not install shopping cart software on his own web site, there are a number of third-party options available. When a merchant utilizes third-party shopping cart software, the merchant must place a link on his web site to the third party's web site where the application exists. This link takes customers to the merchant's offsite shopping cart software. Microsoft's BCentral is one of the more popular third-party shopping cart software. Yahoo! offers a similar third-party shopping cart software package. Storefront.net and 1shoppingcart.com both offer services that include shopping carts as well as advanced tools like email list management, affiliate program integration, etc.

**Provide E-mail Message Encryptions.** If a merchant plans on accepting orders and sending or receiving credit card information via email, the merchant will need to encrypt the information that is transmitted. PGP, which stands for "Pretty Good Privacy," is the most common form of email encryption. PGP encrypts an email when it is sent and decrypts the email when it has reached the intended recipient. If e-commerce merchants plan to use PGP, they will also need to make sure that their email clients support it. Merchants must keep the PGP security key in a location where it cannot be accessed by others.

**Utilize a Firewall.** If a merchant stores customer credit card numbers or other personal information on his server, it is necessary to have a site-wide firewall to protect this information. Many merchants expose their customers to hackers by neglecting to implement a proper firewall.

**Use Anti-Virus Software and Update it Frequently.** Anti-virus software will prevent most of the hacker's attempts to invade the merchant's Web site and steal personal information such as credit card numbers. This software should be updated on a regular basis.

**Regularly Download and Install Security Updates.** Software performance and security can be optimized by installing all service and security updates when they become available.

After merchants have implemented these basic technology requirements, they are ready to offer their customers an easy way to purchase their merchandise or services. Merchants can also give their customers comfort in knowing that they are providing a safe and secure environment for making credit card payments and providing other personal information.

## HOW CREDIT CARDS PAYMENTS ARE ACCEPTED AND PROCESSED ONLINE

If most of a merchant's business is conducted on the Internet, Real-Time processing is the appropriate solution. When a customer who is using a merchant's Web site is finished shopping and is ready to pay, typically the customer simply clicks on a "Check Out" button which is a link to a secure page where customers type in their credit card information. After a few seconds, a message will then appear showing whether the credit card has been accept or declined. Two days later the money will be transferred into the merchant's business checking account. Real-Time credit card processor or merchant account service providers will have an online database containing all of the credit card transactions for a merchant which makes month-end accounting and balancing simple. Real-Time processing is the best solution for those who plan on having a high volume of daily transactions. Real-Time processing helps to automate the payment acceptance process, unlike in retail establishments where entering credit card information must be done manually. Most Real-Time solutions are coupled with a "Virtual Terminal" that allows a merchant to process Mail Order/Telephone Order (MOTO) orders manually via a web browser from any location that has access to the Internet.

The process a credit card transaction goes through is fairly complicated; however it generally only takes a few seconds. The steps below illustrate how credit card transactions are typically processed using a Real-Time credit card processing service (Smith, 2009; Murdock, 2006).

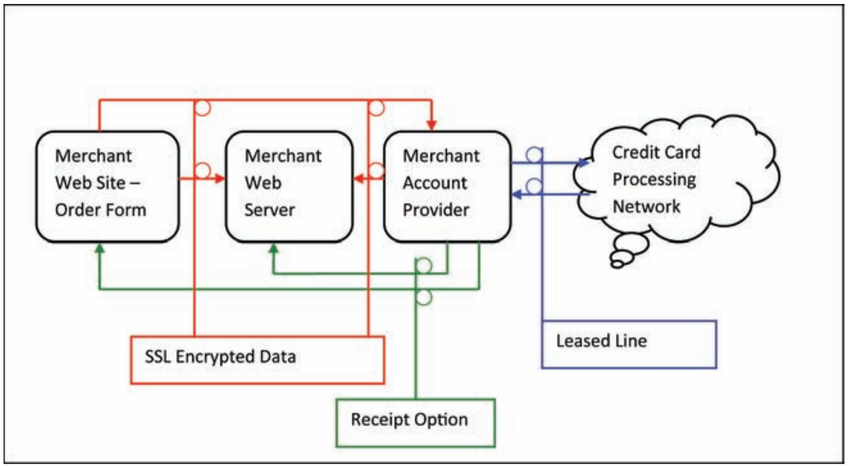
1. Using the merchant's shopping cart Web interface, customers select "check out" with the items they placed into their shopping cart or selected from an order form on a merchant's Website.
2. Customer then selects "credit card" as their method of payment.
3. The customer's Web browser then connects to the Merchant's website host's secure server, and brings up the secure payment form.
4. Customer enter their credit card information on the secure payment form, and authorize the transaction by clicking a "Complete Order" or "Continue" type of button.
5. The credit card transaction information is transmitted to the Website host's secure server using SSL encryption.
6. The merchant's secure server connects to the merchant's processing bank either via a secure payment gateway (a third party which provides the connection to the processing bank), or directly (some credit card processors have their own proprietary secure payment gateway and therefore do not require a third party to provide this service).
7. The credit card processor service sends the transaction to the credit card association network, such as Visa or MasterCard, directly, and the validity of the card and availability of funds is confirmed.
8. If the credit card transaction is approved, an authorization code is returned to the credit card processor service, or to the Secure Payment Gateway from the credit card association network.
9. The authorization is encrypted by the Payment Gateway or credit card processor and transmitted in encrypted form to the secure Web server of the merchant, which permits fulfillment of the order.
10. The merchant's secure Web server then sends the customer's Web browser a confirmation receipt.
11. The amount due for the credit card transaction is moved from the card holder's bank to the merchant's credit card processing bank. The merchant's credit card processing bank transfers the money to the merchant's local bank within 2 to 3 business days.

Figure 1 illustrates the technological components of a typical credit card processing system.

## MINIMIZING INTERNET CREDIT CARD FRAUD

Although there are no verifiable global figures on losses from credit card fraud, an FBI report issued in 2005 indicated that credit cards represented the majority of the total $315 billion U.S. financial fraud loss for that year. A recent European study found that more than 22 million adults were victims of credit card fraud in 2006. Figures from the Banque de France, the country's central bank, showed a credit card fraud loss of $319 million, for 2005 (Conlin, (2007). For US buyers, credit card fraud does not pose a significant problem, as their loss is limited to $50. But, for merchants who shoulder the burden of the losses that is not the situation. Between November 1999 and February 2000, travel site Expedia.com lost 12% to 18% of sales through fraudulent card purchases. Visa and MasterCard claim a fraud rate of 0.08% to 0.09%, and have stated that there is little difference between Internet sales fraud and other type of credit card sales fraud, but they have invoked serious penalties for excessive chargebacks for on-line credit card fraud. When a consumer reports an instance of fraud, the disputed amount is removed from the merchant's account and credited back to the customer. This "chargeback" typically comes with a standard fee of $15 per instance. The Internet Fraud Prevention Advisory Council has established online transaction fraud rates at 2% to 40%, depending upon the product category. At highest risk are downloadable software and

*Figure 1. Typical credit card processing system*




entertainment, and high ticket items such as airline tickets, computers, and diamonds.

Payment gateways in the US have developed sophisticated fraud checking techniques, but it has not halted credit card fraud. To protect themselves, merchants can capture the IP address of purchasers, carefully examine purchases made from free e-mail addresses, those with different shipping and billing addresses, bounced e-mail order confirmations, no-existent telephone numbers, and large middle-of-the-night transactions. Merchants must also be cautious about shipping to Eastern European and other countries with a history of fraudulent transactions and telephone the buyer before shipping high ticket items (Faughnan, 2007).

## Sophisticated Security Required to Prevent Credit Card Fraud

Online merchants have been forced to develop sophisticated security protections that far exceed the normal security approval process by the credit card companies (Wilson, 2008). In 2005, an estimated 13.5 percent of U.S. adults (30.2 million consumers) were victims of one or more cases of identity fraud in the previous year. There were an estimated 48.7 million incidents of fraud during this one year period (Woolsey & Schulz, (2009). Currently, credit card companies only verify whether a credit card number is correct and then match the number against the customer's billing address but cyber-criminals can make sure the address is correct and that the addresses match. Cybercrime, in all forms, shows no signs of decreasing in the near future. For example, MSNBC reported that Visa quietly informed select merchants that 485,000 credit card numbers were stolen from a major e-tailer in January 1999 and in 2008 the Bank of America notified thousand of card holders that their MasterCard information had been compromised. E-tailers (Web Merchants) find themselves in a difficult position regarding credit card fraud (MasterCard Worldwide, 2009; Montague, 2004).

## Credit Card Fraud Solution Approaches

While there does not appear to be any simple solutions, experts believe that potential cyber-criminals will soon begin to reconsider committing credit card fraud. This type of criminal activity has, for a long time, been considered too small to bother with, but using credit cards fraudulently is quickly becoming "identity theft"; which has been defined as a serious federal felony. Cyber-criminals do leave digital fingerprints and can get caught. There are a number of approaches used by criminals to commit credit card fraud and there are a number of procedures implemented to deter their attempts at credit card fraud. These are discussed below.

## Security Codes

An important Internet security feature that now appears on the back of most Visa/MasterCard and Discover cards, and on the front of American Express cards is a security code. This code is generally a three or four-digit number which provides a cryptographic check of the information embossed on the card. The security code helps validate that the customer placing an online order actually has the credit card in his/her possession, and that the credit/debit card account is legitimate. The security code is only printed on the card and it is not contained in the magnetic stripe information nor does it appear on sales receipts or billing statements. The goal is to make certain that the customer must have the card in his/her possession in order to use this code. Since Card Security Codes are not scanned into standard credit card readers, in theory, these numbers are only visible to the customer. When customers give their Card Security Code to merchants, they assist merchants in verifying that the orders being placed are being placed by the credit card holder. Visa, MasterCard, Discover and American Express now require Internet commerce sites to obtain the security code for all cards that have a code printed on them. In order for a credit card transaction to be accepted and processed, this code is required as part of the transaction data.

Unfortunately, the cyber-thieves are also using advanced techniques to ascertain critical information about stolen card numbers. They have developed software that can determine which bank issued a card, harvest the three-digit card verification number and determine the available credit-card limit. They can check a card number's validity and personal information such as address and telephone number about the owner as well.

## Credit Card "Skimming"

Criminal gangs recruit individuals who work within restaurants, hotels and retail outlets. The recruits are given battery powered electronic devices known as "skimmers" that read and capture all of the credit or debit cards details in the few seconds that it takes to swipe the card through the credit card reader machine. When customers pay their bill, their card is first swiped through the legitimate credit card machine, but then it is also swiped through the "skimmer" reader. The recruits then pass the "skimmer" machines onto counterfeiters, who pay the recruits for their part in the crime. Once the "skimmer" machines have been given to the counterfeiters, they download the information onto a computer and produce a fake clone of the credit card. The "cloned" card is embossed with the details of the victim's credit card and passed on to gang members who may sell it for between $400 and $700, depending on the perceived credit limit. The buyer then uses the "cloned" credit card to illegally purchase products and services. Skimming is costing credit card users worldwide millions of dollars in phony charges, as stolen clones are sold and used in the United States and elsewhere around the world. Often skimming is done at gas stations or restaurants, since those are the places that hire people who work for minimum wage and are businesses that don't bother with background checks, especially since many employees are part-time workers (Fraud Guides, 2009).

## Skimming Prevention

The following are measures merchants can use to avoid credit card fraud by skimmers:

1. Subscribe to stolen credit card checking systems
2. Verify the address
3. Verify the telephone number
4. Call the credit card issuing bank
5. Examine the email address - hotmail and yahoo mail can be easily faked
6. Call the cardholder
7. Be cautious of bulk orders
8. Shipping and billing address should match
9. Single-use credit card numbers
10. Smart Cards

## Single Use Credit Card Numbers

Some credit card companies have a new security and privacy offering which utilizes the concept of disposable credit card numbers. With this system, customers can get unique credit card numbers linked to their credit card account each time they make a purchase online. This allows the customer to avoid transmitting their "real" credit card numbers. The single-use numbers don't work for recurring charges but they also don't work for cyber-thieves who try to make multiple purchases. The utilization of single-use credit card numbers can help reduce the risk posed by hackers who steal and reuse numbers

## Smart Card Technology for On-Line Purchasing

Newer "smart cards" are embedded with a computer chip containing a digital certificate. A digital certificate consists of basic information about the cardholder's digital identity. It contains elementary personal information such as the cardholder's name, e-mail address and digital signature. The digital signature is nothing more than a series of numbers called a public key which forms the basis of encryption algorithms. Unlike a written signature, a digital signature has two purposes. It authenticates who the cardholder is legally and it also allows the cardholder's messages to be encrypted.

Because the smart card chips are programmable, "smart chip technology" is flexible, and designed for multiple applications. These cards are inserted into a, typically free, smart card reader plugged into the user's computer. The card, together with a PIN number, allows consumers to buy on the Internet using their digital certificate. The card allows access to an online wallet, which contains information such as shipping and ordering information. This information is automatically transmitted to the merchant's online order forms.

The current problem with digital certificates is a lack of standardization. Almost anyone can establish themselves as a digital certificate issuing authority (CA). Currently, the major players include retail-oriented certificate authorities such as Entrust, VeriSign, Thawte and Cybertrust although there are many others. Consumers are becoming increasingly aware of the role played by digital certificates. Many consumers will only buy from a merchant who displays a digital certificate issued by one of these certificate authorities. Secure communications generally requires five key elements to work correctly, namely: Confidentiality, authorization, authentication, integrity and non-repudiation. Confidentiality and authorization are supplied by encryption systems. The others, namely: authentication, integrity and non-repudiation depend on a digital signature.

## Address Verification System (AVS)

E-commerce merchants can utilize an Address Verification System (AVS) for consumers from the United States. An AVS takes the consumer's ZIP code and the numbers in the street address, and compares them with the numbers in the credit card billing address. If they agree, the transaction is authorized; if they do not agree, the transaction is flagged as suspicious or in some cases not allowed, depending upon the merchant's preference. Using AVS lowers the merchant's discount rate, and can protect against stolen credit cards where the thief has the credit card number, but not a correct address.

## Telephone Number Authentication

A Telephone authentication service can provide a decrease in the number of fraudulent transactions that pass through an on-line ecommerce web site. Most cyber-criminals are not willing to provide their real telephone number to complete a transaction and many, if asked for a telephone number will simply exit the transaction. There are a number of services that will provide real time telephone number authentication. These services can determine whether a telephone number is real, no longer in service, stolen or a legitimate working number at the address given by the user.

## Telephone Verification

Telephone Verification works by automatically calling an online end-user's telephone number at the same time the end-user is making a transaction on a website. The user while on the website answers the phone and is provided a one-time personal identification number (PIN) presented via the web interface; an otherwise anonymous online end-user will be able to confirm that the person who received the phone call and the person who is interacting on the website are the same person. If the consumer, or end user, cannot verify through the phone, they should asked to try again with another phone number. If they cannot pass on the second attempt; assume the consumer or end user is high risk and do not allow the transaction.

## Customer Transaction and IP History Databases Checks

Another approach for detecting online fraud is to compare a transaction with previous transactions made for a given credit card number and make sure it fits the pattern of use. There are companies that provide real time checks of credit cards with databases of millions and, in some cases billions, of records to detect anomalies (Wilson, 2008). This type of service will score a credit card transaction based on all the intelligence it has gathered both about the transaction and former purchases. In addition, online fraud detection solutions based on a combination of IP reputation analysis and a mutual collaboration network has proved successful. IP reputation uses geolocation and proxy detection by providing relevant information about the IP's historic behavior, both legitimate and suspicious (MaxMind Inc., 2008).

## Intelligent Credit Card Fraud Detection

An intelligent credit card detection system monitors card transactions as they occur by gathering data from the current and previous transactions and uses this data to compute a transaction score for the current transaction. The algorithms used to compute such a score are called classifiers. Typically, high scores for transactions are more likely to be fraudulent than low scores thus transaction scores are compared to a threshold and the score is classified as normal or fraudulent. Credit card fraud detection is a complicated problem involving many input variables such as time, transaction amount, merchant, merchant category code, country, etc) acquired from multiple transactions in a sequence. A classifier computes a fraud score based on a number of these variables.

Two basic approaches have been used in developing classifiers, namely, neural networks and Bayesian decision methods. A neural network is a nonlinear function which takes multiple input variables and computes a score from them. A neural network consists of a series of interconnected neurons similar to the structure of the brain. The interconnections have weights assigned to them and the input neurons (input nodes) to a network represent each continuous variable and every value that a categorical variable can take. Since the weights in a neural network need to be optimized, a learning or training process iteratively passes through a database of card transactions containing both fraudulent and legitimate transactions and systematically adjusts the weights so that the resulting scores discriminates between fraudulent and legitimate transactions.

The Bayesian approach to card fraud detection is based on probability theory. Research has identified a number of characteristics derived from credit card transactions which tend to be predictive of fraud. A Bayesian approach computes the probability distributions for each of these credit card transaction characteristics using a process called evidence integration to compute a fraud probability from the individual characteristic probabilities. Therefore, in a Bayesian approach the classifier consists of credit card transactions characteristics, their probability distributions and an evidence integrator (Alaric Inc., 2008).

## REGULATORY & LEGISLATIVE ISSUES

Management of information risk is now tied to regulatory mandates. Since 1999, laws enacted at the federal and state levels have forced companies to be extremely careful in protecting the confidentiality and reliability of medical, financial and other sensitive information stored on their computer systems. Failure to comply with these mandates can lead to civil and criminal penalties, lawsuits and related litigation costs and, of course, damage to reputations.

Although the earlier laws focused on financial and healthcare companies, two of the most recent laws, namely, the 2002 Sarbanes-Oxley Act and the California Data Protection Law (SB 1386), broadened the scope of companies that are required to comply. The Gramm-Leach-Bliley Act (GLB), also known as the Gramm-Leach-Bliley Financial Services Modernization Act, is an Act of the United States Congress that stipulates that every financial institution must protect the security and confidentiality of its customers' personal information. The Federal Trade Commission in conjunction with several other federal and state agencies along with the Federal Bureau of Investigation (FBI) is the federal agency responsible for enforcement of these laws and mandates (United States Department of Justice, 2009).

## FEDERAL TRADE COMMISSION (FTC)

The FTC deals with issues that are related to the economic life of every American citizen and business. It is the only federal agency with both consumer protection and competition jurisdiction across all sectors of the economy including e-commerce. The FTC is charged with law enforcement and protecting consumers' as well as business' interests by sharing its expertise with federal and state legislatures and U.S. and international government agencies; developing policy and research tools through hearings, workshops, and conferences; and creating practical educational programs for consumers and businesses in a global marketplace with constantly changing technologies. The FTC has also been directed to administer a wide variety of other consumer protection laws, including the Telemarketing Sales Rule, the Pay-Per-Call Rule and the Equal Credit Opportunity Act. In 1975, Congress gave the FTC the authority to adopt industry-wide trade regulation rules. The FTC's work is performed by the Bureaus of Consumer Protection, Competition and Economics. That work is aided by the Office of General Counsel and seven regional offices. Credit card fraud is within the FTC's domain of responsibility and this responsibility is shared with the Federal Bureau of Investigation (FBI) (Federal Trade Commission, 2009).

## MANAGING INFORMATION RISK

Managing information risk must be integrated with a merchant's overall risk management strategy. The technology infrastructure; including servers, network monitors, and firewalls, needs to be assessed and managed in terms of its relation to people, operations, supply chains and other business drivers. Some of the steps involved with information technology (IT) risk management include paying attention to human factors, putting proper security policies in place, identifying critical assets and fostering better communication and an enterprise-wide perspective among IT managers and risk managers. Bringing together IT, risk management, internal audit, legal and human resources to address information management risk issues produce a consensus to the identification of threats, the areas of operation (ranked in order of most critical and sensitive) that could be affected by a threat, potential financial or reputational loss, and the most cost-effective way to reduce the risk (Stoneburner; Goguen; Feringa; Alexis, 2009).

### An Information Risk Assessment

A risk assessment should be performed by any merchant accepting credit card payments and this assessment should examine the following risk factors (Cooney, 2007; Frank, 2004):

- **System Characteristics:** Assess and identify the resources and information that constitute the systems used for financial purposes and identify the business systems jointly with management personnel, IT personnel and users.
- **Threat Identification:** Conduct interviews and utilize work-group sessions with key management team members, technology administrators and system users to uncover potential threat agents that may impact the confidentiality, integrity and availability of information stored in databases and files.
- **Vulnerability Identification:** Conduct a technical assessment to detect vulnerabilities and to assess how effective the controls are for preventing unauthorized access,
- **Control Analysis:** Assess countermeasures regarding items such as firewalls, encryption, web server access policies, password policies, backup and recovery procedures, change-management procedures, currency of software, hardware maintenance and the physical environment.
- **Insurance Gap Analysis:** Assess current insurance policies in terms of coverage for financial loss arising out of unauthorized access or use of confidential information, damage to third-party software or data as well as damage to the business network or databases and files.

The risk assessment can not only help identify the critical areas of risk to be addressed, but can also be used to recommend best practices to remedy the risk. Creating a more secure environment can help produce and maintain consumer confidence and deter financial loss, which could, in turn, give a merchant a competitive edge (United States General Accounting Office- Accounting and Information Management Division, 1988).

## CREDIT CARD FRAUD PREVENTIVE STEPS FOR ONLINE BUSINESS OWNERS

When a merchant physically accepts a credit card, and the charge is authorized, and the merchant has conformed to credit card regulation, the merchant will get paid, even if a stolen card is used. But, the liability for fraud shifts from the card issuer to the merchant for 'Card Not Present' sales (Internet sales, mail order, and telephone/fax order). After a credit card processor or registration service approves a credit card transaction, the merchant should perform additional checks, as fraudulent orders are sometimes approved.

The following methods and techniques can be utilized to protect an e-commerce merchant against credit card fraud (Wilson, 2000; Jepson, 2009; Authorize.com, 2009; Federal Trade Commission, 2009). Typically, a combination of methods is the best approach.

- **Follow the procedures** recommended by your credit card processor and the credit card companies.
- **Authorization approval -** make sure you get it from the issuing bank.
- **Address Verification System (AVS) -** AVS is only available for the U.S. and partially available in four European countries to verify the address matches.
- **Card Verification Methods (CVM) -** Security Codes: VISA = CVV2, MasterCard = CVC2, and American Express = CID use a security code of 3 or 4 extra digits.
- **Payer Authentification Programs -** Authentification programs (Verified by Visa and MasterCard's SecureCode) use personal passwords to ensure the identity of the online card user.
- **Real-Time Authorization -** Credit card information is sent to the processor for immediate approval.
- **Bin Check -** The first 6 digits of the credit card are called the Bank Identification Number (BIN).
- **Calling The Card-Issuing Bank -** Call the card-issuing bank, to verify the charge.
- **Different Bill And Ship To Addresses** – Use a search engine such as Google to search for the street address number, street name, and zip code.
- **Negative Historical File -** Keep a database or other electronic record of prior fraud attempts, problem customers, charge back records, and customers receiving refunds.
- **Shared Negative Historical File –** Combine negative historical databases/files from several e-commerce merchants.
- **Positive Database File –** Maintain a file that contains a list of good customers
- **Credit Service Database – Use a** credit database service, such as Equifax (www.equfax.com), Experian (www.experian.com), and Trans Union (www.tuc.com) for high-dollar value items.
- **Customizable Merchant Rules -** A merchant should establish rules to stop or flag specific orders for review.
- **Fraud Scoring Systems – Assign** weights, points or probabilities to different components of a transaction (IP Address, free-email account, time of day, AVS results, amount of sale, type of products ordered, shipment method, different shipping/billing addresses, certain zip codes, etc) to generate a fraud score to indicate the likelihood of fraud.
- **Pattern Detection -** Check if multiple orders are placed shipping to the same address, but different credit cards were used. Check orders for an unusually high quantity of a single item.
- **Alternate Thank You Page -** If an order is being shipped to a non-English speaking country, display an alternate thank you page. Require the customer to fax either a photo of the credit card or a scanned copy of his/her credit card bill.
- **Preventative Data Checking Measures -** Check the data fields entered by the buyer to determine if the buyer actually exists based on data entered on the order. Check to see if the ZIP Code the customer listed actually exists. Make sure the customer's e-mail address is formatted properly. Check for incomplete names or an address like 100 Elm Street.
- **Free Email Accounts -** There is a much higher incidence of fraud from free email

services. Many fraudsters use free email addresses to remain anonymous.

- **Reverse IP Address Checks –** Make sure the user's IP address matches the email address and physical billing address of the customer. The IP address identifies the location of the server where the order was placed. Numerical IP addresses can be checked through programs such as WsPing32.
- **Anonymous And Open Proxy IP Addresses** - IP addresses can be falsified thus hiding the falsified IP addresses true location of the criminal. Organized credit card fraud rings often use anonymous proxies.
- **Checking Telephone Numbers -** The web sites at http://www.freeality.com/finde.htm, http://www.theultimates.com/, http://www.anywho.com, http://nt.jcsm.com/ziproundacx.asp, and http://nt.jcsm.com/ziproundacx.asp provide tools to match a telephone area code to a postal zip code, reverse telephone directories, search for email addresses, maps, directions, etc. A merchant can call directory assistance to determine if the phone number on the order matches the customer's phone number based on their name and address.
- **Fax Orders -** When a credit card order is received by fax, require the customer to also fax copies of both sides of their credit card and a copy of their state-issued ID, or driver's license
- **International Orders -** Some countries have a bad reputation as a source of fraud transactions. Banks or credit card processors can provide a list of high-risk countries. High risk countries include developing nations like Indonesia, Malaysia, Benin, Nigeria, Pakistan, Israel, Egypt, and Eastern European countries. Placing an international phone call to the issuing bank may be worth the cost for large orders and/or ask the customer to contact the merchant by phone or email for shipping costs. A cyber-criminal may consider this too much contact, and decide to go elsewhere.
- **Calling The Customer -** Calling customers is not only an excellent way to detect fraud, but it can also be a valuable part of your customer service
- **Web Site Information –** Make sure the order form includes fields to enter the CVV2 verification code imprinted on the credit card, the name of the card-issuing bank, and the bank's toll-free telephone number, the customer's telephone number and email address.
- **Processing Orders –** Do not ship any order until the charge can be verified by additional checks.
- **Use Temporary Activation Codes -** If the merchant wants to process orders immediately, issue thirty-day temporary validation keys for downloaded software
- **Anti-Fraud Groups –** Become educated about fraud prevention by attending seminars offered by credit card companies and card processors. Organizations such as www.antifraud.com and www.wiscocomputing.com offer help. These groups also offer tips, databases of stolen credit cards, and web lookup tools.
- **File a Complaint with the FTC and the FBI** – If you detect fraud or have been a victim of fraud, file a complaint with the FTC at https://www.ftccomplaintassistant.gov/ and the FBI's Internet Crime Complaint Center or IC3, a partnership of the FBI and the National White Collar Crime Center at http://www.fbi.gov/majcases/fraud/internetschemes.htm (Internet Crime Complaint Center (IC3), 2009).

## CONCLUSION

Based on past performance and predictions for the future, it seems safe to say that purchasing goods and services over the internet will continue to increase. This is because it is more efficient for the merchants and they can reach a much larger audience than using the face-to-face, in-store methods of the past. But like most uses of technology, there are individuals who find ways to use the technology for criminal purposes. This has been the case when utilizing credit or debit cards for purchasing goods and services over the internet. Thus, a sort of battleground has evolved between the e-commerce merchants along with their customers and the cyber-criminals. As new technological security methods are implemented by merchants to protect themselves and their customers, the cyber-criminals attempt to find ways through or around these technological barriers. If past events are any indication of the future, this battle is not over and merchants and their customers must continue to find secure methods to combat the criminals attempting to fraudulently steal financial and other personal information for their own financial gain.

## REFERENCES

Alaric, Inc. (2008). *Card fraud detection - Comparison of Detection Technologies*. Retrieved December 28, 2008 from http://www.alaric.com/public/products/fractals?gclid=CI20ofLAnZgCFQpxHgodKmPDmg

Authorize.com. (2009). *Security Best Practices (2009)*. Retrieved January 21, 2009 from http://www.authorize.net/upload/images/Files/White%20Papers/Security_0604.pdf

Bank of America. (2009). *Card Processing Basics (2009)*. Retrieved January 21, 2009 from http://www.bankofamerica.com/small_business/merchant_card_processing/index.cfm?template=card_processing_basics

Conlin, J. (2007, May 11). *Credit card fraud keeps growing on the Net*. Retrieved December 28, 2008 from http://www.iht.com/articles/2007/05/11/news/mcredit.php

Cooney, M. (2007, November 11). *Credit card transaction security fortified by new risk assessment system*. Retrieved from http://www.networkworld.com/community/node/21731

Dept, G. A. of Technical and Adult Education (Ed.). (1996). *Credit Card Processing Overview*. GA Dept of Tech & Adult Education, Quick Start.

Faughnan, J. G. (2007, November 23). *International Net-Based Credit Card/Check Card Fraud with Small Charges.* Retrieved from http://www.faughnan.com/ccfraud.html

Federal Trade Commission. (2009a). *Avoiding Credit and Charge Card Fraud*. Retrieved April 24, 2009, from http://www.ftc.gov/bcp/edu/pubs/consumer/credit/cre07.shtm

Federal Trade Commission. (2009b). *About the Federal Trade Commission (2009)*. Retrieved January 22, 2009 from http://www.ftc.gov/ftc/about.shtm

Frank, J. (2004). *Fraud risk assessments: audits focused on identifying fraud-related exposures can serve as the cornerstone of an effective antifraud program*. Retrieved from http://findarticles.com/p/articles/mi_m4153/is_2_61/ai_n6152654/

Fraud Guides. (2009). *Credit Card Skimming*. Retrieved from http://www.fraudguides.com/business-credit-card-skimming.asp

*Internet Crime Complaint Center* (*IC3*). (2009). Retrieved January 21, 2009 from http://www.ic3.gov/default.aspx

Jepson, T. (2009). *Merchant Credit Card Fraud: 31 Ways to Minimize Credit Card Fraud.* Retrieved from January 17, 2009 from http://www.wisco-computing.com/articles/ccfraud.htm

MasterCard Worldwide. (2009). *Site Data Reflections The top five Web intrusions*. Retrieved January 21, 2009, from http://www.northamericanbancard.com/google/smart_templates/default/web/MC_SECURITY.pdf

MaxMind, Inc. (2008). *IP Address Reputation and a Mutual Collaboration Network.* Retrieved December 28, 2008, from http://www.maxmind.com/minFraudWhitePaper.pdf

Montague, D. A. (2004). *Fraud Prevention Techniques for Credit Card Fraud*. Victoria, Canada: Trafford Publishing.

Murdock, K. (2006). *Credit Card Processing: How It All Works*. Retrieved January 21, 2009, from http://www.practicalecommerce.com/articles/168-Credit-Card-Processing-How-It-All-Works

Smith, R. (2009). *How Credit Card Processing Works. Review*. Retrieved January 21, 2009 from http://www.smithfam.com/news/nov99d.html

Stoneburner, G., Goguen, A., & Feringa, A. (2009). *Risk Management Guide for Information Technology Systems Recommendations of the National Institute of Standards and Technology.* Retrieved January 22, 2009, from http://csrc.nist.gov/publications/nistpubs/800-30/sp800-30.pdf

TopTenReviews. (2009). *Credit Card Processing Services Review*. Retrieved January 21, 2009 from http://credit-card-processing-review.toptenreviews.com/

United States Department of Justice. (2009). *Internet and Telemarketing Fraud*. Retrieved April 28, 2009, from http://www.usdoj.gov/criminal/fraud/internet/

United States General Accounting Office- Accounting and Information Management Division. (1988). *Information Security Risk Assessment, Practices of Leading Organizations*. GAO, May, 1988.

Wilson, R. F. (2000, March 15a). Sophisticated Fraud Protection Systems. *Web Commerce Today*, 32. Retrieved January 12, 2008 from http://www.wilsonweb.com/wct3/fraud-systems.cfm

Wilson, R. F. (2000, March 15b). Inexpensive Techniques to Protect Merchants against Credit Card Fraud. *Web Commerce Today*, 32. Retrieved from January 15, 2009 from http://www.wilson-web.com/wct3/fraud-lowcost.cfm

Woolsey, B., & Schulz, M. (2009). *Credit Card Industry Facts, Debt Statistics 2006-2009*. Retrieved January 12, 2009 from http://www.creditcards.com/credit-card-news/credit-card-industry-facts-personal-debt-statistics-1276.php

## KEY TERMS AND DEFINITIONS

**Acquiring Bank:** The bank that represents the e-commerce merchant and processes all of the merchant's credit card payments with the credit card associations

**Credit Card Processor:** A third party utilized to process credit card payments for merchants and their acquiring bank

**Credit Card:** A card issued by banks, savings and loans, retail stores, and other businesses that can be used to borrow money or buy products and services on credit.

**Cyber-Criminal:** An individual who commits a crime using a computer and the internet to steal a person's identity such as credit card information.

**E-Commerce:** The buying and selling of goods and services on the Internet.

**Fraud:** An act of deception for the purpose of unlawful financial gain using stolen credit card information.

**Issuing Bank:** The bank that issues consumers their credit cards.

**Merchant Account:** A legally binding contract wherein an acquiring bank extends a line of credit to a merchant who desires to accept payment using credit cards.

**service gateway:** This is another name for a credit card processor.

**Skimming:** This is a type of fraud wherein the numbers on a credit card are recorded and transferred to a duplicate card.

**SSL:** SSL is an abbreviation for Secure Sockets Layer, a protocol developed for transmitting documents over the Internet using a cryptographic system that uses two keys to encrypt data; namely a public key known to everyone and a private or secret key known only to the recipient of the document.

# Chapter 46
# Virtual Stock Markets as a Research Tool in Marketing and Management

**Lorenz Zimmermann**
*Ludwig-Maximilians-University Munich, Germany*

## ABSTRACT

*Virtual Stock Markets (VSM) are a young, powerful and still evolving research tool. VSM were developed around 20 years ago as forecasting instrument of election outcomes, having delivered very precise results ever since. In recent years, various business applications of the given concept have been presented, namely forecast generation, decision support, product concept evaluation and the identification of lead users. This article explains the basic concept of VSM, describes the potential areas of application and shows examples of successful implementations in business practice. Directions for further research are identified.*

## INTRODUCTION

Virtual Stock Markets[1] (VSM) are still relatively unknown as a research tool in marketing and management (Surowiecki, 2005). Yet, the concept of VSM has received increased attention in recent years. The number of scientific publications, dealing with the given concept, has grown substantially over the last years (Tziralis & Tatsiopoulos, 2007). Most notably, the year of 2007 saw the introduction of the *Journal of Prediction Markets*, an academic journal dedicated to this topic exclusively.

VSM can fulfill a number of purposes in marketing and management, ranging from relatively simple business forecasts to more complex tests of product concepts, decision support and the identification of lead users among traders. VSM are especially relevant in e-Business as they provide a means for companies to aggregate the knowledge and opinions of a very large number of participants from distant locations using electronic communication devices.

DOI: 10.4018/978-1-61520-611-7.ch046

## BACKGROUND

VSM work similar to regular stock markets. However, the listed stocks do not represent the shares of companies but are tied to the outcomes of future events. Every stock has a fixed lifetime after which the actual outcome of the predicted event can be observed. The final value of the stock is determined accordingly. During the lifetime of the stock market, traders compare the current market prices with their individual expectations of the outcome and make trades accordingly. Supply and demand determine the prices of stocks.[2]

Following the logic of *Hayek hypothesis* (Hayek, 1945) and *information efficiency hypothesis* (Fama, 1970), the resulting market prices reflect the traders' aggregate expectations of the future events, which the stocks are tied to. According to Hayek (1945), this mechanism to aggregate information works efficiently even in the extreme case of all market participants holding diverging information.

The first application of VSM was the *Iowa Presidential Stock Market* (Forsythe et al., 1992). In this example, virtual stocks were traded representing the vote shares of the different candidates in the 1988 Presidential elections. Actual outcomes could be predicted very precisely. Forecasts based on VSM outperformed every pollster's forecast in terms of prediction accuracy and low fluctuation levels in forecasts prior to the election date. VSM have been able to repeat this remarkable performance in the subsequent implementations (e.g., Berg et al., 2008), sparking academics´ interest and laying the basis for different applications in related fields, most importantly in business research and practice.

## AREAS OF VSM DEPLOYMENT IN MARKETING AND MANAGEMENT

### Forecast Generation

Companies can use VSM to predict a wide range of relevant problems. Market participants can either be company insiders (e. g., sales employees predicting futures price levels in the market) or outsiders (e. g., customers predicting market shares for specific products).

VSM are especially useful when other forecasting techniques cannot be used, e.g. when data are inaccessible or influencing factors are complex (Berg et al., 2003; Hanson, 2006a). Also, VSM bypass the flaws of traditional research instruments in business. VSM results are not dependent on a representative sample. Traders usually enjoy participating and do not have to be offered large monetary incentives. Furthermore, the results are unbiased by social desirable behavior or researcher´s influences because market participants act anonymously (Hanson, 2006b). VSM are a dynamic system, being able to incorporate new information quickly (Snowberg et al., 2007) and therefore make it possible to observe developments over time. Also, fluctuations in stock prices allow for the estimation of forecast precision and predictions of standard forecast errors (Berg et al., 2003).

VSM minimize the danger of *groupthink,* which can be a problem with traditional forecasting techniques like the Delphi method. VSM are immune to groupthink as traders are constantly in competition and profits can be made when deviating from the estimation of the majority of actors in the market (Hopman, 2007). Finally, VSM implementation and operation are very cost-efficient and VSM are perfectly scalable to integrating large numbers of participants (Spann et al., 2009).

Various companies have already successfully implemented VSM as a forecasting tool: *Google* uses VSM to continuously predict a wide number of developments relevant to the company, ranging from the future number of *Gmail* users to opening dates for new office locations around the world (Sunstein, 2006). *Hewlett Packard* uses VSM to estimate future sales volumes (Chen & Plott, 2002), *Intel's* VSM forecasts customer demand (Hopman, 2007). Probably, the best known example of VSM forecasts is the *Hollywood Stock Exchange (HSX)*:

Established in 1996, it brings together over 1.6 million participants trading movies´ box office results (Hollywood Stock Exchange, 2009). HSX has received comprehensive attention by the general public (e.g., Alster, 2003) as well as by the scientific community (Elberse, 2007).

## Decision Support

Besides these simple forecasts, VSM can be designed to serve as a decision support system. The underlying idea is to measure the interdependency of two events and to improve decision making. Like the basic concept of VSM, the concept of decision support stems from election forecasting. Berg and Rietz (2003) construct stocks that generate payoffs according to the vote share of a political party provided that the candidate of the other party is predicted correctly. This way, VSM deliver election forecasts, which depend on the parties´ nominees.

Transfers into business applications are obvious. VSM can be used to evaluate the consequences of various business decisions for the overall company performance or the company´s real stock price. Such a decision support makes VSM even more useful than simple forecasts because recommendations for action become easily available from market results. At the same time, such VSM implementations can be a means of making decisions more democratic as the estimations of large crowds can be taken into consideration (Hanson, 2006b).

To date, very few implementations have been documented in business practice. Kiviat (2004) presents the example of *Intel* using VSM to make allocation decisions and determine which factory should be chosen to produce computer chips and when.

## Evaluation of Product Concepts

VSM can help to identify promising product concepts long before their market launch. For this purpose, participants trade stocks, representing future market shares or expected ratings by consumers (Spann & Skiera, 2004).

Unlike the above mentioned VSM variants, evaluations of product concepts are not an adoption from political research but rather an original concept from business research. Dahan et al. (2007) first demonstrate the applicability of VSM for these product concept tests. They show that VSM are able to deliver results even with very limited runtime of the markets. As the stock prices converge quickly, market durations of a few minutes to up to an hour are fairly sufficient. Product concept tests via VSM are very flexible, which allows comparing product concepts with products already being marketed. Also, full concepts can be studied and compared with single components of a product or concept. VSM generate unbiased estimations, allowing analyses for willingness to pay. The market mechanism also allows traders to learn from each other´s estimations which is useful for evaluating fashion goods or products with network effects where one consumer´s utility is co-determined by the other users´ behavior.

The first large scale implementation of such product concept test is *Yahoo's Tech Buzz Game,* which was active between 2005 and 2008 (20082008Yahoo!, 2008!!). Its aim was to identify emerging technology trends by predicting the future number of search requests for a specific term in the *Yahoo!* search engine. The Tech Buzz Game comprised around 50 markets and attracted as many as 20,000 participants.

## Identification of Lead Users

Very active and successful VSM participants show characteristics of lead users (Spann et al., 2009): They qualify by an excellent understanding of the relevant product category and develop needs prior to other users.[3] Therefore, companies can use VSM specifically to identify lead users and, subsequently, recruit them for more in-depth market research and e.g. set up focus groups.

Lead user identification through VSM can be very valuable for businesses as a large number of participants can join the market at low cost for a company. VSM are especially useful on consumer goods markets where companies face a large number of customers and do not interact with them in person. Also, VSM help to detect those users that are able to transfer their expertise in the relevant product category into predictions of future market success. VSM, detecting lead users, can easily be integrated into a company´s existing online community where users converge who qualify by their high product involvement. Such online communities will, therefore, contain a number of potential lead users.

To date, only one implementation of such lead user identification via VSM has been documented: Spann et al. (2009) have identified lead users among traders of a VSM predicting movies´ box office results. The authors are able to show that there is a significantly higher portion of lead users among the top 20% of traders than among the rest of the participants.

## FUTURE RESEARCH DIRECTIONS

In recent years, there has been a lot of effort dedicated to the demonstration of the practical efficacy of VSM. The majority of publications have been focused on developing and describing applications of the concept (Tziralis & Tatsiopoulos, 2007). Future work also has to address the development of a theoretical basis for the concept and answer the questions outlined below. The newly established *Journal of Prediction Markets* can be an adequate outlet for this work.

The theoretical explanation of the excellent forecasting results is not yet complete. At the moment, not a single model is able to explain the exact way VSM work aggregating the information. Also, there is no coherent explanation for why people trade in the first place. Every trader potentially has to fear that other participants hold superior information, which certainly increases the risk of losing one´s money (Milgrom & Stokey, 1982). Also, there is no theoretical explanation for the individual trading behavior, which significantly varies among individual traders. Especially, characteristics of *marginal traders* have to be researched who qualify by their expertise and active trading behavior and are of great importance for the generation of precise forecasts (Forsythe et al., 1999). Besides, the exact factors have to be identified that influence the quality of the obtained results. The influence of different reward structures on forecast precision has to be especially analyzed. The question whether real money or play money should be used has not yet been resolved. Also, the optimal time horizon for making precise forecasts has yet to be identified.

To win a better understanding of the quality of VSM results, the effects of possible bias in VSM results need to be researched in more detail. Various authors observe *favorite-longshot bias* with traders systematically overestimating the likelihood of very improbable events and underestimating the likelihood of highly probable events making market prices slightly biased towards the center (e. g. Berg & Rietz, 2002; Tetlock, 2004; Wolfers & Zitzewitz, 2004). Even though it does not seem to affect market prices, there is evidence for individual trading behavior being biased towards outcomes more desirable for the company that runs the market (Cowgill et al., 2009) or for individual traders themselves (Forsythe et al., 1999).

From a manager´s point a view, clear guidelines are desirable on how VSM should be used in business practice. At present, no general rule exists for when VSM are the first choice over other research instruments. Even though VSM will always yield some results, they might not offer meaningful insights and have very little predictive power if important information is unavailable to traders. Sunstein (2006) documents cases in which relevant information is out of reach for market participants and subsequent VSM predictions are wrong. Also, diffusion of power can be a problem: When VSM are used for corporate decision making, neither a single person nor a group of people can be held responsible for decisions that turn out to be wrong. Instead, decisions are made based on the estimations of a pool of anonymous traders. In within-company applications, market participants can be tempted to withhold important information from their colleagues or influence actual outcomes negatively in order to benefit from their superior level of information (Hanson, 2006). Also, anonymous trading can run counter to a corporate culture encouraging openness (Hopman, 2007).

When VSM are used to evaluate product concepts based on the estimations of company outsiders, transparency of results can be disadvantageous. Market prices are open to all participants who might then draw conclusions from VSM results about future company policies. Hence, confidentiality of research results cannot be guaranteed. Also, legal concerns have to be clarified that still remain for VSM operating on the basis of real money. At present, VSM either use play money, operate from off shore locations where legal rules are less strict, or fulfill tight regulations so as to comply with online gambling laws[4] (Hahn & Tetlock, 2006). Finally, in order to win general acceptance as a standard research tool in business practice, the monetary benefits of VSM use need to be quantified, so that they can be compared with traditional instruments of business research.

## CONCLUSION

VSM have the great potential to become a very powerful research tool in marketing and management. Their advantages have been identified over other research techniques, and companies clearly seem to be aware of the concept's potential. If the remaining questions can be resolved in the near future, VSM will further gain in importance and the number of implementations in business practice will most likely grow.

## REFERENCES


Alster, N. (2003, November 23). It´s just a game, but Hollywood is paying attention. *The New York Times*, 4.

Berg, J., Forsythe, R., & Rietz, T. (1996). What makes markets predict well? Evidence from the Iowa Electronic Markets. In W. Albers, W. Güth, & P. Hammerstein (Eds.), *Understanding strategic interaction: Essays in honor of Reinhard Selten* (pp. 444-463). Berlin: Springer.

Berg, J., Nelson, F., & Rietz, T. (2003). *Accuracy and forecast standard error of prediction markets.* Retrieved January 27, 2009, from http://www.biz.uiowa.edu/iem/archive/forecasting.pdf

Berg, J., Nelson, F., & Rietz, T. (2008). Prediction market accuracy in the long run. *International Journal of Forecasting*, *24*(2), 283–298. doi:10.1016/j.ijforecast.2008.03.007

Berg, J., & Rietz, T. (2002). *Longshots, overconfidence and efficiency on the Iowa Electronic Market.* Retrieved May 6, 2009, from http://www.biz.uiowa.edu/iem/archive/Longshots_2002January.pdf

Berg, J., & Rietz, T. (2003). Prediction markets as decision support systems. *Information Systems Frontiers*, *5*(1), 79–93. doi:10.1023/A:1022002107255

Chen, K.-Y., & Plott, C. R. (2002). *Information aggregation mechanisms: Concept, design and implementation for a sales forecasting problem.* Retrieved February 10, 2008, from http://www.hss.caltech.edu/SSPapers/wp1131.pdf

Cowgill, B., Wolfers, J., & Zitzewitz, E. (2009). *Using prediction markets to track information flows: Evidence from Google.* Retrieved May 6, 2009, from http://www.bocowgill.com/GooglePredictionMarketPaper.pdf

Dahan, E., Lo, A. W., Poggio, T., Chan, N., & Kim, A. (2007). *Securities trading of concepts (STOC)*. Retrieved January 27, 2009, from http://ssrn.com/abstract=1163442

Elberse, A. (2007). The power of stars: Do star actors drive the success of movies? *Journal of Marketing*, *71*(4), 102–120. doi:10.1509/jmkg.71.4.102

Fama, E. (1970). Efficient capital markets: A review of theory and empirical work. *The Journal of Finance*, *25*(2), 383–417. doi:10.2307/2325486

Forsythe, R., Nelson, F., Neumann, G. R., & Wright, J. (1992). Anatomy of an experimental political stock market. *The American Economic Review*, *80*(5), 1142–1161.

Forsythe, R., Rietz, T., & Ross, T. (1999). Wishes, expectations and actions: a survey on price formation in election stock markets. *Journal of Economic Behavior & Organization*, *39*(1), 83–110. doi:10.1016/S0167-2681(99)00027-X

Hahn, R., & Tetlock, P. (2006). A new approach for regulating information markets. *Journal of Regulatory Economics*, *29*(3), 265–281. doi:10.1007/s11149-006-7399-z

Hanson, R. (2006a). Decision markets for policy advice. In A. S. Gerber & E. M. Patashnik (Eds.), *Promoting the general welfare: New perspectives on government performance* (pp. 151-173). Washington, DC: Brookings Institution Press.

Hanson, R. (2006b). Foul play in information markets. In B. Hahn & P. Tetlock (Eds.), *Information markets: A new way of making decisions* (pp. 126-141). Washington, DC: American Enterprise Institute Publishing.

Hollywood Stock Exchange. (2009). *Corporate Overview*. Retrieved January 26, 2009, from http://www.hsxresearch.com/corporate_overview.htm

Hopman, J. W. (2007). Using forecasting markets to manage demand risk. *Intel Technology Journal*, *11*(2), 127–135.

Kiviat, B. (2004, July 12). The end of management? *Time*, Inside Business, A4.

Milgrom, P., & Stokey, N. (1982). Information, trade and common knowledge. *Journal of Economic Theory*, *26*(1), 17–27. doi:10.1016/0022-0531(82)90046-1

Moore, W. L. (1982). Concept Testing. *Journal of Business Research*, *10*, 279–294. doi:10.1016/0148-2963(82)90034-0

Snowberg, E., Wolfers, J., & Zitzewitz, E. (2007). Partisan impacts on the economy: Evidence from prediction markets and close elections. *The Quarterly Journal of Economics*, *122*(2), 807–829. doi:10.1162/qjec.122.2.807

Spann, M., Ernst, H., Skiera, B., & Soll, J. H. (2009). Identification of lead users for consumer products via virtual stock markets. *Journal of Product Innovation Management*, *26*(3), 322–335. doi:10.1111/j.1540-5885.2009.00661.x

Spann, M., & Skiera, B. (2003). Internet-based virtual stock markets for business forecasting. *Management Science*, *49*(10), 1310–1326. doi:10.1287/mnsc.49.10.1310.17314

Spann, M., & Skiera, B. (2004). Opportunities of virtual stock markets to support new product development. In S. Albers (Ed.), *Cross-functional innovation management* (pp. 227-242). Wiesbaden, Germany: Gabler.

Sunstein, C. (2006). *Infotopia – how many minds produce knowledge*. Oxford, UK: Oxford University Press.

Surowiecki, J. (2005). *The Wisdom of Crowds*. New York: Anchor Books.

Tetlock, P. C. (2004). *How efficient are information markets? Evidence from an online exchange.* Retrieved May 6, 2009, from http://www.mccombs.utexas.edu/faculty/paul.tetlock/papers/Tetlock-Efficient_Info_Markets-01_02.pdf

Tziralis, G., & Tatsiopoulos, I. (2007). Prediction markets: An extended literature review. *Journal of Prediction Markets*, *1*(1), 75–91.

von Hayek, F. A. (1945). The use of knowledge in society. *The American Economic Review*, *35*(4), 519–530.

von Hippel, E. (1986). Lead users: A source of novel product concepts. *Management Science*, *32*(7), 791–805. doi:10.1287/mnsc.32.7.791

Wolfers, J., & Zitzewitz, E. (2004). Prediction markets. *The Journal of Economic Perspectives*, *18*(2), 107–126. doi:10.1257/0895330041371321

Yahoo! (2008). *Tech Buzz Game*. Retrieved January 29, 2008, from http://buzz.research.yahoo.com

## KEY TERMS AND DEFINITIONS

**Decision Support Systems:** a computer information systems that support decision-making activities.

**Groupthink:** a pattern of decision making by a group characterized by reaching consensus without sufficient discussion and consideration of alternative solutions to the problem at hand.

**Hayek Hypothesis:** Market prices work as a quick and efficient means to aggregate information that are diversely held by individual market participants (Hayek, 1945).

**Information Efficiency Hypothesis:** A capital market is called "efficient" if its prices always fully reflect all available information (Fama, 1970).

**Lead User:** a user who faces needs months or years prior to the majority of users in a market and who benefits significantly from obtaining a solution to those needs (von Hippel, 1986).

**Marginal Trader:** a very active and well informed market participant. Marginal traders do not suffer from any bias when evaluating stock prices. They frequently make trades close to the current market price, thereby adjusting it to the information they hold.

**Products Concept Testing:** the process of estimating consumer responses to a product idea prior to its market launch. Product concepts are tested in order to improve the rate of successful new product introductions (Moore, 1982).

**Virtual Stock Market (VSM):** a market that allows trading of stocks representing the outcomes of future events. Market prices reflect the aggregate expectations of participants and can be used as a forecasting tool.

## ENDNOTES

1. Currently, there is no universally accepted terminology for the concept of Virtual Stock Markets (VSM). Alternative terms can be found, such as *Prediction Markets, Information Markets* or *Idea Futures*. For an overview of the different terms employed and their frequency of use, see Figure 1 in Tziralis and Tatsiopoulos (2007).
2. More detailed descriptions of the functionality and theoretical foundation of VSM are offered in Spann and Skiera (2003).
3. For the concept of lead users see von Hippel (1986).
4. The operators of the IEM agreed to maintain the market´s academic focus, not to seek any profit and limit maximum stakes to USD 500. In return, the *Commodities Futures Trading Commission (CFTC)* issued a no-action-letter extending no-action relief to the market (Berg et al., 1996).

# Chapter 47
# Potential Benefits of Analyzing Website Analytic Data

**Elizabeth Votta**
*Roosevelt University, USA*

## INTRODUCTION

This article presents an overview of the potential benefits of analyzing website analytic data. During the last several years I have gained first-hand knowledge of Internet marketing programs of a variety of companies ranging from national name brands to small businesses. In addition, I have been active in the local chapter of the American Marketing Association. During this time, it has become clear to me that many small business owners and marketing managers at various size companies lack a basic understanding of the potential benefits of analyzing website analytic data. This article introduces the basics of website analytics and the potential benefits derived from analyzing that data.

The objectives of this article include:

- Define the following terms: website analytics, Internet marketing, bounce rate, information architecture, Web 1.0, Web 2.0, and search engine spider.
- This article presents potential benefits of analyzing website analytic data, including: discovering traffic trends, target market segmentation, developing best practices, optimizing landing pages, and improving conversion rates.

DOI: 10.4018/978-1-61520-611-7.ch047

## BACKGROUND

Currently there is great interest in Internet marketing as Internet usage continues to increase. According to Internetworldstats.com (2009) world Internet usage has grown 338.10% from 2000 to 2008. Internet marketing offers both Business to Consumer (B to C) and Business to Business (B to B) companies a way to drive high-quality, low-cost traffic to their website(s). Internet marketing can include a mix of paid and unpaid media along with website adjustments and strategies to drive quality traffic to a website and improve conversion rates. The Internet marketing mix may include but is not limited to: Pay Per Click (PPC), Search Engine Optimization (SEO), banner advertising, landing pages, link building, and email campaigns.

Internet marketing is continuously evolving and offers substantial website statistical data to develop an understanding of return on investment (ROI) of Internet marketing strategies. It is crucial for companies to monitor their website analytic data and develop a baseline report to continually monitor and have the website evolve based on consumer usage of the site. While a percentage of businesses have embraced Web 2.0 trends, a larger percentage of businesses have not yet successfully harnessed the power of or comprehended Web 1.0. Web 1.0 refers to the first versions of websites that were and are basically online brochures. Web 2.0 refers to a website that has evolved past Web 1.0 and includes consumer-generated-content and/or user reviews that allow website visitors to interact with the site.

Website analytics are programs that capture website user data that can be analyzed to develop an understanding of website trends and website strategy ROI. The information varies depending on the analytic program being used but generally includes the total number of visitors to a site along with other data that can be analyzed for trends. Many analytic programs are available and each has its own list of advantages and disadvantages. The two analytic programs that are used for the purpose of this article are Google Analytics and AW Stats.

Google Analytics (2009) website states: "Use Google Analytics to learn which online marketing initiatives are cost effective and see how visitors actually interact with your site. Make informed site design improvements, drive targeted traffic, and increase your conversions and profits." An advantage of using Google Analytics is that it is continuously updated to include advanced reporting tools. A disadvantage is that by offering the product for free, Google also has access to the data.

AW Stats (2009) website states: "AW stats is a free powerful and feature full tool that generates advanced web, streaming, ftp or mail server statistics, graphically. This log analyzer works as a CGI or from command line and shows you all possible information your log contains, in few graphical web pages." An advantage of using AW stats is that it captures the search engine spider visits. A disadvantage is that it is lacks in-depth reporting tools. Search engine spiders are bots (search engine robots) sent from the various search engines to crawl the pages of a website and index the pages based on what they find. It is important to note that search engines do not index a whole website but rather individual pages of a website.

Developing a routine analysis of a website will most likely lead to new ideas for improving the overall user site experience and improving conversion rates. The analysis can easily identify problem areas of the website that might otherwise be overlooked.

## WEBSITE ANALYTICS DATA ANALYSIS

By professionally analyzing the marketing data available via an analytics program on a regular basis, new ideas for improved graphics, copy, and calls to action are likely to be developed. Generally the goal of Internet marketing options such as PPC, SEO, link building, banner advertising, and email campaigns is to drive low-cost, high-quality traffic to a website. Upon entry to the site, their job is done. It is up to the website to convert the consumer. Now that the consumer is on the site, it is up to an analytics program to offer insights into what the consumer is actually doing on the site.

It is crucial for companies to monitor their website analytic data and develop a baseline report. The recommended report will serve as a benchmark to develop best practices and have the website evolve based on consumer usage of the site. A baseline report is recommended to be pulled and analyzed monthly from the following Google Analytics data: visitors and new visitors, page views, time, bounce rate, landing pages, and conversion rates. Details and possible benefits of each are listed below. Initially it is recommended to pull and analyze the reports monthly until enough data is collected or testing is being conducted to justify daily or weekly reports. The more visitors that come to your website, the more accurate your analysis of trends will become. The overall goal of the monthly reports is to determine how successful or unsuccessful your website is for consumers.

## Visitors and New Visitors

First, the monthly report should start tracking the total number of visitors and new visitors. By monitoring total visitor stats each month, it is possible to discover traffic patterns. A visitor is the total number of visits to the site. A new visitor will most likely be a smaller number as a new visitor is only counted the first time the program captures the Internet Protocol (IP) address used. For example, if a visitor uses her work computer for visits on a daily basis Monday through Friday she will only be counted once. However, if on Saturday she visits the site from home, she will now be counted as a new visitor for a second time due to the system capturing a new IP address. It is also possible that twenty different employees at work visiting the same website are only counted as one new visitor if they share one IP address.

## Page Views

Overall total page views should be monitored on a month to month basis to watch for varying levels of interest in the overall site. Individual page views are also important to monitor as this can offer insights into what parts of the website consumers are most interested in. For example, if one section of a website is receiving a disproportionate amount of website traffic, it may make sense to further develop this area of the site. Further, if a single website has several different target markets but one of the target markets website pages or areas of the website are receiving a higher total number of page views compared to other pages or areas of the site, it may make sense to develop more pages or run tests specifically aimed at this target market segment.

## Time

Overall time spent on the site should be monitored month to month to determine if usage increases or decreases over time. This can give insights into overall interest of the site and overall site health. If the total time spent on the site is brief, this may indicate that consumers are not finding the copy or website materials relevant to their needs. Total time spent on the website may or may not be important to the overall website marketing goals. However, time spent on individual pages could be monitored for trends and for special marketing programs to develop best practices if appropriate. Google Analytics times out after thirty minutes if a website is idle and a new session is counted if the visitor is active again.

## Bounce Rate

A bounce rate of a website page refers to a visitor that landed on the page and did not click through to any other pages on that website and hence “bounced” out. A high bounce rate is generally not relevant to blogs, as a consumer may read a post that is relevant to her search and not need to click through to any other pages. However, for many websites a high bounce rate may indicate that the information presented on the page is not relevant to the user, the page is not organized well, or that the page lacks a clear call to action.

Each website's statistics are unique and should be treated as such but in same cases benchmarking may be appropriate. A rule of thumb is that a page bounce rate over 50% may indicate that the page needs to be revisited and tested with improved design, calls to action, and/or copy.

## Landing Pages

Landing pages are often used in PPC campaigns to offer the consumer a clear call to action or the most relevant copy determined by the keyword clicked. Particular website pages of a site may be well indexed by a search engine and act as a landing page for the website. If this is the case, the page will want to be optimized with relevant calls to action, design, and/or copy to improve the bounce rate of the page or improve conversions if appropriate.

## Exit Pages

For an e-commerce site or a Web 2.0 site, the ideal exit page would be the thank you page for a purchase or a submission. Most likely, the website will have multiple pages that rank high as exit pages. These pages should be reviewed to determine if the calls to action, design, and/or copy can be improved to keep the consumer moving through the site.

## Referrals

Referrals are keywords searched for on a search engine or other websites that link to a website to drive traffic to the site. These should be monitored for relevancy and popularity. It is important that over time the best converting keywords are used in a SEO campaign to drive more relevant traffic to the website.

## Conversion Rates

Finally, are conversion rates. The majority of Web 1.0 websites end goal is for the consumer to contact the company or to complete a sales transaction online. Analyzing conversion rates can offer insights into possible ways to test or improve the site to continually fine-tune and improve the conversion rates.

Web 2.0 conversion rates may include calls to actions that may not be easily captured by an analytics program. However, measurable metrics should try to be monitored to determine overall effectiveness of reaching Web 2.0 goals. Overall conversion rates will reveal vital information about the effectiveness of the website converting the consumer. Conversion rates are essential information to analyze to monitor and gauge Internet marketing campaign's ROI.

## Issues, Controversies, Problems

It is important to note that website analytics programs are not 100% accurate. This becomes very clear if you view a website analytics report for the same website using AW Stats and Google Analytics. Most likely they will show very different traffic statistics. This is due to the way the data is collected and is a good reminder that neither program is 100% accurate.

Although Google Analytics is a powerful program that is currently offered for free, sensitive website data is shared with Google in exchange for the free use of the program. Some companies will prefer to pay for a website analytics program that allows their website data to remain private. In addition, some companies will prefer a paid website analytics program that can be customized and offer reporting based specifically on their own reporting needs.

## Solutions and Recommendations

Using readily available and free website analytics programs such as AW Stats and Google Analytics together offers the average marketer insights into website trends, and allows for benchmarking and gaining insights into return on investment of various Internet marketing campaigns.

However, using free website analytics programs may not be the ideal solution for all websites. It is recommended that the advantages and disadvantages of several website analytics programs are weighed by the company before a selection is made. In some cases, it may make sense to start with free programs such as AW Stats and Google Analytics and as analytics reporting becomes more advanced then upgrade to a paid program or invest in an executive becoming certified by Google via Conversion University to fully utilize Google analytics.

## FUTURE RESEARCH DIRECTIONS

Website analytics programs continue to evolve at a fast pace as users become more savvy. I expect that the programs offered will continue to offer more advanced and in-depth analysis as this marketing segment grows. This article offers an introduction to website analytics and the potential benefits derived from analysis. Future research opportunities include building upon the foundation of this article, by delving deeper into the statistics provided by Google Analytics and giving insights into some of the more advanced features currently available.

## CONCLUSION

If you build it, they will not come. Launching a website does not guarantee traffic, let alone quality traffic, to a website. A comprehensive Internet marketing strategy should be developed, and in its most basic form, it should include a comprehensive website analytics report. The report should include the basic information detailed in this article as a baseline to start. A well-written and analyzed report will naturally guide future website growth and evolution.

A website needs to evolve – it must evolve to stay relevant. A website can not afford to stay static because the technology and expectations of the consumer will pass the business by. By developing a website analytics program that continually monitors and reports on trends, a business is able to develop an understanding of consumers' usage and adapt the website and Internet marketing strategies accordingly to reach marketing goals.

## REFERENCES

Analytics, G. (2009). *Google Analytics: Improve your website and increase marketing ROI.* Retrieved February 4, 2009, from https://www.google.com/analytics/reporting/login?ctu=https%3A%2F%2Fwww.google.com%2Fanalytics%2Fsettings%2F%3F

Internetworldstats.com. (2009). *Internet Usage Statistics*. Retrieved February 4, 2009, from http://www.internetworldstats.com/stats.htm

Stats, A. W. (2009). *AW Stats Official Website*. Retrieved February 4, 2009, from http://awstats.sourceforge.net/

## ADDITIONAL READING

Burby, J., Atchison, S., & Sterne, J. (2007). *Actionable Web Analytics: Using Data to Make Smart Business Decisions*. Hoboken, NJ: Sybex.

Clifton, B. (2008). *Advanced Web Metrics with Google Analytics*. Hoboken, NJ: Sybex.

Eisenberg, B., Eisenberg, J., & Davis, L. T. (2006). *Call to Action: Secret Formulas to Improve Online Results*. Nashville, TN: Thomas Nelson.

Inan, H. (2001). *The Need for Web Site Traffic Analysis*, Retrieved February 4, 2009, from http://www.clickz.com/840921

Inan, H. (2001). *Web Site Traffic Analysis Untangled*. Retrieved February 4, 2009, from http://www.clickz.com/841671

Inan, H. (2001). *Two Limitations of Web Site Traffic Analysis Tools*. Retrieved February 4, 2009, from http://www.clickz.com/ 842331

Jackson, S. (2004). Case Study: www.healthylifepharmacy.com 1300% Increase in Sales. *The Conversion Chronicles*. Retrieved March 28, 2009, from http://www.conversionchronicles.com/Refer_us_and_receive_a_free_report.html

Jones, K. B. (2008). *Search Engine Optimization: Your Visual Blueprint for Effective Internet marketing.* Hoboken, NJ: John Wiley and Sons.

Kaushik, A. (2007). *Web Analytics: An Hour a Day.* Hoboken, NJ: Sybex.

Krug, S. (2005). Don't *Make Me Think: A Common Sense Apadvantageach to Web Usability, 2nd Edition.* Upper Saddle River, NJ: New Riders Press.

Ledford, J., & Tyler, M. E. (2007). *Google Analytics 2.0.* Hoboken, NJ: Wiley.

Lovegrove, C. (2005). *A Comprehensive Strategy for Using Web Site Statistics Track The Effectiveness Of Your Marketing Effort.* Retrieved January 15, 2009 from http://www.searchengineadvantagemotionhelp.com/m/articles/site-disadvantagetent-design/site-statistics-strategy-1.php

Perez, J. C. (2005). Google Dumps Fees For Analytics Tools. *IDG News Service.* Retrieved February 4, 2009, from http://www.pcworld.com/article/123519/google_dumps_fees_for_analytics_tools.html

Perez, J. C. (2005). Google Suspends Analytics Sign-Ups. *IDG News Service.* Retrieved February 4, 2009, from http://www.pcworld.com/article/123665/google_suspends_analytics_signups.html

Peterson, E. (2004). *Web Analytics Demystified: A Marketer's Guide to Understanding How Your Web Site Affects Your Business.* Portland, OR: Celilo Group Media.

Phippen, A., Sheppard, L., & Furnell, S. (2004). A practical evaluation of Web analytics. *Internet Research*, *14*(4), 284–293. doi:10.1108/10662240410555306

Sen, A., Dacin, P. A., & Pattichis, C. (2006). Current Trends in Web Data Analysis. *Communications of the ACM*, *49*(11), 85–91. doi:10.1145/1167838.1167842

Terdiman, D. (2004). *Website Analysis Isn't a Game*. Retrieved December 28, 2008 from http://www.wired.com/science/discoveries/news/2004/06/63767

Viney, D. (2008). *Get to the Top on Google: Tips and Techniques to Get Your Site to the Top of the Search Engine Rankings -- and Stay There.* Boston, MA: Nicholas Brealey Publishing.

## KEY TERMS AND DEFINITIONS

**Bounce:** A bounce rate of a website page refers to a visitor that landed on the page and did not click through to any other pages on that website and hence "bounced" out. A high bounce rate is generally not relevant to blogs, but for other websites may indicate that the information presented on the page is not relevant to the user, the page is not organized well, or that the page lacks a clear call to action.

**Information Architecture:** Information architecture refers to the way information is organized on a website. Successful Information Architecture includes information that is easy to find and is arranged in a way that is intuitive to the website visitor.

**Internet Marketing:** Internet marketing can include a mix of paid and unpaid Internet media along with website adjustments and strategies to drive quality traffic to a website and/or improve conversion rates. The Internet marketing mix may include but is not limited to: Pay Per Click (PPC), Search Engine Optimization (SEO), banner advertising, landing pages, link building, and email campaigns.

**Search Engine Spider:** Search engine spiders are bots sent from the various search engines to crawl the pages of a website and index the pages based on what they find.

**Web 1.0:** Web 1.0 refers to the first versions of websites that were and are basically online brochures.

**Web 2.0:** Web 2.0 refers to a website that has evolved past Web 1.0 and includes consumer generated content and/or user reviews that allow website visitors to interact with the site.

**Website Analytics:** Website Analytics are programs that capture website user data that can be analyzed to develop an understanding of website trends and website strategy ROI.

# Chapter 48
# Teams of Leaders Concept (ToL) and E-Business Operations

**Dag von Lubitz**
*MedSMART Inc., USA & Bieda Poco Dargante Inst., Denmark*

## GLOBALIZATION 3.0

Information Technology (IT), and the subsequent broad acceptance of Information and Knowledge Management (IM/KM) methods revolutionized the way business is thought of and practiced. With e-business facilitating the ability to do more, more, faster, at a wider range, and to influence ever larger and more diverse consumer groups, the impact of technology on commerce, finance, and global economy has been frequently compared to the "paradigm shift" that Kuhn (1970) proposed as the essence of scientific revolution. Yet, despite the transformational influence of modernity on the ancient art, the fundamental principles of business have not changed: overreliance on the *facilitation* of business operations as the substitution for the adherence to the *soundness* of their conduct fuelled rampant growth of corporate *laisse faire,* and already twice brought the world to the brink of economic disaster (Stiglitz, 2003; Steingart, 2008).

Ultimately, a new realization begins to emerge: e-business makes cut-throat competition, winning at any price, and "devil take the hindmost" philosophy (Chancellor, 1999) not only obsolete but perceived by the increasing number of business leaders as harmful if not even dangerous (e.g., Greenwald and Kahn, 2005; Mittlestaedt, 2005; Prahalad and Ramaswalmy, 2004). Instead, the notion that "we are in this boat together" is gaining an ever wider acceptance: under the influence of technology the world has, indeed, changed (e.g., Canton, 2006). It started to converge, and now some even conceive it as "flat" (Friedman, 2005.) In reality, the world is probably not "flat" but far more three-dimensional and textured than it has ever been before. Technology converted point to point interactions into a complex set of relations that, based on networks

DOI: 10.4018/978-1-61520-611-7.ch048

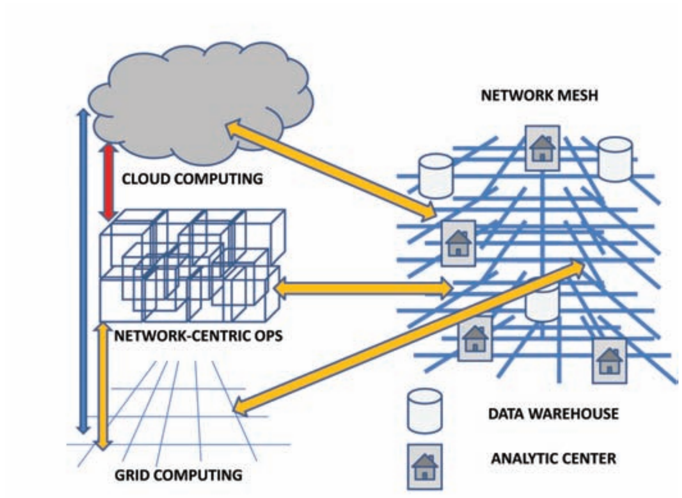
where knowledge is the most sought commodity (Wickramasinghe and von Lubitz, 2008), and we now live embedded in a rapidly evolving, globe-spanning mesh of a "network of networks" (von Lubitz, 2009; see fig.1). Simultaneously with the development of new technology-based transaction platforms, another major technology-facilitated transformation began to occur: subtly, but with an ever increasing force, business interactions begun to move away from the traditional concept of ownership and its transfer as the basis of transaction between firms, firms and their customers, and even among customers themselves. Instead, *access* to goods and services among organizations became the increasingly prominent form, and Friedman's era of Globalization 3.0 (Friedman, 2005) became synonymous with Rifkin's "Age of Access" (Rifkin, 2003). Individuals rather than state and corporate bureaucracies acquired unprecedented power, and started to actively shape the world. In contrast to the first and second stage of Globalization, the process of change altered its direction, the flow now moving upward, from the bottom up, instead of hierarchically sanctified top-down descent of orders, commands, and directives. The boost for the change was provided by the intensification of horizontal exchanges conducted across boundaries of time, space, and specialization among individuals and groups of increasingly diverse character. Technology not only altered the way we do business but caused a fundamental transformation in the way we think about business. While Globalization 2.0 (Friedman, 2005) had the characteristics of Kuhnian "paradigm shift" (Kuhn, 1970), the forces that induced Globalization 3.0 induced *business mutagenesis* – a permanent alteration in the hitherto immutable "genetic" structure of the organism.

## THE CONSEQUENCES OF CHANGE

While transformation in global relations that Friedman (2005) termed as Globalization 1.0 and 2.0 took place over approximately 200 years, the second stage – Globalization 3.0 – occurred within less than ten, at a pace unprecedented in the history of humanity. The new political and economic realities of the "global world" (Haas, 2005; Sachs, 2005) provided fertile ground for the development of new customer- and knowledge-driven concepts of doing business (Wickramasinghe and von Lubitz, 2008) conducted by the growing number of learning organizations (Senge, 1990) able to both understand better and respond with a much greater agility to the shifting demands of markets. The concomitant intensification of consumer-generated pressures altered the nature of competition: "the hunter became the hunted" (Prahalad and Ramaswamy, 2004; Greenwald and Kahn, 2005). Size and power-based quest for market dominance that characterized earlier stages of globalization transformed into customer-driven need for innovation, adaptability, and highly innovative approaches to product development, marketing, and sales. Ultimately, business strategies based on collaboration, knowledge sharing, and increasing level of organizational transparency became increasingly the norm rather than exception (Christensen et al., 2004; Kim and Mauborgne, 2005; Evans and Wurster, 2000). Increasingly, and in a curious similarity to political confrontation and conflict (Smith, 2007), modern business operations became increasingly conducted "amongst the people."

Technology shrunk the world in both physical and temporal sense (Friedman, 2005.) It simplified processes, reduced bureaucratically-imposed loads on business, and increased efficiency. Yet, because it also increased the range of operational permutations, escalated the number of direct and indirect actors, intensified their mutual relationships, and introduced technology-specific complexities, technology also led to the emergence of a tightly coupled, highly intricate global system of mutual dependencies and vulnerabilities. With the chances of failure depending exponentially on system's complexity, and with the resulting

*Figure 1. The network mesh consists of several network layers (e.g., financial, reporting, logistics, etc.) each associated with its data/information/knowledge storage facilities, analytic centers, and entry portals). Within each layer activities are conducted using a wide variety of computing and analytic platforms (grid and cloud computing, network-centric operations). All layers are interconnected, and data/information/knowledge flows are omnidirectional, i.e., the output of one entity (or network layer) may provide input to another one. User-oriented outputs consist predominantly of actionable information and actionable knowledge*




failures often having catastrophic proportions (Ebenhart, 2003; Mandelbrot, 2004; Taleb, 2007), globalization created the environment in which potential for such catastrophic events became increasingly greater.

The complexity characteristic of closely coupled systems is also the source of elevated "random noise", i.e., normal and quite harmless performance variation. However, that very same random noise may mask critically destabilizing events that hide below the level of detection based on casual observation (Mandelbrot, 2004; von Lubitz and Wickramasinghe, 2006; Taleb, 2007). Information technology is now used very extensively as the means to detect such events through gathering of business intelligence, operational performance monitoring and control, and alert generation. Increasingly more ubiquitous "smart portals" (Wickramasinghe and von Lubitz, 2007) provide access to web-based analytic tools, and grid- and cloud computing, and network-centric approaches (von Lubitz, 2009; Chang, 2008) enhance the speed and the range of the data/information/knowledge retrieval, manipulation, and analysis. In turn, their outputs facilitate generation of pertinent knowledge and evidence-based practices (von Lubitz and Wickramasinghe, 2006a).

Under ideal circumstances, all participating actors, whether within the same entity or across collaborating entities would have equal status and equal access to all inputs and outputs involved in these processes. In reality, however, while inputs may be shared among collaborators, most of the outputs are generated within narrowly defined, discipline-oriented sectors of action. Furthermore, the products of analyses are distributed hierarchically in a bottom-up flow. Individual streams of knowledge are subsequently converted at the executive level of the organizational pyramids into *actionable knowledge*, then distributed in form of standard operational practices, doctrines, rules, and regulations in the top-bottom direction. More importantly, the generated actionable knowledge has also a very limited lateral spread: it is domain related and affects predominantly only those at whom it is directly aimed, i.e., intra-domain specialists and experts. Consequently, many actors for whom such knowledge would be *pertinent and germane* (von Lubitz and Wickramasinghe, 2006b) remain entirely unaware of its existence. Despite all advantages offered by information technology and increasingly ubiquitous information/knowledge management techniques, their current employment in business operations does not engender creation of the cardinal transforming catalyst – the *actionable understanding*. Yet, it is the latter which transforms the wealth of pre-existing actionable knowledge into a clear strategy and links it to cohesive operations conducted in the precise alignment with the strategy-defined objectives.

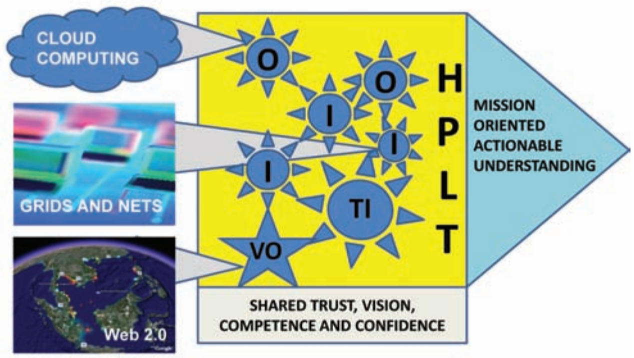
## THE CONCEPT OF 'TEAMS OF LEADERS" (TOL)

The concept of *"actionable understanding"* has been introduced several years ago by the US Army general Frederic Brown (Brown, 2002; see also Bradford and Brown, 2008) to denote the final "product" of all actions and activities performed within the broad realm of the "Teams of Leaders" (ToL) environment. ToL is the direct outcome of the requirements faced by the US Army following the end of the Cold War, where decisions made by the "man on the spot" have the potential to influence national interests, the fate of alliances, and the difference between rebuilding broken societies and perpetuation of armed conflict. The new demand necessitated a new breed of soldier-leaders: flexible, adaptable, versatile, and comfortable in operating within the complex setting of Joint Interagency, Intergovernment, Multinational (JIIM) operations in which military and civilian concepts intertwined into a tightly woven mesh (Brown, 2002; Brown, 2008a,b; Bradford and Brown, 2008). In several aspects, the issues affecting the US Army were and are nearly identical to those seen in the conduct of global-scale business activities: increasing organizational complexity and spectrum of operations, the need for mission-centered cooperation of others, be it corporate partners, regulatory agencies, or customers themselves, and the need to adapt in order to address increasingly larger host of rapidly diversifying issues. The process of this far ranging transformation is complicated by the fact that it must be enacted while continuing simultaneous engagement in routine activities (Brown, 2008a).

## WHAT IS TOL?

Conceptually, ToL centers on the active, platform independent fusion of advanced IM, KM and High Performing Leader Teams (HPLT; see Bradford and Brown, 2008; also von Lubitz, 2009; Fig. 2). What distinguishes ToL from a specialized social network is the essential prerequisite for the development and functions of HPLT: the shared foundation of *skills, knowledge, and attitudes* based on the previously acquired appropriate and universally high-quality professional preparation of individual team members. The preparation demands intensive training to *task, condition, and standard*, and the ability to demonstrate complete, practical mastery of performance. To be efficient, the rigorous professional training must satisfy strictly defined metrics-based performance standards. Consequently, general uniformity of education/training outcomes is attained, assuring not only the high professional capability of the participants, but also shared confidence in mutual professionalism and ability to act appropriately under a very wide range of conditions both as individuals and teams of individuals. Mutual trust and sharing are the cornerstones of successful performance, and their development and strengthening a contiguous process.

*Figure 2. A high performing leader team (HPLTs) may consist of individuals (I), teams of individuals (TI), organizations (O), and virtual organizations (VO). The latter may be created ad hoc by the team members as the means of addressing specialized aspects of the mission, or enter HPLT as already formed entities. The foundations of an HPLT are shared Skills, Knowledge, and Attitudes (SKA) whose team-based application promotes development of shared trust, vision, competence, and confidence. All intensely collaborative, purpose-oriented, and meaningful interactions among Team members are based on/facilitated by the extensive, platform independent use of all available IT/IM/KM resources. Interactions result in a rapid development of shared vision, empowering sense of mutual trust, and confidence, and the conversion of actionable knowledge possessed by individual team members into mission-oriented actionable understanding shared by all members of the team. In the process of that conversion, new knowledge is generated which is fed back (bottom-up generation) into the world of computing clouds, grids, nets, and Web, where it is converted into tacit and/or explicit knowledge, then distributed (top-bottom) either as such or as actionable information back into the HPLT "universe" (von Lubitz, 2009). The entire process is made possible through the intense use of all available IT/IM/KM tools and resources. The wide variety of high-level expertise characterizing HPLTs serves as the principal facilitator in access to, acquisition, and transformation of multi-domain information and knowledge into a unified, mission-relevant body of knowledge supported by mission-oriented actionable understanding. The latter constitutes the culminating output of the team (von Lubitz, 2009)*




Training alone is not sufficient: it must have roots in active learning which, in the context of leader team development, requires collaborative learning shown to significantly improve critical thinking and task performance (Bradford and Brown, 2008, von Lubitz, 2009). To assure task performance to a predetermined standard, the learning process is experiential rather than didactic, and involves routine exposure to sudden, unpredictable scenario changes ("confounders"). The latter develops the required mental flexibility and adaptability of individuals within the team as well as the entire team (Brown 2002; Bradford and Brown, 2008). This type of training has been used with the great success in medicine, nursing, and in advanced business education, and assures the mastery of skills, knowledge, and also emergence of the related mental and physical attributes employed with equal ease under routine circumstances and in the environments of maximum stress, uncertainty, and tempo.

Performance assessment under rigorous and highly demanding conditions constitutes the essential part of High Performing Leader Team development: the process becomes a chain of objective self-evaluation which promotes further training leading to pitch efficiency of the teams. Due to the standardized approach used in HPLT development, teams can be inserted as "modular elements" whenever and wherever required, and the standardized training/testing regimen assures that organizations, whether real or virtual, which co-opt HPLTs as part of their operational profile will have full confidence and trust in their capabilities. The latter is of possibly the greatest significance in the development of efficiency and cohesion that, in turn, serve as the critical lubricant in multi-organizational efforts (Smith, 2007). Conversely, it has been demonstrated on several occasions that absence of such trust and acceptance are among the primary reasons for several failures (see von Lubitz, 2009 for further references).

## THE IMPACT OF TOL ON GENERATION OF NEW KNOWLEDGE AND EVIDENCE-BASED, BEST PRACTICES

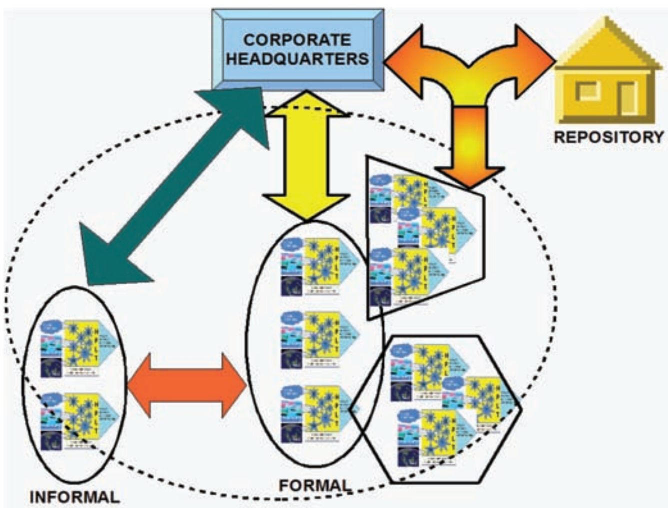
Continuing limitations in the use of sophisticated, technology-based methods in the process of generating actionable knowledge (see above, and von Lubitz, 2009) may lead to inadvertent "stove-piping." Implementation of ToL avoids this issue through the "horizontal spread" (Fig. 3) attained by means of platform-independent, peer-to-peer exchanges, social and professional networks, text- and visual blogs, avatars, etc., whose increasing functionality, reach, and practicality of use are supported and expanded by the rapidly growing impact of Web 2.0. Combined with the enterprise-wide access to the internal and external primary information and knowledge sources, the resulting pervasive, system-wide use of IT promotes generation of *ad hoc* collaborative entities (teams) needed to address common problems or develop "just-in-time" solutions. In the process of such interactions, and by fusing expertise of team members and teams with all available e-based resources and analytic tools, both new knowledge and best practices are created.

Extensive use of a wide range of technology platforms and technology implementation concepts frees individual team members and teams themselves from the constraints of time, space, organizational/inter-organizational cultures, and – most importantly – the destructive influence of organizational status and rank (Bradford and Brown, 2008). For this reason ToL and its inherent processes of action and interaction have been employed with a great success by the US Army in a wide range of pilot projects involving both military and civilian affairs ((Brown, 2008a,b; Bradford and Brown, 2008). Moreover, with the already well proven methods and techniques ToL is now vigorously implemented on the national and international/multinational scale by the organization of great complexity, involved in a wide range of support and nation building missions which demand the closest possible cooperation with other, equally complex organizations of national, international, multi-national, or even global level (Brown 2008a; Bradford and Brown. 2008).

## TOL AND "ACTION SWARMS"

The extensive use of IT, IM, and KM as the means of sharing information and knowledge serves as a powerful promoter of rapid development of shared vision, competence, confidence, and trust (Bradford and Brown, 2008) that constitute the critical attribute of High Performing Leader Teams. The close relationship of team members to each other, and to members of other teams is the chief mechanism which transforms previously top-down bureaucratic and organizational structures into a bottom-up/lateral knowledge and "best practices" generator. Due to the pervasive nature of the exchanges within the lattice of the rapidly forming relationships, the process of transformation helps to demolish the existing organizational barriers. Instead, close socialization ensues, and

*Figure 3. Information and knowledge generation and distribution in ToL environment consisting of formal and informal teams. While informal teams provide supporting roles (background functionality), formal teams generate actionable knowledge, best practice definitions, and define the framework of actionable understanding. Individual HPLTs and Teams of Leaders share information and knowledge both horizontally among themselves (indicated by the overlap of individual teams) and vertically, along hierarchical chains of command. Horizontal spread results in the generation of new knowledge and formulation of "best practices." Vertical flows provide inputs to the executive layer of the organization where strategies are formulated and modified on the basis of bottom-up inputs. All flows are bi-directional (arrows). ToL-based interactions prevent both vertical and intra-specialty/domain information/knowledge distribution. Because of this characteristic, ToL environment provides the ideal setting for both broad-spectrum and specific intelligence gathering, analysis, and dissemination across organizational/institutional boundaries. At present, no other approach is equally powerful in these tasks (after von Lubitz, 2009)*



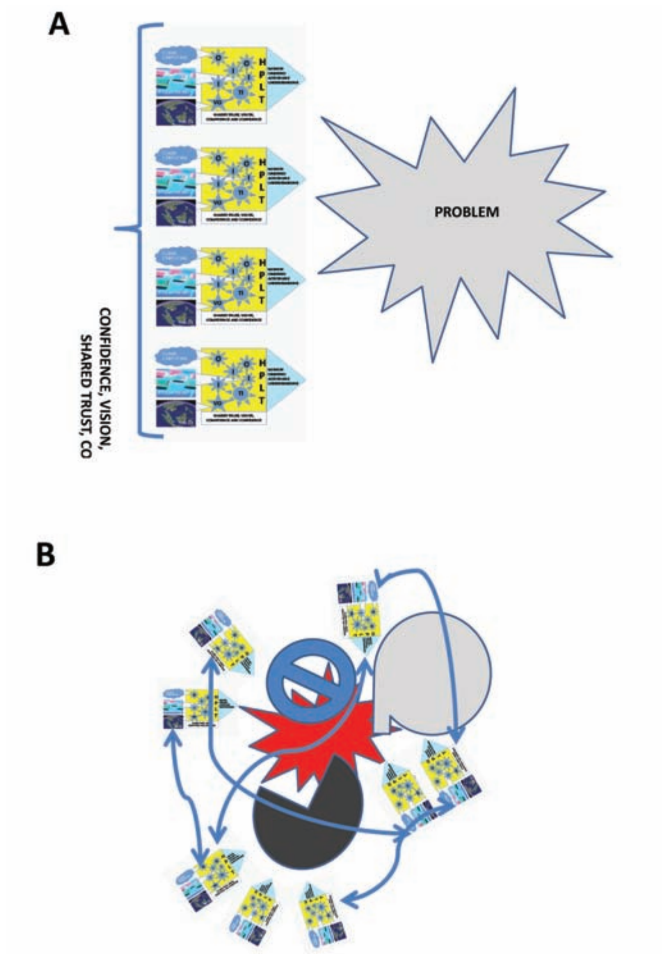

fosters further growth of mutual confidence and trust among members of leader teams.

The transforming process has chain-reaction characteristics: professional and social relationships based on universal trust and confidence expand rapidly and freely, and lead to the emergence of Teams of Leaders (Bradford and Brown, 2008; see also Lipnack et al., in press). Individuals and groups who have been physically and/or organizationally isolated convert into "swarms" and converge whenever needed based on the exact match to the requirements of the task and mission at hand (Fig. 4). Such swarms are essential when addressing problems affecting performance at the "Domain of Domains" complexity level, and the activities of Teams of Leaders have been shown to restore coherence to disorganized multi-organizational efforts (Brown 2008a; Bradford and Brown, 2008), and help in aligning them with the underlying strategies. Indeed, ToL reached the level of maturity and broad utility that its implementation and applications manual has been developed and disseminated by the US Army (Lipnack et al., 2009).

## TOL AND THE SYNTHESIS OF ACTIONABLE INTELLIGENCE AND ACTIONABLE KNOWLEDGE

Throughout the course of transition from HPLT to ToL a less tangible but critical advantage emerges:

*Figure 4. Among the principal attributes of ToL interactions is task/mission-centered swarming. Simple, intra-domain tasks can be addressed by relatively small swarms representing relatively narrow range of often highly specialized expertise and knowledge (A). Very complex missions performed in domain of domain" environments (B) may require several HPLT "swarms" addressing individual sub-components or component-aggregates of the overall mission. Nonetheless, individual swarms cooperate very closely, coordinate their actions, and share information, knowledge, and results (bidirectional arrows). This type of interactions, possible only in ToL environments maximizes efficiency, maximizes strength and utility of effort, and increases operational OODA Loop revolution speed. Overall, strategic goals are attained through collaborative rather than confrontational means, and the entire process is both faster and less resource demanding*




people who previously had no knowledge of each other, who might have been separated by distance, institutional or specialty barriers begin to rapidly form a network of close social relationships.

Consequently, the development of collaborative spirit that often characterizes interactions between local actors can now emerge among groups of actors residing on different continents. The collaboration-building attribute of ToL is further strengthened by the fact that teams can change their status from informal to formal depending on circumstances. Also, because of the intensity of the existing interactions, team members cooperate as readily and effectively in distributed environments as when the contact is based either on the mix of physical and distributed, or direct interactions.

ToL based activities enhance both the external reach and tempo of action. It is important to stress that the enhancement is made possible due to significantly improved intelligence gathering which, in ToL environments transcend classical concepts of business intelligence. The largely multidisciplinary nature of HPLT permits gathering of intelligence data in a wide variety of forms and from a wide variety of sources (Brown, 2009a,b; Bradford and Brown, 2008), while close collaboration among HPLT members converts individual, domain-centered data streams into *intelligence-based operational picture*. The latter has two major functions: it helps in selecting the elements constituting *actionable intelligence* that leads to immediate organizational response, and as the predictor of the forthcoming needs to modify the accepted strategy to better suit and respond to the forthcoming changes within the operational environment. During the latter process actionable knowledge is rapidly generated. Altogether, the outcomes of network-centric activities that might have been shared between two isolated but professionally related groups (von Lubitz, 2009) are transformed through ToL-based interaction into a broad based "*actionable understanding*" which unifies several groups (Bradford and Brown, 2008).

Actionable understanding constitutes the most essential prerogative for operational efficiency in the environments of uncertainty and rapid, unpredictable change (Bradford and Brown, 2008) seen in complex, multi-entity business operations conducted in the environment of uncertain political and economical influences. Circumstantial evidence clearly indicates that the lack of such understanding may be among the chief sources of errors (Mittelstaedt, 2005).

## TOL AND SYNTHESIS AND DISSEMINATION OF MULTIDISCIPLINARY KNOWLEDGE

The process of globalization transformed relatively straightforward business operations into the new realm of "domain of domains." It is intensely complex, involves disciplines that, until recently, seemed to be entirely alien to commercial activities (e.g., military operations, nation building, global healthcare, etc.). Modern business conducted on the worldwide scale represents probably the only arena outside military operations where success of missions (particularly when conducted on a national, international, or global scale) *demands* extraordinarily close cooperation of vast numbers of individuals, agencies, and nations.

Implementation of ToL practices in business will unquestionably have major impact (Table 1) due to the nature in which information and knowledge are gathered, handled, and disseminated. At peer-to-peer level, ToL promotes lateral spread and sharing of information and knowledge to the audiences greatly extending beyond one's own professional specialty. Likewise, ToL supports *downward* migration of knowledge from more experienced/senior professionals within teams to the more junior ones. The direct advantage of such spread is the enhancement of *distributed* socialization *across unrelated but mutually relevant intra and inter-domain professional specialties.* In similarity to *within-profession* trends, on-line communities of practice will form. However, ToL promotes and consolidates from the outset the *interdisciplinary and trans-domain communities* of practice rather than narrow, domain-restricted ones. Cumulatively, ToL offers the most fertile ground for innovation, lateral and vertical dissemination of knowledge, and the dissemination and development of evidence-based practices. All of these are of utmost importance for business in Globalization 3.0 environment: changed relationships that this stage introduced demands major change of practices and substitution of the

*Table 1. Impact of tol-based activities (after von Lubitz, 2009)*

| TYPE | IMPACT |
|---|---|
| **OPERATIONS** | Generates actionable understanding<br>Supports strategy development<br>Promotes mission definition<br>Promotes actor cooperation and collaboration across disciplines and domains<br>Speeds OODA Loop cycles<br>Increases OODA Loop operational space and reach<br>Promotes extraction and analysis of mission-relevant intelligence<br>Promotes generation of alternative approaches (“workarounds”)<br>Serves as force multiplier<br>Maximizes mission support through the employment of shared skills, knowledge and attitudes |
| **RESOURCES** | Promotes strategy-relevant resource assembly<br>Promotes mission-centered, parallel use of intellectual and material resources<br>Maximizes optimal resource exploitation<br>Utilizes legacy and future IT/IM/KM platforms<br>Maximizes resource deployment speed<br>Promotes mission-relevant resource concentration<br>Maximizes utilization of platform-independent CT/IT/IM/KM resources |
| **ORGANIZATION** | Promotes creation of collaborative actor grids<br>Promotes ad hoc creation of collaborative virtual organizations and communities pf practice<br>Maximizes mission-centered utilization of actionable information and actionable knowledge<br>Supports hierarchical and peer-to-peer interaction<br>Maximizes information and knowledge sharing among all actors of the mission grid<br>Generates bottom-up actionable knowledge generation and top-bottom actionable information flows<br>Promotes interdisiciplinary and interdomain information and knowledge distribution and use |
| **SOCIAL** | Maximizes generation of trust and understanding among all actors<br>Enhances mentoring<br>Maximizes personal contacts<br>Enhances personal knowledge and competence beyond boundaries of own discipline/specialization (promotes “generalist” education)<br>Maximizes development of shared skills, knowledge, and attitudes |

rigid top-down methods by the ultra-agile and dynamic bottom-up generated advances.

## “FORCE MULTIPLIER” ROLE OF TOL

At present, there is a clearly perceptible absence of a clearly defined “global strategy” and foresight among the Western nations mirrored in the failure to incorporate into the future plans anything beyond the most obvious. The inability of the West to detect, analyze, and counteract the growing dissatisfaction with its policies is among the principal causes underlying the explosive emergence of anti-Western sentiment, religious extremism, and – ultimately – international terrorism as the sole means available to the populations of the “gap” to attain emotional if not economical “parity” with the developed countries.

In turn, the political destabilization that typically accompanies these extreme forms of protest weakens the economies in the underdeveloped regions, promotes escalation of poverty, and leads to an even greater decline of their already meager (or practically nonexistent) economies. Consequently, despite substantial funds provided by the multinational Western sources, most attempts to establish comprehensive solutions to the problems of the developing and underdeveloped world continue to fail.

ToL may change all that. It brings to the forefront the fact that technology, no matter how powerful it might be, serves nothing but the solution of "tactical" tasks whether simple or unimaginably complex. Processes (such as IM and KM) or their combination (network-centric operations) lead to the formulation and operational implementation of actionable knowledge, in typically very task specific (i.e., narrow) context. By bringing together people able to maximally exploit their mutual talents and expertise, able to efficiently implement technology and technology-based processes, and by rooting their activities in the *maximum, platform-independent use of all tools and methods and processes offered by ITC*, ToL permits to develop the *strategy* which serves as the guide and rationale of all subsequent operations (Fig. 5).

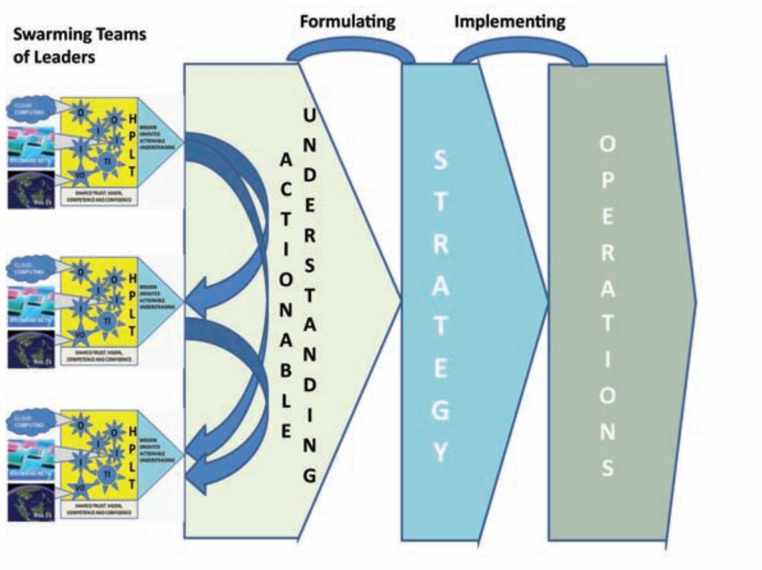
Such strategy cannot be devised by even the most intense application of either technology or processes alone. ToL provides the needed catalyst and *force multiplier*. It is in that context that ToL, contrary to "within the profession" approaches, supports the development of both evidence-based methods and of best practices among a much wider range of professionals, disciplines and agencies at a scale that has not been possible previously. The new "rules of engagement" that the jointly created best practices represent are among the major beneficial "side effects" of ToL implementation (Bradford and Brown, 2008).

Most importantly, however, ToL brings people to the forefront: it facilitates generation of locally appropriate solutions by the "people on the ground." It transforms grand but unrealistic international schemes into a coordinated "bottom-up" effort whose ground effect becomes measurable, lasting, and aligned with the overall strategy devised on the basis of vertical inputs generated within the realm of ToL operations. All that relates directly to the manner in which e-tools, methods, and processes are used in the operational environment of ToL-based business operations: ToL transforms advanced technology from a Ferrari accessible only to a few into a hammer available to all.

## TOL AS THE PLATFORM FOR THE DEVELOPMENT OF FLEXIBLE STRATEGIES

In the ToL environment, results are generated *at the practitioner level* rather than at the level of executive policies (von Lubitz and Beakley, 2009). What emerges is the *bottom-up* spread of knowledge developed through *consensus of practitioners supported by joint practical experience* and acceptable by the business communities, consumers, and regulatory bodies far more willingly than directives descending from the executive level of corporate headquarters or the governmental and international bureaucracies. Once thoroughly analyzed and tested within "communities of actors" (i.e., producers of goods and services, their distributors, and the consumers), the generated best practices can be converted via hierarchical process into a flexible and practical strategies with clear and attainable objectives. Endowed with these attributes, such strategies are readily acceptable and understandable to all involved actors at the horizontal and hierarchical levels of administration and operations. Moreover, the continuous up-down-lateral interactions keep will keep the strategy attuned to changes in the operational environment; knowledge ceases to be confined to the vertical and often entirely separated channels of profession and bureaucracy but spreads laterally and the strategy becomes actionable rather than bureaucratic (von Lubitz, 2009).

*Figure 5. Operations of teams of leaders. Individual, multi-, inter-, and trans-disciplinary HPLTs join into mission-oriented "swarms." Their intense interactions both within and among individual HPLTs generate mutually shared actionable understanding. Through vertical bottom-up spread, actionable understanding assists in formulating a coherent strategy. The latter is then implemented as precise, focused ("effect-oriented"), and simultaneous operations. Actionable understanding is critical for the development of strategy-based, coherent operations conducted in "domain of domains" environments such as global range business activities. While for some of these operations actionable knowledge may be sufficient, increasing environmental complexity and the number of the participating actors shifts the balance toward ToL-based solutions and enhances the demand for actionable understanding prior to operational execution of the intended missions (after von Lubitz, 2009)*




By promoting mutual trust, ToL furthers rapid development and coalescence of shared attitudes among all actors. It is a process of critical significance in international and multinational operations in any arena, be it civilian or military (Bradfford and Brown, 2008, Brown, 2008a, Smith, 2007). It has been said that, in the context of globalization, mutual trust has eroded since the policies of the developed nations are rooted within their mono-cultural, ethno-centric concepts, and the remedies proposed by the rich may therefore be both beyond the reach and without any relevance to the present and future problems of the poor (e.g., Sachs, 2005). ToL not only allows for fully empowered inclusion and interaction of all affected groups – in order to be effective, the concept of ToL *demands* such inclusion since only then can problems be addressed effectively and efficiently. By its very nature, ToL makes global business into the business of the people of the globe.

## WHY TOL?

It would be exceedingly naïve to expect that consequent implementation ToL practices will offer a dilemma-solving panacea for the global business. Nonetheless, in the realm of complex, modern business operations it may provide the launch-pad for the needed remedies. ToL is endowed with a number of distinct and unique advantages. First of all, the essential physical constituents already exist: computational methods based on grid- and cloud computing begin to impact the realm of near-real time data analysis, high-speed Internet access rapidly transforms from a Western luxury to high-speed Internet the popularly available global tool, wireless communications networks increase their reach and presence, while Web 2.0 offers increasingly wider range of tools and platforms. Intuitively applied, the ToL concept serves as the foundation of modern practice in national and global medicine and biomedical sciences (von Lubitz, 2009a,b). It is also a pre-eminently suitable tool in the development of disaster preparedness centered on mitigation of catastrophic incidents in which close collaboration among national and international agencies is required (von Lubitz et al., 2008). Most importantly, however, ToL is implemented with a remarkable success in solving extremely difficult challenges of international cooperation and collaboration by the US European Command (EUCOM) as part of its extensive interaction with the civilian authorities of several European and non-European countries (Bradford and Brown, 2008). Thus, the "lessons learned" can be readily adopted into a broad range of purely civilian environments and activities and in order to facilitate rapid dissemination of the concept into the widest practical implementation, EUCOM published recently a "rapid implementation manual" of ToL which allows users operating in practically any field to rapidly implement ToL-based operations at essentially no cost, and based on the already existing IT and personnel resources (EUCOM, 2008).

In conclusion, one aspect of ToL must be forcefully underlined: ToL unifies continuously disconnected fields of business, social responsibility, environmental protection, and global security and stability, and, for the first time, a concept has been crated that fosters rapid development of actionable understanding rather than actionable knowledge. As argued in the preceding sections, it is actionable understanding rather than actionable knowledge which serves as the prerequisite and the *essential* prelude to creating a solid foundation for the development of the very badly needed collaboration and cooperation among all involved actors on the global business stage. Without such understanding, all efforts to relieve the mounting pressures of conflicting demands, inequities, and deficiencies will ultimately fail. The signs of the approaching collapse are clearly visible already, and the currently favored erratic application of ever larger amounts of money or increasingly complex, technology-based solutions to avert the inevitable is, has been condemned by many leading businessmen and economists of the world as utterly inadequate. ToL does not represent a "paradigm shift" but a conceptual mutagenesis necessary if the increasingly more difficult and polarizing problems of the contemporary world are to be addressed successfully.

## REFERENCES


Bradford, Z. B., & Brown, F. J. (2008). *America's Army: A Model for Interagency Effectiveness*. Westport, CN: Praeger Security International.

Brown, F. J. (2002, September-October). Imperatives for tomorrow. *Military Review*, 81–91.

Brown, F.J. (2008a). *Institutionalizing EUR ToL.* Unpublished working document.

Brown, F.J. (2008b). *Designing of ToL pilots*. Unpublished working document.

Canton, J. (2006). *The Extreme Future*. New York: Dutton/Penguin.

Chancellor, E. (2000). *Devil Take the Hindmost: A History of Financial Speculation*. New York: Plume Books.

Chang, W. (2008). *Network-centric Service Oriented Enterprise*. Dordrecht, Netherlands: Springer.

Ebenhart, M. (2003). *Why Things Fail*. New York: Three Rivers Press.

EUCOM (US Army European Command). (2009). *EUCOM Teams of Leaders Coaching Guide, Vs. 1.0*. Stuttgart, Germany: European Command.

Evans, P., & Wurster, T. S. (2000). *Blown to Bits*. Cambridge, MA: Harvard Business School Press.

Greenwald, B., & Kahn, J. (2005). *Competition Demystified.* New York: Portfolio/Penguin.

Haas, R. N. (2005). *The Opportunit*y. New York: Public Affairs.

Holm, H. H., & Sorensen, G. (Eds.). (1995). *Whose World Order? Uneven Globalization and the End of the Cold War*. Boulder, CO: Westview Press.

Kim, W. C., & Mauborgne, R. (2005). *Blue Ocean Strategy.* Cambridge, MA: Harvard Business School Press.

Kuhn, T. S. (1970). *The Structure of Scientific Revolutions*. Chicago, IL: University of Chicago Press.

Lipnack, J., Stamps, J., Prevou, M., & Hannah, M. (2009). *Teams of Leaders Handbook*. Battle Command Knowledge System Combined Arms Center – Knowledge, Fort Leavenworth, KS.

Mandelbrot, B., & Hudson, R. L. (2004). *The (Mis) Behavior of Markets.* New York: Basic Books.

Mittlestaedt, R. E., Jr. (2005). *Will Your Next Mistake Be Fatal?* Upper Saddle River, NJ: Wharton School Publishing.

Prahalad, C. K., & Ramaswamy, V. (2004). *The Future of Competition*. Boston, MA: Harvard Business School Press.

Rifkin, J. (2001). *The Age of Access*. New York: Tarcher/Putnam.

Sachs, J. D. (2005). *The End of Poverty*. New York: Penguin.

Senge, P. M. (1994). *The Fifth Discipline*. New York: Currency (Doubleday).

Smith, P. (2007). *The Utility of Force: The Art of War in the Modern World*. New York: Knopf.

Steingart, G. (2008). *The War for Wealth*. New York: McGraw-Hill.

Stiglitz, J. E. (2003). *The Roaring Nineties*. New York: Norton & Co.

Taleb, N. N. (2007). *The Black Swan*. New York: Random House.

von Lubitz, D. K. J. E. (2009a). The Teams of Leaders (ToL) concept: the grid, the mesh, and the people in the world of information and knowledge-based global healthcare. In E. Kladiashvili (Ed.), *Grid Technologies for e-Health: Applications for Telemedicine Services and Delivery*. Hershey, PA: IGI Press.

von Lubitz, D. K. J. E. (2009b). Healthcare among the people: Teams of Leaders concept (ToL) and the world of technology-oriented global healthcare. In S. Kabene (Ed.), *Healthcare and the Effect of Technology: Developments, Challenges and Advancements*. Hershey, PA: IGI Press.

von Lubitz, D. K. J. E. (2009c). "Teams of Leaders" concept in homeland security and disaster management operations. *J. Homeland Sec. Disaster Manag., 1466.*

von Lubitz, D. K. J. E., Beakley, E., & Patricelli, F. (2008). Disaster Management: The Structure, Function, and Significance of Network-Centric Operations. *Journal of Homeland Security and Emergency Management, 1/1*(5). Retrieved from http://www.bepress.com/jhsem/vol5/iss1/1

von Lubitz, D. K. J. E., & Wickramasinghe, N. (2006a). Networkcentric healthcare: outline of entry portal concept. *Intl. J. Electronic Business Management*, *4*(1), 16–28.

von Lubitz, D. K. J. E., & Wickramasinghe, N. (2006b). Networkcentric healthcare and bioinformatics: unified operations within three domains of knowledge. *Expert Systems with Applications*, *30*, 11–23. doi:10.1016/j.eswa.2005.09.069

Wickramasinghe, N., & von Lubitz, D. K. J. E. (2007). *Knowledge-Based Enterprise: Theories and Fundamentals*. Hershey, PA: IDEA Group Publishing.

## KEY TERMS AND DEFINITIONS

**Actionable Knowledge:** knowledge which is necessary for and required to initiate immediate response to changes in the operational environment. Hence, Actionable Knowledge includes in its fullest form both pertinent and germane forms of knowledge, the latter two providing only the supportive background. Actionable Knowledge is typically domain-restricted even if its application may affect several related domains.

**Actionable Understanding:** the state of uniform understanding of and agreement about the purpose, goal, strategy, and operational intent developed among all actors about to participate in a complex, often multidisciplinary operation performed on a very large scale within a domain-of-domains (national, international, or multinational/global) environment. Actionable Understanding is the most critical and fundamental prerequisite necessary in the development of strategy, formulation of "commander's intent" necessary for the translation of strategy into a set of actions to be executed (theater activities) in order to reach strategy-determined objective. Actionable Understanding assures maximum flexibility in the execution of strategy-determined actions, and frees individual subcomponents of the organization from command-control influences into share-collaborate-coordinate pattern of activities.

**Domain-of-Domains (Environment):** environment characterized by extreme complexity of interactions among individual often seemingly unrelated subcomponents, the latter existing as individual domains in their own right. In contrast to closely coupled systems, events in one domain may or may not affect events taking place within another constituent domain. Therefore, detection of critical events cap able of producing wide-ranging perturbations and crises is significantly more difficult, requires a much broader range of expertise and knowledge, and most often remains undetected by domain-centered human experts or automated monitoring systems (e.g., ERPs)

**High Power Leader Team:** (HPLT) a group of individuals, organizations, virtual organizations, or teams of individuals centered on devising solutions to a complex task or complex task aggregate. Members of the team can be either distributed (even globally) or partially co-located. All members posses demonstrable advanced professional skills, knowledge, and abilities (SKAs) and have been thoroughly trained in their practical use. All interactions within the team are built on mutual trust, competence, and shared vision, and most are conducted using the entire range of the available IT platforms and means of data/information/knowledge exchange. Rapidly developing trust promotes intensification of sharing necessary to develop broad-based solutions to the task at hand. HPLTs can be formal (created within the organization to address a specific task), informal (devoted to addressing general issues affecting the field or domain), permanent or ad hoc.

**Network-Centric Operations:** operations based on the maximum use of multi-layered data/information/knowledge networks (mesh of networks) that facilitate command and control of all activities. Originally devised as the means to decentralize the two latter functions, it evolved into a hierarchical up-down command approach that allows the executive levels full and instantaneous access to ground level information. Consequently, in current implementation, network-centric activities serve as a "peek over the shoulder" approach.

**Teams of Leaders (ToL):** HPLT groups united on addressing a common task within a domain-of domains environment. ToL interactions are based on the foundation of shared actionable understanding, trust, and vision. HPLTs within ToL environment can either act in full concert or aggregate as "just-in-time" swarms devoted to the solution of specific, suddenly emerging and mission-critical tasks, then disperse to participate in other strategy-dictated activities. ToL-based exchanges are both horizontal and vertical, and are also based on the maximum platform-independent utilization of all capabilities and advantages offered by IT/IM/KM Horizontal exchanges promote development of best practices and evidence-based methods. They also provide real-time upgrades to the state of actionable knowledge and significantly elevate the range and pertinence of intelligence gathering processes. Vertical interactions channel best practices, evidence-based methods, and newly generated actionable knowledge and high quality intelligence information needed to retain organizational agility, and strategic adaptability to sudden and unpredicted changes within the operational environment. ToL interactions are free from influences of organizational hierarchies, influence of rank or status of participants, and assure maximum freedom of content exchange and analysis.

**Theater of Operations:** The entire complex of people, processes, technologies, and methods involved in specific set(-s) of activities within a specific geographic/political realm and including both own resources, resources of allied organizations and entities, and those of the opposition. In order to have full utility, all actions executed within the theatre of operations need to have roots in a coherent strategy, be executed in a manner that promotes reaching strategy-determined objective(-s), and the execution of such actions must be characterized by coherence and cohesion. Actions performed within the theater of operations have strategic impact but are often executed as tactical events, i.e., activities affecting only a small segment of the major activity (e.g., construction of a new air/sea container terminals at strategic locations represents coherently conducted tactical action in the strategic effort to simplify transoceanic supply chain linking several collaborating and closely coupled entities).

# Chapter 49
# Customer Relationship Management (CRM): A Dichotomy of Online and Offline Activities

**Kelley O'Reilly**
*Utah State University, USA*

**David Paper**
*Utah State University, USA*

## ABSTRACT

*By establishing the position that electronic customer relationship management (eCRM) is a form of CRM, this chapter sets out to aid the reader in understanding why CRM and eCRM initiatives are both promising and challenging. By exposing the reader to common CRM literature, the chapter documents how companies can determine the best blended approach to CRM initiatives that balance both online and offline marketing initiatives. Additionally, by considering that each unique customer touch point represents a key market strategy decision, companies can thoughtfully, and with strategic intent, design, develop, and ultimately deploy systems that effectively balance human and computer interaction. By following the suggested guidelines provided for optimizing strategic marketing decisions, companies are more likely to avoid the common pitfalls and barriers to success that have been experienced by others as documented in the literature.*

## INTRODUCTION

This chapter centers on the dichotomy (online v. offline) of customer relationship management (CRM). Specifically, we explore the challenges and opportunities that a CRM strategy can have for an organization. This article addresses (1) the importance of CRM and electronic CRM initiatives for enhancing customer relationships with the firm, (2) the challenges of CRM and eCRM, (3) how each key customer 'touch point' represents a marketing strategy decision for companies, and (4) how a blended approach to CRM will yield the best results in most cases.

DOI: 10.4018/978-1-61520-611-7.ch049

## BACKGROUND

The practice of marketing to new as well as existing customers to enhance the relationship between company and consumer has become commonplace. This phenomenon, called relationship marketing (RM), is particularly salient for services marketing because of "the maturing of services marketing with the emphasis on quality, increased recognition of potential benefits for the firm and the customer, and technological advances" (Berry, 1995, p. 236). This RM practice is commonly referred to as customer relationship management (CRM). Today, CRM is rarely discussed without the additive construct of an Internet-oriented business model relying on e-business technologies with which to interact, communicate, and exchange information with customers and/or suppliers.

### The Importance of CRM and eCRM Initiatives

In 2004, The American Marketing Association (AMA) changed its definition of marketing to "Marketing is an organizational function and a set of processes for creating, communicating, and delivering value to customers and for managing customer *relationships* in ways that benefit the organization and its stakeholders" (AMA, 2008). Since that time, the concept of RM has become accepted as a more modern view of marketing (Harker & Egan, 2006). Many marketing researchers proclaim that customers can no longer be viewed as being in endless supply and passive in regard to decision making – no longer can we take a 'one size fits all' approach to the simple manipulation of McCarthy's (1960) 4Ps: Product, Price, Place and Promotion, as has been the case for decades using a transactional approach to marketing.

### Issues, Controversies, and Problems

While electronic customer relationship management (eCRM) is considered by many to hold even greater promise for business due to its digital foundation that enables greater data mining potential, it has yet to consistently deliver on its promise of facilitating better understanding of customer behavior (Adamson, Jones & Tapp, 2005; Bentum & Stone, 2005; Chen & Chen, 2004; Fjermestad & Romano, 2003; Jang, Hu & Bai, 2006; Li, Browne & Wetherbe, 2007; Lin & Huang, 2007). However, even with challenges, eCRM continues to be viewed as a "core element of enterprise competitive strategy" (Forrester Research, Inc., 2008, p. 5). According to Forrester Research, Inc. (2008) worldwide spending on CRM is expected to exceed $11 billion by 2010; almost double the spending level of 2003.

The eCRM challenge, as well as the promise, is interesting and perplexing. Many pundits cite an historic optimism and hope for the marketing 'silver bullet' as a key reason for the many eCRM failures. Meaning, many companies embraced eCRM without diligent and thoughtful strategic intent and planning. From these failures came a natural and cautious view of eCRM by many that had either previously dallied in the technology or considered doing so.

Although eCRM research is prolific, there appears to be a lack of consistent understanding and agreement as to the operationalization of the term eCRM. To complicate matters, in some instances, eCRM is differentiated as either analytical or operational (Fjermestad & Romano, 2003; Swift, 2002). Analytical eCRM focuses on the collection and analysis of customer data, while operational eCRM focuses on all customer touch points throughout a transaction. With CRM defined as the orientation of the company that involves direct customer interaction as well as the data and its uses for enhancing customer relations, it is appropriate to define eCRM as *the e-Business initiatives of a firm concerned with attracting, maintaining, and* *enhancing the relationship between the firm and the customers it serves*.

## BEST PRACTICES FOR MAXIMIZING CRM IMPLEMENTATIONS

While there is a great body of research on both CRM and eCRM, the literature can generally be classified into a few strands focusing on strategies for success including, (1) the need to develop and nurture trust and loyalty, (2) the importance of leadership and strategy, and (3) systems integration and data issues. Each of these will be discussed in more detail below.

### The Need to Develop and Nurture Trust and Loyalty

The value of nurturing and developing a relationship between a firm and its customers is well understood in the business world. At the center of such a relationship is trust. Specifically, in an effort to encourage repeat purchases, capture a greater share of 'wallet' (customer wealth) and improve the likelihood of referrals, many have recognized the role that trust must play (Bart, Shankar, Sultan & Urban, 2005; Chau, Hu, Lee, & Au, 2006; Kim & Tadisina, 2007; Porter & Donthu, 2008; Walczuch & Lundgren, 2004; Wang & Emurian, 2005). Fostering a relationship that will ultimately create trust between parties is both intuitive and logical. However, the direct links from *relationship → trust → repeat purchase intention → loyalty* have been difficult to demonstrate empirically. As a relevant example, while it is generally recognized that a relationship of trust (versus a relationship without trust) is more likely to result in a customer recommending a firm to their friends and family and to encourage repeat purchases, some findings show that recommendation intention alone is not a good predictor of a customers' future loyalty (Keiningham, Cooil, Aksoy, Andreassen & Weiner, 2007).

### Leadership and Strategy

From the literature, leadership is identified as a critical success factor for successful CRM implementation. In a study by Chen and Chen (2004), the researchers identify the need for initial management support as well as ongoing management leadership as demonstrated by consistent organizational commitment. Additional research considers the use of incentives and training as key factors for combating resistance from associates and managers who will be users of the CRM system or tool (Fjermestad and Romano, 2003).

Strategic planning is also critical for CRM success. Without a sound business strategy that links directly to the expected outcomes of CRM, CRM systems and tools are unlikely to succeed. Strategic elements such as customer related benefits, the consolidation of customer information, and improved response times are examples that must be carefully planned and designed (Lin and Huang, 2007). Likewise, organizations with an existing culture of excellent customer care as demonstrated by service consciousness, a customer-centric organization, and customer-focused strategies are more likely to experience CRM success.

### Systems Integration and Data

Systems integration and the alignment between business and information technology (IT) is another success factor prevalent in the literature. The failure to achieve this alignment is one of the most cited reasons for CRM failure. For instance, consideration for where data resides, the number of systems required for integration, the usability of, and resistance to, the system by users, and the expected outcomes and system functionality are commonly overlooked (Chen and Chen, 2004; Fjermestad and Romano, 2003; Lin and Huang; Padmanabhan and Tuzhilin, 2003).

While 'tight' system integration is important, a technology's ability to be flexible (Szmigin, Canning & Reppel, 2005) is also needed. Such flexibility allows the system to adapt to customer data and trends, and ultimately delivers the ability to personalize marketing information to customers. However, developing fully integrated systems is difficult. Understanding this, it is important to "continually measure and model customer sales, satisfaction, and value, both in terms of absolute figures and trends" (Cuthbertson and Bridson, 2006, p. 293) to ensure the system integrates with as well as improves the business.

The power of CRM tools lies in the application of data *and* knowledge. For instance, the power is not found in the simple collection or mining of data, but rather in the means and methods by which the data is analyzed and applied to improve customer relationships. Therefore, knowing what to collect, how to collect it, and subsequently understanding how to use data is critical. This power is often created through a balance between human and computer interaction (Chen, Chen & Kazman, 2007).

## Customer 'Touch Points' as Determinants of Marketing Strategy

What is clear in the literature is that often, eCRM and CRM are viewed as two separate initiatives within companies. That is, IT often leads eCRM innovation, while Marketing leads CRM innovation. However, such a silo-based approach is sub-optimal and fails to consider that eCRM is simply a *form* of CRM, and as such, all elements related to CRM (whether electronic or not) should be contemplated holistically and inclusively.

Since the goal of CRM is to add value, CRM innovation should be a priority. However, adding value to a business should be process-based rather than silo-based so it is interesting that IT and Marketing tend to work in isolation when innovating in this realm. The determining factor of CRM and eCRM is after all always how we can better serve the customer, not whether the customer is served on or offline. Meaning, customer 'touch points' can be managed either online or offline and each determination for what is and is not online, represents a distinct decision related to a firm's marketing strategy. For example, in the case of a carpet cleaning company, a customer could schedule the varying services online, over the phone, or face-to-face from an in-home service technician. Therefore, the idea of eCRM being anything other than complementary to CRM initiatives (versus a replacement) is not warranted. To provide a better understanding of this idea, we introduce Table One. This table illustrates the common 'stages' of customer interaction with a firm and some of the typical 'touch points' that companies can utilize as part of their strategic decision making.

For instance, when contemplating how the firm can interact during the 'follow-up & on-going communications' stage with a customer, the firm can consider the various on and offline means with which to interact. Choosing the 'right' balance is best determined by seeking guidance from customers and then measuring the outcomes of those decisions.

For many organizations, these choices create a battle of the 'old offline ways' vs. the 'new online ways' and represent the struggle organizations face to find the appropriate balance between offline and online activities. Keep in mind that the struggle is internal. That is, the customer just wants to receive excellent service and believes that he/she should be able to choose at will whether such service is online or offline. Balancing a company's traditional offline RM strategies with the emerging, complementary, and inclusive strategy of e-enabled CRM should provide a reasonable *blended* approach (Chen et al., 2007). By blending both offline and online CRM activities, organizations are more likely to resonate with more customers simply by being flexible and responsive to a customer's preferred channel for interaction and communication.

## A Blended Model of Success

The balance between offline and online activities must be navigated carefully. Consistent with Chen

*Table 1. Key customer touch points and the dichotomy of online v. offline*

| Typical Firm/Customer ‘Touch Points’ | Common Examples of Online (eCRM) | Common Examples of Offline (CRM) |
|---|---|---|
| **ATTRACTING**<br>The initial interactions between customer and firm to attract the customer to a specific product or firm. | • Company website adequately optimized for search engines.<br>• e-marketing such as banner ads online. | • Multi-media and broadcast such as TV, radio, direct mail advertising, etc.<br>• Personal selling such as outbound “cold calling” or door-to-door selling.<br>• Neighborhood activities such as school contests and sponsorships.<br>• Tradeshows & Fairs<br>• Customer incentives for referring additional customers to company. |
| **BROWSING**<br>The interactions between customer and firm during browsing when a customer is evaluating the degree to which a firm’s product or service offerings meet customer needs. | • Company website<br>• Robust search engine on company website for customer use.<br>• Personalized web preferences offered on company website for customers after they have “registered” and defined their profile.<br>• Instant messaging “live chat” with service reps via company website.<br>• Product recommendations on company website via Recommendation Agents (RAs), product popularity based on “best sellers”, etc. | • Brick and mortar traditional retail store formats.<br>• Direct marketing such as direct mail catalogs.<br>• Product and service displays, merchandising, and signage in store. |
| **ORDERING**<br>The interactions between customer and firm after a customer has selected product and wants to place order. | • Via company website<br>• Shopping cart functionality on company website.<br>• Online booking for services and appointments. | • Customer service phone rep for ordering over the phone.<br>• Retail Store clerk.<br>• Door-to-door salesperson. |
| **PAYING**<br>The interactions between customer and firm to execute the actual transaction. | • Online payment and confirmation via the company website. | • In-store<br>• In-person (in home service)<br>• By phone<br>• By fax<br>• By mail |
| **SHIPPING/DELIVERY**<br>The interactions between customer and firm that occur after payment and up to point of customer taking possession of goods or services. | • Online tracking and integration between website and delivery agent.<br>• Email confirmation of purchase and shipping details. | • In-store pick-up (typically at time of payment).<br>• Service performed in home (e.g. carpet cleaning). |
| **RETURNS**<br>The interactions between customer and firm to execute a product return, exchange, or request for service to be re-done due to customer satisfaction reasons. | • Online return authorization via the company website.<br>• Online tracking and integration between website and delivery agent via the company website. | • Return via mail service.<br>• Return initiated over the phone via company representative.<br>• In-store returns, exchanges, or re-service.<br>• Call-back for service re-do at customer’s home. |
| **FOLLOW-UP & ONGOING COMMUNICATIONS**<br>The interaction between customer and firm after transaction is complete to encourage next purchase or other customer referrals. | • Email marketing messages<br>• Customer-Company Blogs<br>• Social networks<br>• Twitters<br>• Mobile texting<br>• Website promos and offers | • Personal visit<br>• Follow-up phone call<br>• Thank you letter<br>• Direct mail marketing<br>• Phone solicitation |

et al. (2007), we adopt the view that eCRM value is gained through a *blended* approach to global CRM activities. Therefore, it is recommended to consider the first contact with customers as the ‘signal’ for future contacts. That is, customers who initiate the relationship via the phone or face-to-face remain offline customers, and those who initiate the relationship via online means, remain as online customers. Of course, companies should remain flexible in offering offline customers online access, and online customers offline access - fundamentally, customer preference must be honored to balance the need for human and computer interaction (Sheth and Parvatiyar, 1995).

## Guidelines for Determining a CRM Marketing Strategy

To aid companies in determining how to navigate their own unique 'blend' of online and offline CRM initiatives, we offer the following strategic questions and guidelines for management consideration:

### Understand Your Own Bias for Online v. Offline Programs.

Commonly senior management determines strategic corporate direction. While this is not inherently problematic, consideration must be given to the decision-makers own characteristics and biases. For instance, managers in their 40s or 50s may not appreciate the value of mobile marketing or new social networking e-marketing developments. Therefore, leaders should understand their own biases and invite the views of customers and/or employees so that a wide range of consumer types provide feedback regarding how best to interact with customers.

### Can Company Systems Fully Integrate Online and Offline Activities?

If the computer systems of a firm are unable to effectively integrate with all customer-facing initiatives (whether online or offline), priority should be to upgrade the system to make integration possible. Without a fully-integrated system, CRM and eCRM will be silo-based and unlikely to optimally deliver new and compelling value to customers.

### Is the Organizational Culture Open?

While no one culture has been identified as superior for CRM, it has been suggested that an open corporate culture will yield best results (Bentum & Stone, 2005). In closed cultures, internal employee opinions, ideas, and suggestions are stifled. As a result, creating customer-facing initiatives and optimizing customer touch points may not be considered a priority.

### What Benefits Does the Company Expect to Derive from CRM Innovation?

Unmanaged, CRM can alter the balance between building relationships with customers and creating cost savings through streamlined transactions and automated e-marketing. In essence, the power of the one-to-one relationship can easily be converted into an efficient and effective exchange between customer and the company's computer. While customers do in fact value the benefits of electronic exchange (Porter & Donthu, 2008), we believe the benefits of combining human interaction and accessibility with electronic systems outweigh a purely electronic exchange. Therefore, if the only desire for CRM rests with minimizing overhead or automating customer touch points, CRM is unlikely to deliver optimally.

### How Will the Company Measure CRM Success?

By understanding upfront how CRM innovation success will be measured, managers can thoughtfully consider if the benefits are likely to outweigh the costs. If the measure of success is simply a decrease in traditional (offline) marketing spending, how are changes in consumer interaction, response rates, referrals, or loyalty considered in a cost/benefit analysis? Reduced costs are only of value with concurrent value-added increases in customer behavior like repeat purchases, referrals, or increased job averages.

## FUTURE RESEARCH DIRECTIONS

The nature of e-Business applications, of which CRM and eCRM are a part, will continue to hold great promise as well as challenge for practitioners. Understanding the role that people, business processes, and technology play as a conduit between firm and customer is key. Therefore, we suggest that future research on CRM should be viewed from a cross-disciplinary lens that considers research from information systems, marketing, management, and psychology to name but a few. To effectively bridge this research divide requires a holistic look at the combination of people, processes, and technology as key drivers of CRM innovation and change.

## CONCLUSION

This chapter set out to provide an understanding of CRM and how eCRM is merely a *form* of CRM. By understanding this concept, companies are more likely to optimally deploy CRM programs that resonate with their customers. Additionally, by considering that each unique customer touch point represents a key market strategy decision, companies can thoughtfully, and with strategic intent, design, develop, and ultimately deploy systems that effectively balance human and computer interaction meaningfully with their customers. By following the suggested guidelines for making these strategic marketing decisions regarding the balance of online and offline CRM initiatives, companies are more likely to avoid the common pitfalls and barriers to success that have been experienced by others.

## REFERENCES


Adamson, G., Jones, W., & Tapp, A. (2005). From CRM to FRM: Applying CRM in the football industry. *Database Marketing & Customer Strategy Management*, *13*, 156–172. doi:10.1057/palgrave.dbm.3240292

AMA. (2008). *American Marketing Association Web site*. Retrieved October 23, 2008 from http://www.marketingpower.com/_layouts/Dictionary.aspx?dLetter=M

Bart, Y., Shankar, V., Sultan, F., & Urban, G. L. (2005). Are the drivers and role of online trust the same for all web sites and consumers? A large-scale exploratory empirical study. *Journal of Marketing*, *69*, 133–152. doi:10.1509/jmkg.2005.69.4.133

Bentum, R. V., & Stone, M. (2005). Customer relationship management and the impact of corporate culture – A European study. *Database Marketing & Customer Strategy Management*, *13*, 28–54. doi:10.1057/palgrave.dbm.3240277

Berry, L. L. (1995). Relationship marketing of services: Growing interest, emerging perspectives. *Journal of the Academy of Marketing Science*, *23*, 236–245. doi:10.1177/009207039502300402

Berry, L. L., & Parasuraman, A. (1991). Marketing services: Competing through quality. *The Free Press.*

Chau, P. Y. K., Hu, P. J., Lee, B. L. P., & Au, A. K. K. (2006). Examining customers trust in online vendors and their dropout decisions: An empirical study. *Electronic Commerce Research and Applications*, *6*, 171–182. doi:10.1016/j.elerap.2006.11.008

Chen, H. M., Chen, Q., & Kazman, R. (2007). The affective and cognitive impacts of perceived touch on online customers' intention to return in the Web-based eCRM environment. *Journal of Electronic Commerce in Organizations*, *5*, 69–91.

Chen, Q., & Chen, H. M. (2004). Exploring the success factors of eCRM strategies in practice. *Database Marketing & Customer Strategy Management*, *11*, 333–343. doi:10.1057/palgrave.dbm.3240232

Cuthbertson, R. W., & Bridson, K. (2006). Online retail loyalty strategies. *International Journal of Information Technology and Management*, *5*, 279–294. doi:10.1504/IJITM.2006.012042

Fjermestad, J., & Romano, N. C. Jr. (2003). Electronic customer relationship management. Revisiting the general principles of usability and resistance – an integrative implementation framework. *Business Process Management Journal*, *9*, 572–591. doi:10.1108/14637150310496695

Forrester Research, Inc. (2008). *Topic Overview: Customer Relationship Management 2008* (PDF document). Retrieved November 11, 2008, from http://www.forrester.com

Harker, M. J., & Egan, J. (2006). The past, present and future of relationship marketing. *Journal of Marketing Management*, *22*, 215–242. doi:10.1362/026725706776022326

Jang, S., Hu, C., & Bai, B. (2006). A canonical correlation analysis of e-relationship marketing and hotel financial performance. *Tourism and Hospitality Research*, *6*, 241–250. doi:10.1057/palgrave.thr.6050024

Keiningham, T. L., Cooil, B., Aksoy, L., Andreassen, T. W., & Weiner, J. (2007). The value of different customer satisfaction and loyalty metrics in predicting customer retention, recommendation, and share-of-wallet. *Managing Service Quality*, *17*, 361–384. doi:10.1108/09604520710760526

Kim, E., & Tadisina, S. (2007). A model of customers trust in e-businesses: micro-level inter-party trust formation. *Journal of Computer Information Systems*, (Fall): 88–104.

Li, D., Browne, G. J., & Wetherbe, J. C. (2007). Online consumers switching behavior: A buyer-seller relationship perspective. *Journal of Electronic Commerce in Organizations*, *5*, 30–42.

Lin, C., & Huang, Y. (2007). An integrated framework for managing eCRM evaluation process. *International Journal of Electronic Business*, *5*, 340–359. doi:10.1504/IJEB.2007.014782

McCarthy, E. J. (1960). *Basic Marketing*. Homewood, IL: Irwin.

Padmanabhan, B., & Tuzhilin, A. (2003). On the use of optimization for data mining: theoretical interactions and eCRM opportunities. *Management Science*, *49*, 1327–1343. doi:10.1287/mnsc.49.10.1327.17310

Porter, C. E., & Donthu, N. (2008). Cultivating trust and harvesting value in virtual communities. *Management Science*, *54*, 113–128. doi:10.1287/mnsc.1070.0765

Sheth, J. N., & Parvatiyar, A. (1995). Relationship marketing in consumer markets: Antecedents and consequences. *Journal of the Academy of Marketing Science*, *23*, 255–271. doi:10.1177/009207039502300405

Swift, R. (2002 February). Analytical CRM powers profitable relationships: Creating success by letting customers guide you. *Data Mining Review*.

Szmigin, I., Canning, L., & Reppel, A. E. (2005). Online community: enhancing the relationship marketing concept through customer bonding. *International Journal of Service Industry Management*, *16*, 180–196. doi:10.1108/09564230510625778

Walczuch, R., & Lundgren, H. (2004). Psychological antecedents of institution-based consumer trust in e-tailing. *Information & Management*, *42*, 159–177.

Wang, Y. D., & Emurian, H. H. (2005). An overview of online trust: Concepts, elements, and implications. *Computers in Human Behavior*, *21*, 105–125. doi:10.1016/j.chb.2003.11.008

## ADDITIONAL READING

Berry, L. L. (1983). Relationship marketing. In L. L. Berry, G. Shostack, & G. Upah (Eds.), *Emerging Perspectives on Services Marketing* (pp. 25-8). Chicago, IL: American Marketing Association.

Fink, L., Zeevi, A., & Te'eni, D. (2008). The effectiveness of online customer relations tools: Comparing the perspectives of organizations and customers. *Internet Research*, *18*, 211–228. doi:10.1108/10662240810883281

Foss, B., Stone, M., & Ekinci, Y. (2008). What makes for CRM system success – or failure? *Database Marketing & Customer Strategy Management*, *15*, 68–78. doi:10.1057/dbm.2008.5

Grönoos, C. (1994). From Marketing Mix to Relationship Marketing: Towards a paradigm shift in marketing. *Management Decision*, *32*, 4–20. doi:10.1108/00251749410054774

Jain, R., Jain, S., & Dhar, U. (2003). Measuring customer relationship management. *Journal of Service Research*, *2*, 97–109.

Kennedy, A. (2006). Electronic customer relationship management (eCRM): opportunities and challenges in a digital world. *Irish Marketing Review*, *18*, 58–68.

Kim, C., Zhao, W., & Yan, K. H. (2008). An empirical study on the integrated framework of e-CRM in online shopping: Evaluating the relationships among perceived value, satisfaction, and trust based on customers' perspectives. *Journal of Electronic Commerce in Organizations*, *6*, 1–19.

Palmatier, R. W., Dant, R. P., Grewal, D., & Evans, K. R. (2006). Factors influencing the effectiveness of relationship marketing: A meta-analysis . *Journal of Marketing*, *70*, 136–153. doi:10.1509/jmkg.70.4.136

Pitta, D., Franzak, F., & Fowler, D. (2006). A strategic approach to building online customer loyalty: integrating customer profitability tiers. *Journal of Consumer Marketing*, *23*, 421–429. doi:10.1108/07363760610712966

Ratnasingam, P. (2008). The impact of e-commerce customer relationship management in business-to-consumer e-commerce (Report). *Journal of Electronic Commerce in Organizations*, *30*(17).

Scullin, S. S., Fjermestad, J., & Romano, N. C. Jr. (2004). E-relationship marketing: changes in traditional marketing as an outcome of electronic customer relationship management. *The Journal of Enterprise Information Management*, *17*, 410–415. doi:10.1108/17410390410566698

## KEY TERMS AND DEFINITIONS

**Customer-Facing:** An orientation that relates to the proximity and strength of customer-firm interactions. A customer-facing employee is one who regularly interacts with, speaks with, or services customers.

**Customer Relationship Management (CRM):** The orientation of the company that involves direct customer interaction as well as the data and its uses for enhancing customer relations. Effective CRM is integrated across the organization and throughout functional areas of the firm.

**Customer Touch Points:** All of the various points in time that the firm and customer interact throughout the initial stages of attracting a customer to a product or service through post-sale follow-up.

**e-Business:** All aspects of the firm that can be systematized in an electronic manner to improve operations inside the firm, outside the firm with customers, and with the firm's business partners.

**Electronic Customer Relationship Management (eCRM):** The e-Business initiatives of a firm concerned with attracting, maintaining, and enhancing the relationship between the firm and the customers it serves.

**Marketing Strategy:** The overarching operational and functional programs that determine a firms' market position, communication platform, and tactical marketing initiatives with the goal of optimizing customer interactions with the firm's product and services.

**Relationship Marketing:** The practice of marketing to new as well as existing customers to enhance the relationship between company and consumer.

# Chapter 50

# Understanding E-Payment Services in Traditionally Cash-Based Economies: The Case of China

**Xiaolin Li**
*Towson University, USA*

**Dong-Qing Yao**
*Towson University, USA*

**Yanhua Liu**
*Wuhan College of Economics and Management, China*

## INTRODUCTION

Electronic payment or e-payment refers to any payment transactions conducted electronically. In narrow terms, it usually refers only to online payment. E-payment is a crucial part of e-commerce. It increases transaction speed, improves merchants' liquidity, and enhances buyers' online shopping satisfaction. E-payment also reduces transport costs, robbery, and counterfeiting of fiat cash (Panurach, 1996).

However, e-payment development in emerging economies—most of which rely heavily on cash for e-commerce transactions—has not kept up with advances in e-commerce. As a result, inefficient payment methods have become a bottleneck of further e-commerce growth.

DOI: 10.4018/978-1-61520-611-7.ch050

Over the past few years, China has witnessed phenomenal growth in e-payment. A variety of e-payment services have emerged in China. E-Payment penetration has also started to increase. As of June 2008, approximately 57 million (22.5% of) online shoppers have used e-payment services in China (CNNIC, 2008).

China's rapid e-payment development may provide ideas and lessons for the formulation of e-payment paradigms in similar economies. Despite numerous studies (Bin, Chen, & Sun, 2003; Daily & Cui, 2003; Davison, Vogel, & Harris, 2005; Hailey, 2002; Press, Foster, Wolcott, & McHenry, 2003) on China's e-commerce in general, little endeavor has been made on e-payment in China. This paper intends to fill the gap by examining a series of issues pertaining to China's e-payment services, which include China's e-payment growth, mechanisms, characteristics, opportunities and challenges.

*Table 1. E-Commerce payment methods (Source: Ciweekly, 2006)*

| E-Commerce Payment Methods | Percentage of Merchants |
|---|---|
| E-Payment | 60.2% |
| Cash upon Receipt of Goods | 39.4% |
| Postal Payment | 12.3% |
| Bank Transfer | 6% |
| Others | 2.1% |

The remainder of the paper is arranged as follows: Section 2 discusses e-payment development in China. Section 3 reports the major e-payment methods for online purchases in China. Section 4 focuses on the discussion of China's e-payment services. Section 5 analyzes the characteristics of e-payment in China. Section 6 and 7 discusses the opportunities and challenges of e-payment in China. Section 8 concludes the paper with major contribution of this study.

## E-PAYMENT DEVELOPMENT IN CHINA

China's e-payment services started in 1997 when China Merchants Bank initiated an online payment service for B2B transactions. In 1998, the bank allied with a few major stores in Beijing and Shenzhen and launched its first B2C payment service. In 1999, China Construction Bank established online banking services in Beijing, Guangzhou, Shenzhen, Chongqing, and Qingdao. Other banks soon followed by establishing their own online banking services. The development of online banking built a foundation for e-payment growth in China.

China's e-payment growth was steady but slow in the first few years. In 2001, the total annual online transaction was only 900 million Chinese Yuan. In 2004, it grew to 7.5 billion Chinese Yuan. 2005 witnessed the fastest growth—China's annual online payment transactions reached 16.l billion Chinese Yuan, a more than 100% growth over the previous year. 2005 has thus been known as "The First Year of E-Payment" in China. (Heading-Century, 2008). Today, nearly a quarter (57 million) of shoppers use some forms of e-payment services in China.

## MAJOR PAYMENT METHODS FOR ONLINE PURCHASES

Payment mechanisms for e-commerce transactions are more diversified in China than in countries with high credit card penetration. A variety of E-commerce payment methods are concurrently used in China. The most common ones include e-payment, cash upon receipt of goods, postal payment, and bank transfer (Table 1).

The majority (over 60%) of online merchants use e-payment. But a considerately large proportion of online businesses are still using traditional payment methods. In particular, nearly 40% of merchants are using "cash upon receipt of goods paradigm" — the buyer orders online, the seller physically delivers the goods to the buyer, and the buyer pays cash upon receipt of the goods.

## E-PAYMENT SERVICES

In broad sense, there are three major e-payment methods in China: online payment, mobile payment, and telephone payment (Table 2). Our discussion focuses only on the most common method—online payment, which represents over

*Table 2. Major e-payment services in China (Source: Ciweekly, 2006)*

| E-Payment Services | Percentage of Transactions |
|---|---|
| Online Payment | 80.6% |
| Mobile Payment | 9.5% |
| Telephone Payment | 7.4% |
| Others | 3.5% |

80% of China's e-payment.

*Bankcards:* ChinaPay, sponsored by China Banking Association, is a pioneer of China's bankcard-driven e-payment services. It incorporates fourteen major commercial banks and is capable of both B2B and B2C payment transactions in most cities in China. By the end of 2006, all regional cities and 865 county-level cities had joined ChinaPay network, which included 152 member banks (issuing 900 million bankcards) and 570,000 online merchants. ChinaPay's annual transactions reached 255 trillion Chinese Yuan in 2008 (ChinaPay, 2009). In addition to its services in China, ChinaPay offers services in other countries including Singapore, Thailand, and South Korea.

*Direct Online Payment:* An online payment transaction that involves only a buyer, a merchant, and a bank is referred to as "direct online payment." Figure 1 describes the following operational procedures of direct online payment:

1. The buyer and merchant open accounts with the bank.
2. The buyer places an order for goods/services and sends his/her bank account information to the merchant
3. The merchant forwards to the bank information about the buyer's bank account and charged amount.
4. The bank verifies the buyer's account information and then transfers the charged amount from the buyer's to the merchant's account.

*Indirect Online Payment*: An online payment transaction that involves a third party as well as a buyer, a merchant, and a bank is described as "third- party online payment." Figure 2 delineates the following procedures of third-party online payment:

1. The buyer and merchant register accounts with the third party.
2. The buyer places order for products/services from the merchant's website.
3. The merchant provides payment information to the third party.

*Figure 1. Direct payment procedures*

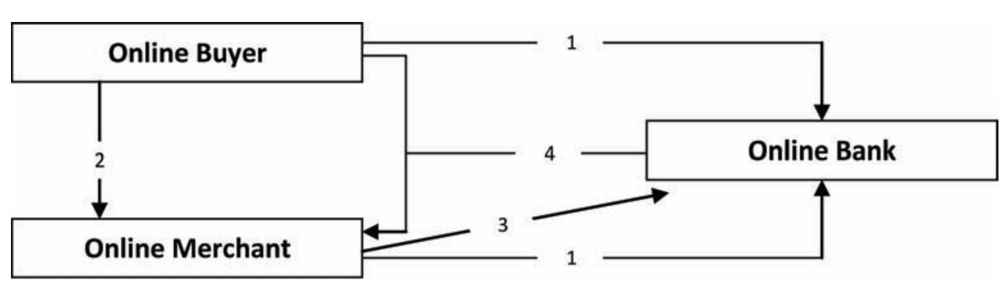
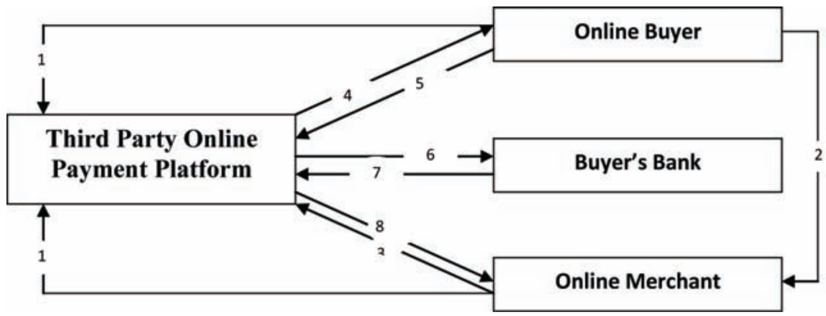


*Figure 2. Third-Party online payment*




4. The third party issues payment request to the buyer.
5. The buyer provides bank account information.
6. The third party connects to buyer's bank to request for payment.
7. Buyer's bank transfers charged amount from buyer's to the third party's bank account
8. The third party releases the money to the merchant after the buyer acknowledges receipt of purchased products/services.

Alipay, launched by Alibaba, is one of China's biggest and most successful independent third-party Internet payment platforms. It has nearly 80 million users, with a daily transaction amount of over 1.5 million and total trading volume of over 350 million Chinese Yuan (China Tech News, July 10, 2008). The latest report on China's online shopping reveals that Alipay has gained a 76.2% market share in the e-payment sector (CNNIC, 2008).

## CHARACTERISTICS OF E-PAYMENT IN CHINA

*The dominant use of debit cards:* The use of credit cards in China is believed to be riskier than in western countries. Therefore, unlike in those countries, a password is often required in China when using a credit card online. For instance, VISA and MasterCard, which have been in business in China since 2002, require online shoppers to have password-secured online shopping accounts with their banks. To avoid the risks and inconveniences of credit cards, merchants and buyers tend to prefer bankcards for their online purchases.

*Increasing role of the third-party:* Relying on creditability and a large user base, third-party online payment platforms are playing an increasing role in e-payment. Alipay, for instance, has not only played an important role in the fast growth of Alibaba's own e-commerce websites (Taobao.com and Alibaba.com), but also provided effective online payment services to other online merchants. Recently, Alipay has even started to offer online payment services for Amazon.com, a key competitor of Taobao (China Tech News, 2008).

*Alliance among banks, major merchants, and the third party*: Alliances among major banks, merchants, and the third party has been a key strategy for an e-payment service to gain credibility and user base. Alipay has established a strategic alliance with Giant Interactive, a major online gaming operator, to enhance Giant's online payment system. "Zhi Fu Bao" (Payment Treasure), a very successful third-party online payment platform, is the result of a strategic cooperation between Alibaba.com and the Industrial and Commercial Bank of China (ICBC).

## OPPORTUNITIES

China has one of the largest Internet user populations and it is still growing rapidly. Over the past three years, China's Internet users have increased from 103 million in 2005 to 253 million in 2008 (CCNIC, 2008). The increase of Internet usage has fueled the growth of e-commerce, which in turn, increases the demand for online payment. By June 2008, 22.5% of online shoppers had used some form of online payment services, which represented a 71.7% growth rate compared with December 2007 (CNNIC, 2008).

Furthermore, online bank users have increased. More than 40 million people are using online banking today (CCNIC, 2008). China also has one of the largest bankcard infrastructures with 1.4 billion bankcards, which somehow overcomes the country's lower credit card penetration problem.

The Chinese government has not merely helped improve the legal and regulatory environment for online banking and e-payment growth, but also passed laws, such as the Electronic Signature Law (Yan, 2005), to safeguard e-commerce and e-payment transactions.

## CHALLENGES

China's online payment penetration rate is still lower than western countries and the payment issue is still the single biggest bottleneck for the country's further growth of e-commerce. The following are among the major challenges China faces in e-payment development.

*Low Credit Card Penetration:* The primary reason why e-payment becomes such a big hassle in China while it is not as serious problem in western countries lies in China's lack of a reliable credit system and low credit card penetration. With a population of 1.3 billion, China has only about 40 million credit card users (Chinadaily, 2007); many of those credit cards are actually prepaid debit cards. Without a sizable and reliable credit system, China has to be more innovative in creating online payment mechanisms. The development and diffusion of such mechanisms take more time and efforts as compared with using an existing functional credit card system.

*Deficient Banking and Legacy Payment Systems:* Despite China's recent reforms in its banking systems to cater to the needs of online monetary transactions, online banking in China is still immature. By June 2008, for instance, the penetration rate of online banking in China is only about 23%, much lower than the rate of western countries like the U.S., which has a penetration rate of 53% (CNNIC, 2008). China is also deficient in legacy payment systems. Traditional monetary transaction systems such as Electronic Data Interchange (EDI) and Electronic Funds Transfer (EFT) barely exist.

*Heavy Reliance on Fiat Cash:* Despite the introduction of various online payment services, buyers' reliance on fiat cash for online purchases is still prevalent. Cash upon delivery of goods, an order online and pay cash offline paradigm is still a common payment method, constituting nearly 40% of e-payment transactions in China (figure 1). Users' trust in and reliance on fiat cash is cultural and cannot be easily changed.

*Geographical Imbalance:* Development in e-payment services across different geographical regions in China is very imbalanced. In major cities and coastal regions where Internet penetration is high, a variety of e-payment services are available, but there may be no online payment services available at all in small cities and remote areas. Many e-payment services are provided only within specific cities, or even only at specific stores.

## CONCLUSION

E-payment is one of the most critical components of e-commerce. But the development of e-payment services in most cash-based countries has not kept up with e-commerce advances, and as a result, has become a bottleneck for the further growth of e-commerce. Some innovative and practical e-payment mechanisms discussed in this study are widely accepted in China, mostly because they have successfully coped with the challenges and difficulties in online payment within China, including the country's low credit card penetration, deficient banking infrastructure, and traditional business transaction norms. Findings of this study may serve as a knowledge base and strategic foundation for e-payment services in similar economies.

## REFERENCES


Bin, Q., Chen, S., & Sun, S. Q. (2003). Cultural differences in e-commerce: a comparison between the U.S. and China. *Journal of Global Information Management*, *11*(2), 48–55.

China Tech News. (2005, March 4). Alibaba and ICBC promote online payment service. *China Tech News.* Retrieved January 11, 2009, from http://www.chinatechnews.com/2005/03/04/2555-alibaba-and-icbc-promote-online-payment-service/

China Tech News. (2008a, June 30). Rival cooperation: Alipay formally begins working with Amazon.com in China. *China Tech News.* Retrieved January 13, 2009, from http://www.chinatechnews.com/2008/06/30/6936-rival-cooperation-alipay-formally-begins-working-with-amazoncn-in-china/

China Tech News. (2008b, July 10). Alipay cooperates with Giant Interactive Group. *China Tech News.* Retrieved January 9, 2009, from http://www.chinatechnews.com/2008/07/10/6984-alipay-cooperates-with-giant-interactive-group/

Chinadaily. (2007, September 14). Credit card more popular in China. *China Daily.* Retrieved January 13, 2009, from http://www.chinadaily.com.cn/bizchina/2007-09/14/content_6107546.htm

Chinapay. (2009). *The development of ChinaPay*. Retrieved January 12, 2009, from http://www.chinapay.com/cpportal/about_us/unionpay.jsp

Ciweekly. (2006). Statistics on China's e-payment industry in 2006. *China Internet Weekly*. Retrieved January 13, 2009, from http://ebanking.ciweekly.com/

CNNIC. (2008). *Statistical Report on China Internet Development, July 2008.* Retrieved January 10, 2009, from http://cnnic.net.cn/uploadfiles/pdf/2008/7/23/170516.pdf

Daly, S. P., & Cui, L. X. (2003). E-logistics in China: basic problems, manageable concerns and intractable solutions. *Industrial Marketing Management*, *32*, 235–242. doi:10.1016/S0019-8501(02)00267-5

Davison, R. M., Vogel, D. R., & Harris, R. W. (2005). The e-transformation of western China. *Communications of the ACM*, *48*(4), 62–66. doi:10.1145/1053291.1053320

Hailey, G. T. (2002). E-commerce in China changing business as we know it. *Industrial Marketing Management*, *31*, 119–124. doi:10.1016/S0019-8501(01)00183-3

Heading-Century. (2008). *Analytical Report of China's E-payment Industry*. Retrieved January 13, 2009, from http://my.icxo.com/?uid-338548-action-viewspace-itemid-111531

Panurach, P. (1996). Money in electronic commerce: digital cash, electronic fund transfer, and Ecash. *Communications of the ACM*, *39*(6), 45–50. doi:10.1145/228503.228512

Press, L., Foster, P. W., & McHenry, W. (2003). The Internet in India and China. *Information Technologies and International Development*, *1*(1), 41–60. doi:10.1162/itid.2003.1.1.41

Yan, W. (2005). The electronic signatures law: China's first national e-commerce legislation. *Intellectual Property & Technology Law Journal*, *17*(6), 6–10.

## KEY TERMS AND DEFINITIONS

**Bank Transfer:** a payment mechanism in which payment transactions are made by transferring fund between bank accounts of the seller and buyer.

**Cash Upon Receipt of Goods:** a payment paradigm in which the buyer orders online, the seller physically delivers the goods to the buyer, and the buyer pays cash upon receipt of the goods.

**ChinaPay:** sponsored by China Banking Association, is a pioneer of China's bankcard-driven e-payment services.

**Direct Online Payment:** An online payment transaction that involves only a buyer, a merchant, and a bank.

**Electronic Payment:** refers to any payment transaction conducted electronically.

**Postal Payment:** a payment method where payment transactions are made via the postal services.

**Third-Party Online Payment:** An online payment transaction that involves a third party as well as a buyer, a merchant, and a bank.

# Chapter 51
# Scenario Driven Decision Support

**M. Daud Ahmed**
*Manukau Institute of Technology, New Zealand*

**David Sundaram**
*University of Auckland, New Zealand*

## INTRODUCTION

Though traditional DSS provide strong data management, modelling and visualisation capabilities for the decision maker, they do not explicitly support scenario management appropriately. Systems that purport to support **scenario planning** are complex and difficult to use and do not fully support all phases of **scenario management**. This research presents a life cycle approach for scenario management. The proposed process helps the decision maker with idea generation, scenario planning, development, organization, analysis, execution, and the use of **scenarios for decision making**. This research introduces scenario as a DSS component and develops a domain independent, component-based, modular framework that supports the proposed **scenario management process**.

DOI: 10.4018/978-1-61520-611-7.ch051

## BACKGROUND

Herman Kahn, a military strategist at Rand Corporation, first applied the term scenario to planning in the 1950s (Schoemaker, 1993). **Scenario analysis** was initially an extension of traditional planning for forecasting or predicting future events. Currently, scenarios are constructed for discovering possibilities, leading to a projection of the most likely alternative. **Scenarios** explore the joint impact of various uncertainties, which stand side by side as equals. Usually sensitivity analysis examines the effect of a change in one variable, keeping all other variables constant. Moving one variable at a time makes sense for small changes. However, if the change is much larger, other variables do not stay constant. Schoemaker (1995) argues that **scenario**, on the other hand, changes several variables at a time, without keeping others constant. Decision makers have been using the concepts of scenarios for a long time, but due to its complexity, its use is still limited to strategic decision making tasks. **Scenario planning** varies widely from one decision maker to another mainly because of lack of generally accepted principles for **scenario management**. Albert (1983) proposes three approaches for scenario planning, namely, Expert scenario approach, Morphological approach and Cross-Impact approach. Ringland (1998) identifies three-step scenario planning – namely brainstorming, building scenarios, and decisions and action planning. Schoemaker (1995) outlines a ten-step scenario analysis process. Huss and Honton (1987) describe three categories of scenario planning.

## SCENARIO MANAGEMENT AND SUPPORT

### Issues, Controversies, Problems

The literature still lacks a suitable approach for planning, developing, analyzing, organizing and evaluating the scenario using model-driven **decision support systems**. Currently available **scenario management processes** are cumbersome and not properly supported by the available tools and technologies. Therefore, we introduce a life cycle approach based scenario management guideline. Generation of multiple scenarios and sensitivity analysis exacerbate the decision makers problem. The available **scenario planning tools** are not suitable for assessing the quality of the scenarios and do not support the evaluation of scenarios properly through comparison processes. We introduce an evaluation process for comparison of instances of homogeneous and heterogeneous scenarios that will enable the user to identify the most suitable and plausible scenario for the organization. Considering the significance of scenarios in the decision-making process, this research includes scenario as a decision-support component of the DSS and defines **Scenario-driven DSS** as an interactive computer-based system, which integrates diverse data, models and solvers to explore decision scenarios for supporting the decision makers in solving problems.

Traditional **DSS** have been for the most part data-driven, model-driven and/or knowledge-driven but have not given due importance to scenario planning and analysis. Some of the DSS have partial support for sensitivity analysis and goal-seek analysis but this does not fulfil the needs of the decision maker. In most cases, the available **scenario analysis tools** deal with a single scenario at a time and are not suitable for development of multiple scenarios simultaneously. A scenario impacts on related scenarios but currently available tools are not suitable for developing a scenario based on another scenario.

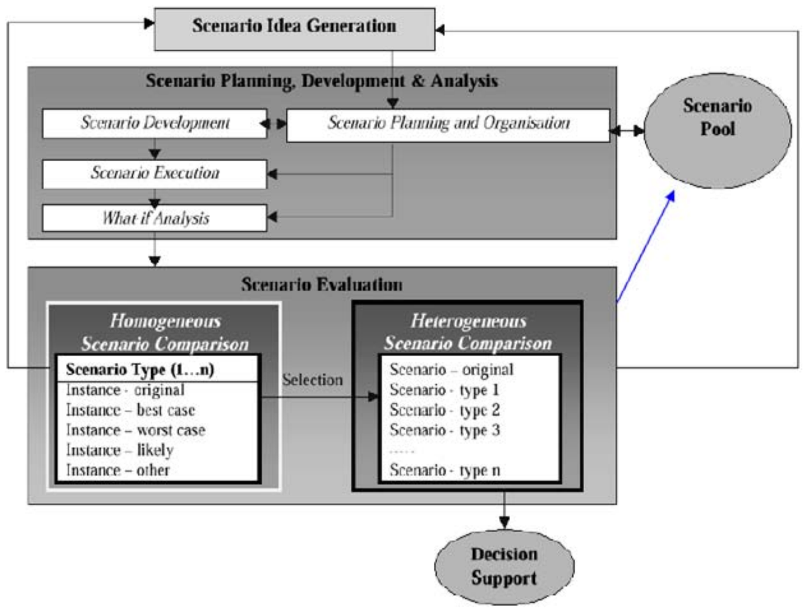
To address the problems and issues raised above we followed an iterative process of observation/evaluation, theory building, and systems development (Nunamaker, Chen and Purdin, 1991), wherein we proposed and implemented a flexible framework and architecture for a scenario driven decision support systems generator (SDSSG). It includes scenario as a DSS component, extends the model-driven DSS, and incorporates knowledge- and document-driven DSS (Power, 2001). A prototype was developed, tested and evaluated using the evaluation criteria for quality and appropriateness of scenarios (Schoemaker, 1995) and principles of DSSG frameworks and architectures (Collier, Carey, Sautter and Marjaniemi, 1999; Geoffrion, 1987; Ramirez, Ching, and Louis, 1990).

### Solutions and Recommendations

#### Scenario Management: A Life Cycle Approach

The scenario can be different for different problems and domains but a single management approach should support the model-driven scenario analysis process. Therefore, this research introduces a **scenario management process** using life cycle approach that synthesizes and extends ideas from

*Figure 1. Scenario management: a life cycle approach*




Ringland (1998, 2002), Schoemaker (1995), Albert (1983), Huss and Honton (1987), van der Heijden, (1996), and Wright, (2000). The proposed life cycle approach for scenario management process addresses a variety of problem scenarios. The life cycle process starts with scenario idea generation and finishes with the usage of scenario for decision support as illustrated in Figure 1. The following sections present all the phases of the life cycle approach for scenario management.

## Idea Generation

The scenario planner foresees the key issues that exist within the scenario and analyses the concerns for identifying the influential driving forces and parameters for the scenarios. In addition the planner may also use the existing scenarios from the scenario pool. The leading factors, which could be either internal and/or external, could lead to various changes to the system. The decision maker as a domain expert predicts the possible changes to the indicators that would guide to the development of ideas for **scenario planning**.

## Scenario Planning, Development and Analysis

In this phase, the decision maker will carry out the tasks of scenario planning and organization, scenario development, scenario execution, and what-if analysis. Existing scenarios could also act as inputs to this phase apart from the ideas generated from the previous phase.

## Scenario Planning and Organization

The **scenario planning** step mainly focuses on decomposing the whole big scenario into multiple inter-related scenarios that are suitable for development, execution, analysis and evaluation. It also includes scenario structuring and identification of the scenario components.

## A Mechanism for Structuring Scenarios

**Scenarios** are complex and dynamically related to other scenarios. In view of addressing the complexity and inter-relatedness of scenarios, we propose to divide larger scenarios into multiple simple scenarios having independent meaning and existence. In this context we identify three types of scenarios, namely:

- **Simple Scenarios** – The simple scenario is not dependent on other scenarios but completely meaningful and usable.
- **Aggregate Scenarios** – This scenario is comprised of several other scenarios. Top level scenario can be broken down to low level scenarios or several low level scenarios can be added together to develop a top level scenario. The structures of different scenarios or results from multiple scenarios are combined together to develop an aggregate scenario.
- **Pipelining Scenarios** – One scenario is an input to another scenario in a hierarchical scenario structure. In this type of scenario, each constituent scenario will have independent existence but the lower-level scenarios may be tightly or loosely integrated with the higher-level scenario.

The decision maker may combine simple as well as complex scenarios together using pipelining and aggregation to develop more complex scenarios.

## Scenario Organization

Scenario organization activities include making available already developed scenarios, storing, retrieving, deleting, and updating scenarios to and from a scenario pool. This scenario pool should support both temporary and permanent storage systems. The temporary storage, termed as a runtime pool, is used for managing scenarios during development, analysis and evaluation. The newly developed and retrieved scenarios are cached in the runtime pool for developing aggregate and/or pipelined scenarios. The scenario pool also permanently stores scenarios for future use or reference. Both the temporary and permanent storage systems are capable of storing the scenario structure, scenario instance and executed scenarios.

## Scenario Development

**Scenario planning** and scenario development stages are inter-dependent and iterative. **Scenario development** is the process of conversion and representation of planned scenarios into fully computer based scenarios. Chermack (2003) argues that scenarios have rarely been applied to develop alternative processes. The proposed life cycle approach supports development of alternative process models and scenarios. In this stage, the decision maker organizes the related data, model, solver, and dependent scenarios for constituting the relationships among them to develop scenario(s). The decision maker could potentially use pre-customized and/or loosely coupled scenarios and may skip this step if they use previously developed scenarios. The scenarios are developed in mainly two steps. In step 1, the basic scenarios of the domain are developed, and in step 2, scenarios related to what-if (goal seek and sensitivity) analysis are developed.

## Scenario Execution

The proposed scenario development process ensures that the scenario can be executed and analyzed for determining quality and plausibility. In this step, the models are instantiated with the data, and then the model instance is executed using the appropriate solver(s). Model selection is completely independent while one or more solvers may be used for a model execution. A flexible mapping process bridges the state attributes of the model and solver to engage in a relationship and to participate in the execution process. For a complex scenario, the decision maker may need to apply several models and solvers to analyze various aspects of the scenario. If a scenario contains other scenario instances, execution of the containing scenario will depend on the execution of the contained scenarios. But if the containing scenario contains the structure of the contained scenarios, the execution of the containing scenario depends on a series of model instantiation and model execution. This process may be pre-customized during the scenario development step or customized during the execution step. The decision maker can skip this step if they use only the previously stored scenario instances and executed scenarios from the scenario pool.

### What-if Analysis

What-if analysis can be divided into two categories, namely sensitivity analysis and goal-seek analysis. **Sensitivity analysis** allows changing one or more parametric value(s) at a time and analyses the outcome of the change. It reveals the impact itself as well as the impact on other related scenarios. Because a scenario contains other scenarios, each and every change dynamically propagates to all the related scenarios. **Goal-seek analysis** accomplishes a particular task rather than analyzing the changing future. This goal seek analysis is just a reverse or feedback evaluation where the decision maker supplies the target output and gets the required input.

### Scenario Evaluation Process

**Scenario evaluation** is a challenging task (Chermack, 2002) but some end-states are predetermined dependent upon the presence of an interaction of identified events (Wright, 2000) which can be used to devise an evaluation process. The decision maker could potentially develop many scenarios. The question is – do all these scenarios represent a unique situation? Each scenario might appropriately draw the strategic question; represent fundamentally different issues; present a plausible future; and challenge conventional wisdom. Schwartz (1991) and Tucker (1999) discourage too many scenarios and advocate the use of best-case scenario, worst-case scenario and most-likely scenario. The evaluation is done through scenario execution and comparison of the executed results. A visualisation object displays results of all the executed scenario instances either as a table or as a graph. This presentation helps comparing the computed inputs and outputs including other attributes. The comparison may take place among homogeneous scenarios or heterogeneous scenarios.

### Decision Support

The above described scenario planning, development, and evaluation through comparative analysis results in improved participant learning (de Geus, 1988; Shoemaker, 1995; Godet, 2001) and helps decision makers re-perceive reality from several points of view (van der Heijden et al., 2002) and thereby provides better support for decision making. The following section proposes a framework that realizes the proposed scenario management process.

## SCENARIO DRIVEN FLEXIBLE DECISION SUPPORT SYSTEMS FRAMEWORK

Few of the DSS frameworks emphasize fully featured scenario planning, development, analysis, execution, evaluation and their usage for decision support. DSS components such as data, model, solver, and visualization have been extensively used in many DSS framework designs but they do not consider scenarios as a component of DSS. Scenario plays such an important role in the decision-making process that it is almost impractical to develop a good **decision modelling** environment while leaving out this component. While scenarios resemble model-driven DSS they are more complex than models and need to be considered as independent entities in an explicit fashion. Therefore, we propose that **scenario-driven DSS** should add the scenario as an independent component in addition to existing decision-support components. The scenario does not have a separate existence without its base components. Every scenario is built up from a unique problem (model) that can have a number of alternative unique instances (data) and each instance can be interpreted, executed or implemented using one or more alternative methods (solvers).

To overcome the problems and address the issues mentioned above we propose a scenario-driven decision support systems generator (**SDSSG**) framework as illustrated in Figure 2. The SDSSG components are separated into the following three categories:

- Decision-support components (DSC) that include the data, model, solver, scenario and visualization.
- Integration Components (IC) that include Kernel, Component Set, Mapping, and Validation Component.
- Component Pools that include data pool, model pool, solver pool, scenario pool, and visualization pool. Each component of the DSC has a direct relationship with a component pool.

In this framework, the DSCs, ICs and Component pools are independent of each other. The DSCs communicate via the kernel component. Mapping component develops the correct path of communication between data and model, and model and solver, while the validation component tests the correct matching of the component interface and the proper communication between the components.

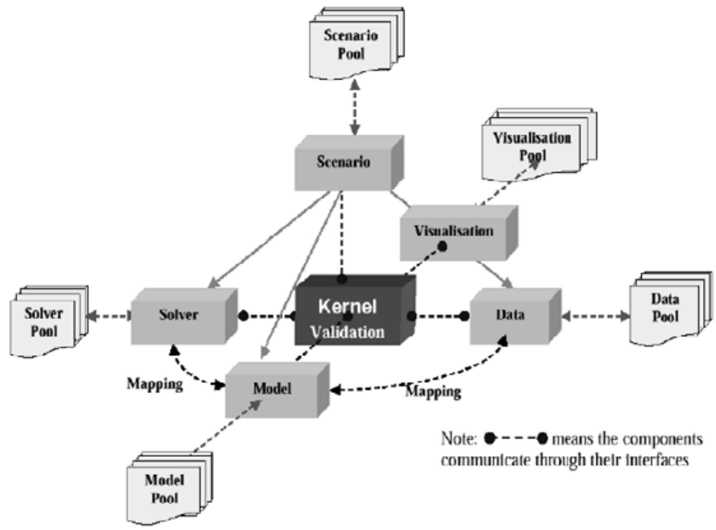
The data, model, solver, scenario, and visualization can be stored in different component pools as shown in Figure 2 and the framework allows retrieving these components from the component pools. The related model, data and solver can be combined together to develop a scenario. This scenario can be saved to the scenario pool for future use. This also allows using the scenario(s) as an input for developing a number of simple, aggregate, and pipelined scenarios. Every instance of the scenario can be termed as a specific decision support system. Therefore, the framework is a generator of scenarios as well as decision support systems.

Scenario information can be saved and retrieved to and from the scenario pool and the same can again be customized using models and solvers. The scenario instances can be used as complex data for input to the next level model for further analysis. Different scenarios can be computed simultaneously and **sensitivity** and **goal-seek analysis** can be done using different scenarios. The framework is suitable for analyzing internally coherent scenarios or scenario bundles, and examining the joint consequences of changes in the environment for supporting the decision maker's strategy.

## FURTHER RESEARCH DIRECTIONS

The generalisability of these concepts, frameworks, and architectures has been proved in other domains and other paradigms. For instance, Ahmed and Sundaram (2007) have applied these principles for developing a generic DSS framework and architecture for sustainability modelling and reporting. The concept of this framework, architecture and scenario management processes can be applied to the decision making components of existing enterprise systems such as SAP and Oracle. Future research could explore the applicability of our concepts, frameworks, and architectures to other domains and paradigms as well as their use in conjunction with existing transaction processing, analytical, and strategic information systems.

*Figure 2. Scenario-driven decision support systems generator (SDSSG) framework*




## CONCLUSION

Current **scenario planning** and analysis systems are very complex, not user friendly, and do not support modelling and evaluation of multiple scenarios simultaneously. To overcome these problems we propose a scenario management life cycle, and a framework and architecture that support the lifecycle. The lifecycle as well as the framework and architecture are validated through a concrete implementation of a prototype. The implementation has been described in detail and fleshed out with examples in Ahmed and Sundaram (2008).

This research introduces the concepts of **scenario structure** and their development strategy. It decomposes large complex scenarios into multiple small and executable scenarios and uses the decomposition and re-composition methodology for defining the scenario structure. The research also proposes a life cycle approach for **scenario management** that supports a range of activities from conceptualizing and understanding the scenario to final use of the scenario for decision making. Key phases of the life cycle are idea generation, scenario planning, organization, development, execution, analysis, evaluation, and finally decision support. The process hides external factors and complexities of the scenario and allows the seamless combination of decision parameters for appropriate scenario generation. We also propose a generalized scenario evaluation process to enable the decision maker in finding appropriate and plausible scenarios through homogeneous and heterogeneous scenario comparisons among the multiple instances of similar and dissimilar scenarios respectively.

The research further realizes the scenario-driven decision-making processes through extending model-driven decision support systems. We develop a generic scenario driven flexible decision support systems generator framework and architecture that supports the above-mentioned scenario management processes as well as sensitivity and **goal-seek analysis**. Scenarios are introduced as a new **DSS component** alongside the traditional data, model, solver, and visualization components.

## REFERENCES


Ahmed, M. D., & Sundaram, D. (2007). A Framework for Sustainability Decision Making System: A Proposal and an Implementation. In *eProceedings of the 9th International Conference on Decision Support Systems (ICDSS 2007)*, Kolkata, India. Retrieved from http://www.cba.uni.edu/ICDSS2007/PDFs/29.pdf

Ahmed, M. D., & Sundaram, D. (2008). A framework for scenario driven decision support systems generator. *International Journal of Information Technology and Web Engineering*, *3*(2), 45–62.

Albert, K. J. (1983). *The Strategic Management Handbook*. New York: McGraw-Hill.

Chermack, T. J. (2002). The mandate for theory in scenario planning. *Futures Research Quarterly*, *18*(2), 25–28.

Chermack, T. J. (2003). A Methodology for Assessing Performance-Based Scenario Planning. *Journal of Leadership & Organizational Studies*, *10*(2), 55. doi:10.1177/107179190301000206

Collier, K., Carey, B., Sautter, D., & Marjaniemi, C. (1999). A Methodology for Evaluating and Selection Data Mining Software. In *Proceedings of the 32nd Hawaii International Conference on System Sciences*.

De Geus, A. (1988). Planning as learning. *Harvard Business Review*, *66*(2), 70–74.

Geoffrion, A. (1987). An Introduction to Structured Modelling . *Management Science*, *33*(5), 547. doi:10.1287/mnsc.33.5.547

Godet, M. (2001). *Creating futures: Scenario planning as a strategic management tool*. London: Economical Publishing.

Huss, W.R., & Honton, E. J. (1987 April). Scenario Planning: What Style Should You Use? *Long Range Planning*.

Nunamaker, J. F. Jr, Chen, M., & Purdin, T. D. M. (1991). Systems Development in Information Systems Research . *Journal of Management Information Systems*, *7*(3), 89–106.

Power, D. J. (2001). Supporting Decision Makers: An Expanded Framework. In *Informing Science Conference*, Poland.

Ramirez, R. G., Ching, C., & St Louis, R. D. (1990). Model-Data and Model-Solver Mappings: A Basis for an Extended DSS Framework. In *ISDSS Conference Proceedings* (pp. 283-312).

Ringland, G. (1998). *Scenario Planning- Managing for the Future*. Hoboken, NJ: John Wiley & Sons.

Ringland, G. (2002). *Scenarios in business*. New York: John Wiley & Sons.

Schoemaker, P. J. H. (1993). Multiple Scenario Development: Its Conceptual and Behavioural Foundation. *Strategic Management Journal*, *14*(3), 193–213. doi:10.1002/smj.4250140304

Schoemaker, P. J. H. (1995). Scenario Planning: A Tool for Strategic Thinking . *Sloan Management Review*, *36*(2), 25–40.

Schwartz, P. (1991). *The Art of the Long View*. New York: Doubleday.

Tucker, K. (1999, April). Scenario Planning . *Association Management*, *51*(4), 70–75.

van der Heijden, K. (1996). *Scenarios, The Art of Strategic Conversation*. Hoboken, NJ: Wiley.

van der Heijden, K., Bradfield, R., Burt, G., Cairns, G., & Wright, G. (2002). The Sixth Sense: Accelerating organizational learning with scenarios. New York: John Wiley.

Wright, A. D. (2000). Scenario planning: A continuous improvement approach to strategy. *Total Quality Management*, *11*(4-6), S433–S438. doi:10.1080/09544120050007742

## ADDITIONAL READING

Ahmed, M. D. (2002). *Design and implementation of Scenario driven flexible decision support systems generator*. Unpublished Masters Thesis, University of Auckland, Auckland, New Zealand.

Fahey, L., & Randall, R. M. (Eds.). (1998). *Learning from the future: competitive foresight scenarios*. New York: Wiley.

Georgantzas, N. C., & Acar, W. (1995). *Scenario-driven planning: learning to manage strategic uncertainty*. Westport, CT: Quorum Books.

Lindgren, M., & Bandhold, H. (2003). *Scenario planning: the link between future and strategy.* New York: Palgrave Macmillan

Ralston, B., & Wilson, I. (2006). *The scenario-planning handbook: a practitioner's guide to developing and using scenarios to direct strategy in today's uncertain times*. Mason, OH: Thomson South-Western.

Ringland, G. (1998). Scenario planning: managing for the future. New York: John Wiley.

Ringland, G., & Young, L. (Eds.). (2006). *Scenarios in marketing: from vision to decision.* Hoboken, NJ: Wiley

van der Heijden, K. (2005). *Scenarios: the art of strategic conversation* (2nd Ed.). Hoboken, NJ: John Wiley & Sons.

## KEY TERMS AND DEFINITIONS

**Aggregate Scenarios:** The structure of different scenarios or results from multiple scenarios are combined / aggregated together to develop a more complex scenario.

**Decision Support Systems/Tools:** in a wider sense can be defined as systems/tools that affect the way people make decisions. But in our present context it is defined as systems that increase the intelligence density of data and supports interactive decision analysis.

**Goal-Seek analysis:** accomplishes a particular task rather than analyzing the changing future. This goal seek analysis is just a reverse or feedback evaluation where the decision maker supplies the target output and gets the required input.

**Intelligence Density:** is the useful 'decision support information' that a decision maker gets from using a system for a certain amount of time or alternately the amount of time taken to get the essence of the underlying data from the output.

**Pipelining Scenarios:** One scenario is an input to another scenario in a hierarchical scenario structure. In this type of scenario, lower-level scenario can be tightly or loosely integrated with the higher-level scenario.

**Scenario:** is a complex problem situation analogous to a model that is instantiated by data and tied to solver(s). A scenario can be presented dynamically using different visualizations. A scenario may contain other scenarios.

**Scenario Life Cycle:** is an iterative process of scenario idea generation, planning, organization, development, execution, what-if analysis, evaluation and decision support.

**Scenario-Driven DSS:** is an interactive computer-based system, which integrates diverse data, models and solvers to explore decision scenarios for supporting the decision makers in solving problems.

**Sensitivity Analysis:** allows changing one or more parametric value(s) at a time and analyses the outcome for the change. It reveals the impact on itself as well as the impact on other related scenarios.

**Simple Scenarios:** The simple scenario is not dependent on other scenarios but completely meaningful and usable.

# Chapter 52
# E-HRM in Turkey:
## A Case Study

**Yonca Gürol**
*Yildiz Technical University, Turkey*

**R. Ayşen Wolff**
*Haliç University, Turkey*

**Esin Ertemsir Berki**
*Yildiz Technical University, Turkey*

## ABSTRACT

*This chapter is about the role of electronic Human Resource Management (E-HRM) in Turkey. E-HRM can be briefly defined as the planning, implementation and application of information technology for both networking and supporting at least two individuals or collective actors in their shared performing of HR activities. New knowledge economy increased competition throughout the world and living in an age of massive technological evolution is changing the nature of business; especially e-business. E-business is challenging current HRM policies and functions as it uses internet technology to drive organizational performance. This study attempts to investigate several specific and critical points that will contribute to a better understanding of E-HRM by illustrating how it is used by a Turkish firm in the health sector. In this sense, the authors' findings will try to exemplify how an E-HRM policy is realized. Our aim is to provide a model for the implementation of E-HRM in other companies.*

## INTRODUCTION

During the past ten years, emerging factors such as globalization, rapid technological developments and limited resources have created a new competitive landscape for all businesses. These developments forced companies to adopt several strategies to survive and to excel in their environment. Obviously, competition and attempts to increase market share between organizations play an important role in the business world. Today information is such an important competitive tool for businesses that a new era has begun known as "The Information Age" or "The New Economy".

Turkey is adapting economically and culturally to a web-based economy, seeing this as essential to its candidacy for the European Union. Although it has been observed that the human factor is among the leading strategic advantages of successful firms' in Turkey, "traditional personnel management" is still

DOI: 10.4018/978-1-61520-611-7.ch052

resisting change. Therefore, issues pertaining to human resources are under increasing investigation by academics, as well as by business people. In Turkey the beginning of academic research into human resource management dates back to the 1970s, to early studies of personnel management. In the 1980s, the transition from personnel management to human resource management has influenced academic study in Turkey in all relevant areas of the subject. The changes observed in these years were not limited to a change from personnel management to HRM. Rather, there is the much more important issue of change within the above mentioned transition stemming from the strategic role ascribed to HRM (Gurol *et al*, 2003). Following this evolutionary process, at present, academic interest in E-HRM has increased. This interest stems from E-HRM's role in cost reduction development of HR services helping to improve strategic planning. Furthermore E-HRM is seen as a driving force for companies growing both regionally and in labor force. It is becoming a prerequisite for the competitive success of any firm. Using the internet theoretically makes your labor pool global rather than local. You can use information technology to do all the routine HR administrative work automatically at any time, at anywhere.

## BACKGROUND

As mentioned in the introduction part, living in age of massive technological evolution is changing the nature of business. This new business structure is named as electronic business(e-business) and can be defined as the overall business strategy that redefines the old business models and uses digital media and network technology to optimize customer value delivery (Karakanian, 2000, 1) which causes certain innovative changes in business life. These computer based innovative changes are especially found in customer relations, marketing, inventory control, and/or human resource management and are clearly affecting the way in which business is conducted.

The new mechanism introduced by e-business utilizes Internet-based computing, which supports the open flow of information between systems. For this purpose, e-business uses business portals (established over the Internet) to interact with customers (Mitchell, 2001).

Information systems have also been applied to HRM for decades. However, the way of using information systems and the way of processing information for HRM have evolved and dramatically improved over the last decade. As a result human resource management has also gone through a change process, especially in terms of HRM policies and functions.

Moving from this point on, Strohmeier (2007) has defined electronic human resource management (E-HRM) as "the planning, implementation and application of information technology for both networking and supporting at least two individual or collective actors in their shared performing of HR activities." (p.20)

According to Ulrich (2007; 2009) human resource managers take place in the strategy designation process with the top managers. As one of the strategic partners, the HR manager derives benefit from Electronic Human Resource Management Systems (EHRMS), which is an important tool in E-HRM, to disseminate and execute the strategy within the organization. E-HRM has gained use of technology as it enables employees to manage much of their own HR administrative work. They can take care of many routine transactions whenever they wish, because automated systems don't keep office hours. In addition to their former operational role, HR professionals can also act as a competency manager by arranging the right people to the right positions in the right time with their new strategic architecture role.

With the use of IT for HRM purposes there will be more time left for strategic decision-making, as a result of a decrease in manually performed administrative tasks. Also as a result of the improvement of overall HRM system, there will be parallel decrease in HR related questions from employees and line management (Ruël, Bondarouk& Velde, 2007).

In light of all these, this study attempts to investigate several specific and critical points that will contribute to a better understanding of E-HRM. In the following sections, we will first briefly describe HR functions in E-HRM, following this; we will go over our findings of a case-study conducted to show how E-HRM and its certain functions are being used today by a Turkish firm in health sector.

## HR FUNCTIONS IN E-HRM

### Job Analysis and HR Planning

E-HRM offers online job descriptions which are the most important output of the job analysis process. The HR specialist can easily establish the competencies of the required applicant in a way that matches the applicant to the job descriptions and rapidly recruit the labor whenever and wherever needed. In the HR planning process it is easier to follow workforce gaps, the quantity and quality of the labor force and to plan future workforce requirements with the help of HR knowledge systems such as Oracle, SAP, PeopleSoft, Excel etc.

### E-Recruitment and Selection

HR managers more often use the Internet for recruiting and the selection of new personnel (Stone, 2005). Internal and external labor pool and the job openings can be pursued by HR knowledge systems. It also creates advantage for internal staffing of open positions. Computerized testing for selection is increasingly replacing conventional paper-and-pencil manual tests (Dessler, 2005).

### E-Learning / Training / Education / Knowledge Management

Setting the training needs, driving web-based courses, evaluating the success of training programs, keeping the results for the future use in the performance and career management functions and storing the organization's intellectual capital are the most prominent advantages of the E-HRM. The most frequently used education technologies are tele-training, video conferencing and training via internet. E-learning, gives the opportunity to learn online rather than face-to-face. Although it is a very flexible learning opportunity, many people may find it difficult to devote the necessary time.

### Performance Management and Appraisal

Targeting the performance results and online evaluating the performance provide effectiveness and rapidness for the performance management process. Electronic performance monitoring (EPM) is the ultimate point in computerized appraising in which supervisors electronically monitor the work force and rate them (Dessler, 2005). Having the feedbacks online can diminish wasted time and keep records confidential.

### Career Development

Knowing the competencies and educational background of the labor is important to make career targets and construct career paths online. The organization can offer on-site or online career centers, encourage role reversal, establish a "corporate campus"; computerized on and offline programs which are available for improving the organizational career planning process.

## Compensation

HR managers prefer using knowledge management systems also for compensation and benefit systems, for accessing electronic databases and undertaking corporate promotion (Stone, 2005). Computers play an important role in benefits administration. PC-based systems let employees interactively update and manipulate their benefits packages. Inter and intranet systems enable employees to get medical information about hospitals and doctors and to do interactive financial planning and investment modeling. Additionally, online award programs can also be used to recognize employees on anniversary dates or give their success awards (Dessler, 2005).

## Employee Safety and Health

Risk and security management is crucial to HR-related information because it involves private and highly sensitive individual data. It follows that data and multiplatform security aspects which are perhaps the most serious factors that need to be taken into consideration during the formulation of an organization's E-HRM strategy (Karakanian, 2000, p.3).

The workplace access through the carding system makes it possible to know where your worker is at the moment. As a result, HR department can easily search the work place for workers during job accidents and keep up with the workers' rotation.

## Employee Relationships / Communication

Intranet systems, allow better interaction between the workforce and their managers and between colleagues as well. HR specialists can use online communication channels efficiently and share internal and external information with the organization as a whole. E-mail groups, discussion meetings, synchronized conferences via the internet keep the organization updated.

It is also possible to use the internet to manage union relations by mass e-mail announcements to collective bargaining unit members, supporters and government officials (Dessler, 2005).

# THE RESEARCH METHOD AND RESULTS ON TURKISH E-HRM PRACTICE

## Method

The method adopted in this research is the case study, since with this method it is possible to gain in-depth understanding of the factors that led to electronic use in HR functions and the way in which the process was realized. It will thus be possible to develop a basis upon which a theoretical framework could be attained for explaining the E-HRM system.

Researchers have conducted interviews with top managers and line managers in key positions related to HR and also with IT support system specialists. The semi-structured interview questions explored HR functions in general and the technical adaptation problems in the transformation process of E-HRM.

The data was collected through a variety of means including in-depth interviews, document analysis and the individual participation of the HR manager. Researchers tape-recorded as well as took notes of the answers during the interviews, and each interview took approximately 30 minutes.

Currently there are 10 workers in the HR unit and also a couple of interns who update the data of the workforce. On-site observations and small talks with the personnel have also been possible during the interview period. Researchers also examined and analyzed the firm's official web site, in addition to other written materials provided by the firm.

## Electronic Human Resources Management System (EHRMS) and its Difference from the Other Softwares

Since Human Resources Department works differently from other departments, its software application is also unlike other departments. For example, in an accounting program, only data is used without any human contact. There is no face to face connection, it's all electronic!

Or the program that the purchasing department uses can be an institutional resource planning system, concerning only that department. The purchasing manager may or may not see an order, but the data will be shared electronically.

However, Human Resources Department is not like other departments. It is not related to only one or two people or departments. It gives support and service to all company employees; its' work is hard and the logic that it uses in its' software is pragmatic.

It is better to analyze Human Resources Software in two parts. The first part is the application that the Human Resources Department uses; the second is the application that the company workers use.

### The Application used by Human Resources Department (Back Office)

This application organizes the HR Department's own operations by informing the front office, and in turn by being informed by them. Other departments besides HR do not use it. For example, it prepares payroll or calculates the budget by entering payment information. It defines the necessary competencies for certain positions which are used in evaluating performance and according to these competencies, mathematical grading is instituted and the right questions are asked. We will call this application **"HRMS"** (Human Resources Management System). Also it is called **"HRIS"** (Human Resource Information Systems). There is a fundamental difference between HRIS and E-HRM in that basically HRIS are directed towards the HR department itself. Users of these systems are mainly HR staff. With e-HR, the target group is not the HR staff but people outside this department: employees and management (Ruël *et al*., 2007).

### The Application Used by the Company Workers (Front Office)

The employees of the company use this application. This application allows examining payrolls during the evaluation process. Data registration improves the back office feedback system between workers and management and defines performance. Data is screened and it is fed by the back office. We call this application **"EHRMS"** (Electronic Human Resources Management System).

## CASE STUDY: APPLIED E-HRM AT THE HR DEPARTMENT OF THE AMERICAN HOSPITAL IN TURKEY

### Human Resources in the Electronic Environment of Turkey

As Turkey has improved in the Human Resources field, use of related technology has grown and a variety of software applications have become integral to daily operations.

In the past, modules such as number of employees, paid leaves and over-time working hours were used for building payroll programs and payroll accounts. Although these modules made Human Resource work easier by storing data, preparing reports and various other reasons in terms of data access, it caused an extra work load.

Nowadays, as the value of Human Resources Department is more appreciated, its functionality has also increased in a parallel way and taken on much of the workload. In the past, Human Resources was seen as a department that registered workers, organized paid leave and prepared the payroll. It has now turned into a department that improves the performance of its employees, prepares training programs for them, specifies work definitions to clarify their career planning and finds the appropriate niche for each employee. At this point, it cannot be neglected to state that, Human Resources managed to adopt itself to such a big workload by taking advantage of the new technology seen especially by the growth of web software.

## Interview Questions and Answers

### Please Give Us Some Information about the Historical Background of your Organization.

Turkey's first, general, not -for profit hospital, American Hospital and School of Nursing, was established by Admiral L. Bristol in 1920. With its 300 bed capacity, American Hospital continues to develop and give the best quality of service to each specialty of modern medicine. Each year VKF American Hospital serves 131,000 patients. Seeking care, they come from all over Turkey and various parts of the world.

The VKF American Hospital offers diagnostic, inpatient and outpatient care in 38 medical specialties. Its 24 hour service meets international standards and has 500 physician specialists and a health care and support service staff of 1,150 people. World standard service is provided with the support of the most modern medical equipment and systems.

In 1995 the management of the American Hospital was transferred to Koç Holding. In 1996-1997, Koç Holding's managers (Arcelik, Otosan etc.) were invited to join the hospital administration and were introduced to health-care management. The first HR professionals were educated among them and the HR department was founded in 1997. There are 10 workers in the HR unit at the moment and there are also interns who update the data of the workforce.

### Can you Describe the Role of HR Department in your Organization? Is it Seen as a Strategic Partner? Is it a Support Unit?

Human Resources Management is a strategic partner; we undertake operational and managerial roles in our daily planning.

### Can you Give Us Information about your Strategic Plans?

Our strategic plan is: to open a new hospital of radiology and oncology and to establish a medical faculty in the mid-term. These plans allow for progress.

### Which HR Functions do you Outsource?

The HR department has no outsourcing activities but we do have IT support from the Koç Systems within the Koç Holding group.

### Which HR Functions are Carried Out in your Organization?

Human Resources functions include job analyzing, planning, salary, employment, career development, employee satisfaction, and training topics. These are carried out in the hospital.

### We Know that E-HRM is Successfully Implemented in your Hospital. How did you Manage the Transformation of the Related Process?

We first improved the IT infrastructure of the hospital. At the beginning of 2002, we started using Electronic Human Resource Management System and preferred Oracles' HR module for E-HRM activities. We chose it as an alternative to the SAP software. We use software like PYXIS and PAX in material management. Besides, pneumatic tube systems are supported by personal communication systems and are used in the flow of information and in sending blood and reports, etc.

## Which HR Functions were Transferred to Electronic Environment?

All Functions transferred into the e-environment;

We first transferred job analyses, job definitions and completed their updates. Later on we continued with HR planning.

## For Which Purposes did you Transfer These Functions to an Electronic Environment?

- With the e-environment we are now able to calculate easily in our integration system: HR Planning; work force loss analyses, follow-up of absenteeism and over-time. Hospital access is done through a carding system so there is the advantage of predicting change and knowing where the worker is. As a result, information is made available on both where the work place of the worker is during work accidents and keeping up with the workers' rotation. Through the e-system, the emergency nurse logs on so one can know the location of the nurse and where to call in case of an emergency. Through the intranet, doctors can fill out their absence forms. Both the work of the appointment center and the call center got easier, as our doctors made their weekly schedules within the system.
- Staffing; it is possible to predict the loss of workforce before it occurs through the e-system. For example, the assignment of 70 people to government jobs was known before hand. We were able to plan, make evaluation of career potential in the candidate pool and were able to fill out positions without any trouble. By the help of EHRMS, we are able to calculate every detail of yearly absences, save them in the system and also plan leaving and replacement. Open positions are visible to everyone in the system and their registration is approved by the managers and HR.
- Training: In-house training is done through the intranet. The worker gets training whenever he/she wants it. There is no cost for physical space and the time factor can be used efficiently both by the trainer and the trainee.
- Performance Appraisal; every semester employees are transferred into the system and are tracked in the e-environment. An employees' development can be followed. Most importantly the "360-degree feedback" performance appraisal is done in this system.
- Career Planning: the career planning of workers can be tracked.
- Wage and Salary System: we use the HEY grading system to enable us to calculate the salaries.

## What are the Advantages and Disadvantages of E-HRM?

Even though at the beginning of an E-HRM application it is necessary to stick to budget, in the long term there is an increase in the productivity of the workforce and a decrease in cost.

In the beginning the system increases workload due to the entering data, but when the system is used actively, the workload decreases. Through this system, data is kept orderly and reports are fully prepared. All statistical information such as; paid leave, performance evaluations and the candidate pool can be obtained easily in the data base. When the system is busy like in the performance appraisal period or career target defining process, the system may slow down as the access to the system increases.

As in every department, there is also an adaptation period in the HR department with the transfer to electronic systems. The help of IT professionals is necessary during this period.

*Thank you very much for your contributions to our academic work and for sharing confidential information with us.*

## FUTURE RESEARCH DIRECTIONS

The geographically separated branches of the multinational company can easily handle recruitment and selection, staffing, performance appraisal, training functions via E-HRM applications. In the future, the number of studies in International Human Resource Management field regarding this issue will likely increase.

Also, another research trend that will gain importance will probably be based on the software and programs on HR. As mentioned before E-HRM is using web-based-technology channels for implementing HR practices. Setting the s-m-a-r-t targets, performance criteria, encouraging e-training, receiving the training results online and using these results as an input for the human performance system will provide further integration of HR functions. As long as the technology changes, electronic human resource management systems will be improved. Moreover, as HR software becomes easier to use and to afford, the number of organizations which prefer E-HRM will continue to increase day by day. It is expected that the HR knowledge systems such as Oracle, SAP, PeopleSoft, etc. will propose new and more functional software and the technology related issues of E-HRM will constitute an emerging trend within the field.

## CONCLUSION

At the end of this case study, we concluded that the work of HR employees in the Human Resources Information System got easier and the cost of intra-organizational processes decreased. It was also concluded that better access to data in the e-environment decreased the need for decision-making at higher levels of management. For our research, we had information from the HR department managers and their team, and also from the users of the system. As expected, the selection and placement process got easier and through e-training, workers were better informed, better coordinated and were better prepared to improve their performance.

## REFERENCES

Allard, S., & Holsapple, C. W. (2002). Knowledge Management as a Key for e-Business Competitiveness: From the Knowledge Chain to KM Audits. *Journal of Computer Information Systems*, *42*(5), 19–25.

Biesalski, E. (2003). Knowledge Management and e-Human Resource Management. In *Workshop Lehren-Lernen-Wissen-Adaptivität*. Retrieved March 20, 2009, from http://km.aifb.uni-karlsruhe.de/ws/LLWA/fgwm/Resources/FGWM03_08_Ernst_Biesalski

Dessler, G. (2005). *Human Resource Management* (10th Ed.). Upper Saddle River, NJ: Prentice Hall.

Gürol, Y., Aşık, Ö., & Doğrusoy, G. (2003). An Examination of Areas of Interest in Turkish Academic Studies of Human Resource Management on the Dimensions of Past, Present and Future. In *Workshop on Management Knowledge on Time and Space*, Bilgi University, Istanbul.

Karakanian, M. (2000). Are Human Resources Departments Ready for E-HR*? Information Systems Management*, *17*(4), 1–5. doi:10.1201/1078/43193.17.4.20000901/31250.6

Lepak, D., & Snell, S. A. (1998). Virtual HR: Strategic Human Resource Management In The 21st Century. *Human Resource Management Review*, *8*(3), 215–234. doi:10.1016/S1053-4822(98)90003-1

Miller, J. S., & Cardy, R. L. (2000). Technology and Managing People: Keeping the Human in Human Resources. *Journal of Labor Research*, *21*(3), 447–461. doi:10.1007/s12122-000-1020-5

Mitchell, M.E. (2001). Human Resource Issues and Challenges for E-Business. *American International College Journal of Business,* 1-14.

Olivas-Lujan, M. R., Ramirez, J., & Zapata-Cantu, L. (2007). E-HRM in Mexico: Adapting Innovations for Global Competitiveness. *International Journal of Manpower*, *28*(5), 418–430. doi:10.1108/01437720710778402

Ruël, H., Bondarouk, T., & Looise, J. K. (2004). E-HRM: Innovation or Irritation. An Explorative Empirical Study in Five Large Companies on Web-based HRM. *Management Review*, *15*(3), 364–381.

Ruël, H., Bondarouk, T., & Velde, M. V. D. (2007). The Contribution of E-HRM to HRM Effectiveness. *Employee Relations*, *29*(3), 280–291. doi:10.1108/01425450710741757

Stone, R. J. (2005). *Human Resource Management* (5th ed). Australia: John Wiley & Sons.

Strohmeier, S. (2007). Research in E-HRM: Review and Implications. *Human Resource Management Review*, *17*(1), 19–37. doi:10.1016/j.hrmr.2006.11.002

Ulrich, D. (2007). The New HR Organization. *Workforce Management*, *86*(21), 40–44.

Ulrich, D., Brockbank, W., Johnson, D., Sandholtz, K., & Younger, J. (2009). *IK Yetkinlikleri*. (Nazlı Şahinbaş Köksal, Trans.). Turkey/Istanbul: Hümanist Press.

Uyargil, C. (2008). *İşletmelerde Performans Yönetimi Sistemi*. Istanbul, Turkey: Arıkan Press.

Uyargil, C., Sadullah, O., Acar, A. C., Ozcelik, A. O., Dundar, G., & Tuzuner, L. (2006). *Cranfield International Strategic Human Resource Management Research Report of Turkey*. Istanbul: Donence Publishing

Voermans, M., & Veldhoven, M. (2007). Attitude Towards E-HRM: An Empirical Study at Philips. *Personnel Review*, *36*(6), 887–902. doi:10.1108/00483480710822418

Walker, A. J., & Perrin, T. (2001). *Web-Based Human Resources*. New York: McGraw-Hill.

Yin, R. K. (1994). Application *of Case Study Research.* Thousand Oaks, CA: Sage Publications.

Zhang, L., & Wang, H. (2006). Intelligent Information Processing In Human Resource Management: An Implementation Case in China. *Expert Systems: International Journal of Knowledge Engineering and Neural Networks*, *23*(5), 356–369. doi:10.1111/j.1468-0394.2006.00416.x

## ADDITIONAL READING

Bondarouk, T., Ruël, H., & Heijden, B. V. D. (2009). E-HRM Effectiveness in a Public Sector Organization: a Multi-Stakeholder Perspective. *International Journal of Human Resource Management*, *20*(3), 578–590. doi:10.1080/09585190802707359

Ceriello, V. R., & Freeman, C. (1998) *Human Resource Management Systems: Strategies,Tactics, and Techniques.* USA: John Wiley & Sons.

Chapman, D. S., & Webster, J. (2003). The Use of Technologies in the Recruiting, Screening, and Selection Processes for Job Candidates . *International Journal of Selection and Assessment*, *11*(2/3), 113–120. doi:10.1111/1468-2389.00234

Collins, C. J., & Smith, K. G. (2006). Knowledge Exchange and Combination: The Role of Human Resource Practices in The Performance of High-Technology Firms . *Academy of Management Journal*, *49*(3), 544–560.

Davenport, T. H. (1994). Saving IT's Soul: Human-Centered Information Management. *Harvard Business Review*, *72*, 119–131.

Debowski, S. (2006). *Knowledge Management*. Singapore: John Wiley&Sons.

Dewett, T., & Jones, G. R. (2001). The Role of Information Technology in the Organization: A Review, Model and Assessment. *Journal of Management*, *27*, 313–346. doi:10.1016/S0149-2063(01)00094-0

Farazmand, Ali (2004) Innovation in Strategic Human Resource Management: Building Capacity in the Age of Globalization. *Public Organization Review: A Global Journal*, 4, 3-24.

Gasco, J. L., Llopis, J., & Gonzales, M. R. (2004). The Use of Information Technology in Training Human Resources: An E-learning Case Study. *Journal of European Industrial Training*, *28*(5), 370–382. doi:10.1108/03090590410533062

Gueutal, H., & Stone, D. L. (Eds.). (2005). *The Brave New World of e-HR: Human Resources in the Digital Age.* San Francisco: Pfeiffer.

Holsapple, C. W., & Lee-Post, A. (2006). Defining, assessing, and promoting e-learning success: An information systems perspective. *Decision Sciences Journal of Innovative Education*, *4*(1), 67–85.

Hooi, L. W. (2006). Implementing E-HRM: The Readiness of Small and Medium Sized Manufacturing Companies in Malaysia. *Asia Pacific Business Review*, *12*(4), 465–485. doi:10.1080/13602380600570874

Hopkins, B., & Markham, J. (2003). *e-HR: Using Intranets to Improve the Effectiveness of Your People*. Hampshire, UK: Gower Publishing.

Jennex, M. E. (Ed.). (2005). *Case Studies in Knowledge Management.* Hershey, PA: Idea Group Publishing.

Kulik, C. T., & Perry, E. L. (2008). When Less is More: The Effect of Devolution on HR's Strategic Role and Construed Image. *Human Resource Management*, *47*(3), 541–558. doi:10.1002/hrm.20231

Lippert, S. K., & Swiercz, P. M. (2005). Human Resource Information Systems (HRIS) and Technology Trust. *Journal of Information Science*, *31*(5), 340–353. doi:10.1177/0165551505055399

Martinez-Fierro, S., Mesina-Garrido, J. A., & Ruiz-Navarro, J. (2006) *Utilizing Information Technology in Developing Strategic Alliances Among Organizations.* Hershey, PA: Idea Group Publishing.

Pershing, J. A. (2006). *Handbook of Human Performance Technology*. San Francisco: Pfeiffer.

Rampton, G. M., Turnbull, I. J., & Doran, J. A. (1999). *Human Resource Management Systems: A Practical Approach.* New York: Carswell.

Steinbuch, P. I. (2005). e-HR:Using Intranets to Improve the Effectiveness of Your People. *Leadership and Organization Development Journal*, *26*(1).

Strohmeier, S. (2009). Concepts of E-HRM Consequences: a Categorisation, Review and Suggestion. *International Journal of Human Resource Management*, *20*(3), 528–543. doi:10.1080/09585190802707292

Torres-Coronas, T., & Arias-Oliva, M. (Eds.). (2004). *E-Human Resources Management: Managing Knowledge People*. Hershey, PA, USA: Idea Group Publishing.

Ulrich, D. (1997). *Human Resource Champions*. Boston: Harvard Business School Press.

Ulrich, D., & Brockbank, W. (2005). *The HR Value Proposition*. Cambridge, MA: Harvard Business School Press.

Wang, Z. (2005). Organizational Effectiveness Through Technology Innovation and HRM Strategies. *International Journal of Manpower*, *26*(6), 481–487. doi:10.1108/01437720510625403

Wolff, A., Gümüş, S., Çalışkan, S., & Ürü, O. The Impact of The Knowledge-Based Economy on the Universities In Turkey, *International Research Conference*, 13-15 June 2008, Burgas Free University, Burgas, Bulgaria, proceedings pp. 30-36.

## KEY TERMS AND DEFINITIONS

**E-Business:** e-business may be defined as the new business strategy that redesigns the old business models and differentiates with the use of information and communication technologies (ICT) in support of all the activities of business. E-business software requires special technical standards and provides the integration of intra and inter firm business processes as well as external relationships with customers and partners.

**E-HRM:** E-HRM is the planning and application of web-based-technology channels for implementing HR strategies, policies and practices in organizations.

**EHRMS:** Electronic human resource management systems refers to the systems and processes at the intersection between human resource management (HRM) and information technology(IT).

**HRMS:** Human Resource Management system or also called Human Resource Information System(HRIS) consists of software, hardware and systematic procedures used to acquire, store, analyze, report and distribute relevant demographic and performance information about an organization's human resources.

**Human Resource Management:** HRM is the process of managing the most valued assets of the organization; the employees. HRM include functions as job analyzing, recruitment and selection, staffing, training, performance management, career development, compensation, security and health issues of the workforce, and coordinates them in tune with the job and organizational requirements.

**Information System:** Information system or information technology refers to the specific software platforms and databases that are used to store data records in a computer system and manages all major functions of the organization provided by the softwares such as SAP, PeopleSoft etc.

**Software Program:** It may be defined as the instructions for computers to perform specific tasks.

# Chapter 53
# ARIBA:
## A Successful Story in E-Commerce

**Zhongxian Wang**
*Montclair State University, USA*

**Ruiliang Yan**
*Indiana University Northwest, USA*

**James Yao**
*Montclair State University, USA*

## ABSTRACT

*Ariba services major corporations, and provides services to smaller companies as well. In this chapter, the authors will examine how Ariba, a small startup company during the Internet boom of the 90's was able to overcome hardships, survive market and industry downturns, and continue to thrive and survive in such a competitive industry. The authors will also review major events and innovations that helped the company to grow and succeed rather than to fail.*

## INTRODUCTION

Ariba, Inc. was born during the dot-com bubble, a star amid countless other e-commerce companies. In the universe of corporations, many bright meteors, like Commerce One, didn't shine too long. However, the interesting evolution of Ariba, from a pioneer to a sufferer to a survivor, has taught us much about survival in the competitive business to business (B2B) software industry. Ariba's software would help many companies save money on their procurements, and control expenses besides payroll. Ariba promised to help companies improve their bottom line. Many of Ariba's clients today hold positions on the coveted Fortune 100 list. Going public in 1999, Ariba's stock price at one time reached $259 per share. At the time, Ariba was still getting their feet wet; they had not yet made a profit. The next year their stock reached $168.75, but a negative turn in the economy lay ahead. Many companies began to cut back on investments and in just 9 months Ariba lost 95% of their value. This would be disastrous to any company, and would be the downfall of most, but Ariba made some critical key decisions that helped continue its leadership in the B2B world. They are one of the few companies to not only survive the burst of the dot-com bubble, and to this day to remain a successful company.

DOI: 10.4018/978-1-61520-611-7.ch053

## BACKGROUND

E-commerce was in many ways revolutionized by Ariba Inc, a leading independent company in the sphere of B2B commerce network providers. The company has been evolving constantly, in cooperation with leading companies in the industry, in order to deliver E-commerce platform products to its customers/clients. Its value chain model has been able to develop business relationships further than anticipated, the results of which made it a top 40 Fortune 500 company.

Ariba has overcome many obstacles, including lawsuits, changing customer requirements, and organizational restructuring, however still managed to remain a leader in its specific niche area. They have done so by delivering solutions and services that meet customers' expectations, and have been able to cope with intense competition by keeping up with today's technologies as well as developing solutions for tomorrow. Ariba was founded in Sunnyvale CA, in September 1996, by seven men, the most influential individual being Steven Krach. Krach's early career accomplishments included being one of the youngest vice presidents General Motors (Ariba, 2008). Having struggled with the procurement process in his time there; it became a precursor and impetus for the birth of Ariba. Krach and his associates brainstormed and came up with the idea of automating the purchasing of common supplies and services. This is a seemingly simple idea, but one with a huge demand and potential.

After three months of intensive research, which included meeting with 60 Fortune 500 companies, Ariba had a prototype developed and ready for their initial marketing campaign. Having signed software licensing deals with Cisco Systems, Advanced Micro Devices and Octel Communications, prior to software completion, the pieces were put into place for the launch of their product. Among the early competitors to Ariba were Commerce One, Oracle, I2, and PeopleSoft, Inc.

The objective was to become a powerhouse company with the means and resources to provide procurement software and network consulting services, enabling corporations to manage their spending more effectively. This included essentially all non payroll expenses associated with running a business. Ariba offered their clients real-time data by providing information over the Internet. These applications were used in conjunction with the *Ariba Supplier Network* to purchase goods and services. Ariba is customer driven, and offered full support, including technical support, implementation, training, and consulting. E-payment and service agreements were made with American Express and Bank of America. All of these were considered large and bold undertakings for a young startup company at that time. In June of 1999, Ariba went public at a modest \$23 per share, however traded as high as \$259 per share at times later that year (Schneider, C. M Bruton, 2008; Haksoz and Seshadri, 2007). A stunning success for a three year old company which had yet to turn a profit, it benefited from being a "first mover" in the business. However, other Internet start-up companies were beginning to offer similar software and services. Over time, smaller companies began emerging with websites that provided a place to manage procurement, some with lower costs and fees. Facing challenges in the market, Ariba began to be faced with difficult challenges and had to make major decisions in order to stay in business.

Ariba finally saw a profit of \$10 million in December of 2000, which also included the completion of three *acquisitions*. Soon after, in 2001, the economy began to weaken in a downward spiral and Ariba's stock plummeted 95%, making a business overhaul necessary. Ariba decided to take drastic cost-cutting measures, cutting about a third of their staff. Because of their specialized and niche product line, their business was able to continue and survive the setbacks faced by other Internet software companies. Krach resigned as CEO in 2001, but stayed on chairman and appointed a CEO that would later cost the company much money and negative publicity. The bursting of the dot-com "bubble" marked the beginning of a relatively mild yet rather lengthy early 2000s recession (Marshall, 2001; Sahay, 2007). In time, Ariba, along with the rest of the B2B business community ran into two big problems. First, the brick-and-mortar Old Economy was stable and could adjust more readily to economic downturns. Secondly, companies were interested in saving transaction fees by using alternate means of such as word processors instead of using costly B2B networks. However, they were less interested in cutting their savings in terms of transaction fees (Cerquides, López-Sánchez, Reyes-Moro, & Rodríguez-Aguilar, 2007).

Still, Ariba persisted and would once again regain its position as a leader in the B2B procurement industry. The firm made adjustments where necessary to still deliver the goods to their clients, without sacrificing their own bottom line. According to the current CEO, Bob Calderoni, Ariba is well positioned in the spend management market and will continue to grow in the current tough global economy.

The following sections explore the internal (*adaptations to a competitive environment, acquire to advance, consulting adds value, emphasis on the customer*) and external (*severe competition, high-priced software, regulator's investigation, unhappy customers*) factors that affect the company's struggles and challenges.

## INTERNAL FACTORS

### Adaptations to a Competitive Environment

At the height of the e-procurement frenzy, two companies dominated the B2B space: Commerce One and Ariba. With the near-collapse of the original B2B procurement model, both companies sought new niches. Commerce One moved towards web services in an attempt to seek viable markets. Ariba, meanwhile, emphasized enterprise spending management (Kinsey, 2004). Ariba strongly believed that a software firm's role is to be a software tool provider. As the B2B world divided into industry sponsored exchanges and independent marketplaces, Ariba avoided involvement in managing its customers' exchanges. Conversely, Commerce One believed that software makers had to do more than simply provide software tools. They had formed strategic partnerships with its customers and helped manage their online marketplaces (Anderson, Opie, & Watton, 2003; Bannan, 2008). It also directed its customers towards an international trading network in order to build critical mass and facilitate e-commerce between them.

As a new CEO, Calderoni monitored the external environment, where a fundamental shift in the marketplace existed, and responded promptly to adjust the company's product offering. He believed that B2B e-business had a direct and indirect impact on all functional areas, and those linkages with a company's supply chain system was critical. In effect, Ariba was changing its focus from e-procurement, to offering products that can increase customer satisfaction by solving a variety of "spend-related" problems faced by corporations (Tadeschi, 2008).

With the concept of division of labor as a microeconomic view, Calderoni added a purchasing system, general ledger, and field system into Ariba's line of products. The added features in the company's products were favored by Ariba's existing customers in the auto, chemical, and manufacturing industries due to the ease of system comparability. The need to transfer data from legacy systems enabled these customers to remove outdated and inaccurate data from their systems and which also helped to improve relationships with their customers.

## Acquire to Advance

According to Krach, a major component of Ariba's business model is partnering followed by organic growth and acquisition, and so the company continues to follow this basic approach to help ensure the firm's success. Ariba acquired companies that had the technology and resources they needed to survive, instead of taking the time to develop them in-house. By acquiring Agile Software, a leading provider of Internet-based B2B communication technology, Ariba was able to add collaboration capability to its services, allowing its customers to communicate and coordinate product supply, design, and other specialized electronic-commerce functions. Mr. Calderoni implemented an aggressive acquisition strategy that significantly expanded Ariba's technology offerings and service capabilities, and positioned the company as a recognized leader in its market. One goal was to secure top Fortune 10 companies and Global 500 companies as customers.

In 2004, Ariba acquired Alliente Inc. and FreeMarkets Inc. to link their spend management software with its existing capacities as a B2B procurement hub. The acquisition of FreeMarkets increased Ariba's offerings by providing global supply management software and services. This acquisition also positioned Ariba as a serious contender in the automotive industry, adding General Motors Corp., Daimler-Chrysler AG and Ford Motor Co. to their customer base. By acquiring Alliente, Ariba expanded its spend management and procurement capabilities to include a procurement out-sourcing provider (Hosford, 2007).

In December 2007, Ariba announced that it had completed the acquisition of Procuri, Inc. a privately held provider of on-demand supply management solutions, rounding out Ariba's offerings that help companies automate the procurement process. According to Ariba CEO Bob Calderoni, more than 70% of Procuri's 300 customers have under \$5 billion in revenues. As a result, this deal also gave Ariba greater access to midmarket customers (Anonymous, 2007).

## Consulting Adds Value

Calderoni believed that Ariba has survived by expanding beyond software that focused mainly on transactions, to encompassing additional facets of the buying process. Calderoni hired hundreds of consultants to advise companies on how to buy goods and services cheaply, using Ariba's software. Although consulting is less profitable than selling software, Calderoni predicted he can successfully combine the two as an integrated set of offerings. While consultants coach Ariba's clients on how to use the software effectively, Ariba's clients can also reply on Internet-based purchasing systems to help them buy direct materials that are core to their company's manufacturing processes.

In order to extend Ariba's consulting services, which in 2004 accounted for nearly half of the company's \$323 million in sales, Ariba made consultants available via email and phone for a fraction of the price that is charged to the larger companies who require dedicated consultants through in site visits.

## Emphasis on the Customer

In 2001, investors were looking for a change in leadership at Ariba after the firm missed revenue and earnings projections by a wide margin. Ariba moved Keith Krach out of the CEO position, filling the post with the company's President and COO, Larry Mueller. Mueller entered the position with a new strategy: to halt the company's current plans to enter new markets, and instead opting to add new features, including electronic payment and invoicing, to its existing e-procurement and auction applications. Mueller heightened the focus on improving e-procurement applications by making heavy investments in existing e-procurement and sourcing platforms; and building technology around the key interactions that enterprises have with trading partners.

Mueller remained focused on bolstering Ariba's role as a traditional B2B transaction platform. Ariba announced plans to invest heavily in its Ariba *Commerce Services Network* and its network-centric applications, including *Network Connect*, which allowed non-Ariba customers to come into the Ariba services network and conduct business or procure services. The company also organized its development, sales, and marketing staff to focus on specific industries. According to Mueller, "Customer ROI is the focus." A focus on international expansion has boosted revenue from outside the US from 10% in the third quarter 2000 to 25% in the same period for 2001 (Purdum, 2007). Ariba is trying to rebuild its fortunes as public marketplaces that use its technology are struggling - some economists feel this is due to the fact the industry just isn't ready for e-commerce.

Since joining the company in 2000, new (and current) chairman and CEO of Ariba, Mr. Calderoni has successfully transformed Ariba from a narrowly focused e-procurement vendor to a comprehensive spend management solutions provider that companies of all sizes rely on to transform the way they do business globally. Under Mr. Calderoni's leadership, Ariba has led the way in developing and delivering innovative solutions that combine technology, commodity expertise and services to help companies streamline the procurement process and drive bottom-line results.

## EXTERNAL FACTORS

### Severe Competition

Simply being a dot-com business survivor, however, would not ensure its continued existence and profitability, and Ariba was at risk of losing business to the likes of other competitors such as SAP and Oracle. SAP, a German enterprise resource planning software maker, joined this market and signed on with Hewlett-Packard for a product called mySAP.com e-business solutions. In addition, it built a marketplace for chemical and pharmaceutical firms by educating them on mySAP.com, and with the result of installing a large SAP user base among Fortune 500 companies.

Nevertheless, Oracle had already anticipated a shift in the market and made plans to capitalize on it. Right now, the procurement sector is dominated by leading software companies Ariba and Commerce One. But as the slowdown in the U.S economy continues, Oracle is hoping the opportunity for companies like Ariba will start to shrink as users look to more established ones, like Oracle, for an all around e-commerce package (Arora, Greenwald, Kannan, Karthik, & Krishnan, 2007). Ariba had in fact provided Oracle with an opportunity to gain market share when it cut a third of its workforce and announced reduced earnings during economic recent downturns.

Ariba recognized that to remain competitive, it had to address the problem of hidden costs associated with the products they sell, in addition to the price they charge for the software itself within the supply chain, especially when the product was in the later stage of its cycle. When a company does not paying attention to the hidden costs of new software implementation, it can creep up and well-intentioned efforts can be result in the form of financial penalties (Angeles & Nath, 2007; Brown, 2008).

By August 2008, the market for supply chain management (SCM) software market has grown. Worldwide spending on SCM solutions reached $6 billion in 2007, which was up 17.6% from 2006. SCM Technologies are well-positioned to address the economic realities facing worldwide markets where costs are skyrocketing while competition and customer demands are intensifying (Eschinger, 2008). A number of the SCM solution vendors are merging, and expanding their capabilities within the realm of supply chain technologies. In comparison, Ariba's 2007 revenue was $160.3 million, which significantly trailed behind Oracle and SAP, who reported $955.2 million and $1,334.4 million in revenue, respectively, showing that the threat of these products cutting into Ariba's bottom line is a real one (Orme & Etzkorn, 2007).

## High-Priced Software

Without a doubt, e-procurement is rising substantially among the nation's largest 500 companies. Well-financed corporations are willing to invest in Internet software and technology that can reduce the inefficiency associated with the purchasing and buying processes. The use of this software can help companies to track spending and make sure they purchase products in accordance with contracts they have negotiated with suppliers. In fact, businesses that spend billions each year on supplies can often save tens of millions in costs by implementing such technology. However, it's only the large firms that can devote the time and money to installing such systems, which frequently required that suppliers link to such systems as well. Since the software is generally expensive and can be complicated to install on the customer's system, for small- and medium-sized businesses facing an uncertain economy, investments of this magnitude are can be difficult to justify.

Ariba took advantage of this situation, and in 2005 announced a strategy to sell its software and services to smaller companies on an on-demand basis, so they can buy supplies more efficiently online, as well. Ariba reshaped its software system so its customers can plug into Ariba's software through the Internet instead of installing it on their own systems. One major benefit of this approach, Mr. Calderoni said, is that Ariba can sell software to procurement managers and others in charge of spending, without involving the company's information technology staff.

## Regulator's Investigation

In early 2003, Ariba became under investigation by the Security and Exchange Commissions (SEC). The reason for the investigation was linked to Ariba's accounting errors, doubtful partner deals, and questionable e-payments items including chartered airplanes. Among the specific allegations were that Ariba failed to record a $10 million payment from chairman Keith Krach to former chief executive Larry Mueller as an expense. The restatements are unusual because the chairman -- not the company -- covered the expense (Lau and Wang, 2007). Then three weeks later, Ariba had decided to do the same for $1.2 million in chartered jet services that was considered as Krach's compensation to Mueller, who subsequently left Ariba in July 2001. The problem is that United States laws and regulations require that payments by a principal holder to executives be treated as expenses paid on behalf of the company.

In addition, Ariba reported an additional $7.5 million to its expenses. In 2000, Ariba acquired TradingDynamic Inc., Tradex Technologies Inc., and SupplierMarket.com, and it reclassified stock options, or goodwill, that it gave to employees of these accompanies as a compensation expense. So by combining all of these expenses, the results were 18.7 million of added expenses. Ariba was aware that the regulator had begun an informal inquiry into its accounting practices after the firm said it would restate its earnings for 10 quarters.

## Unhappy Customers

Ariba was subject to bad publicity after sending out automated emails to mid-size suppliers announcing their accounts had been upgraded to Premier level status. The email listed premier supplier benefits as well. However, the email also informed them that as a Premier Member, they were now required to pay associated annual fees. Many of the small and mid-size companies viewed this as a marketing ploy and felt they should not all of a sudden pay fees associated with their membership (Eschinger, 2008).

## FUTURE RESEARCH DIRECTIONS

A number of the challenges Ariba faced from its start to the present time allowed them to evolve over time. Ariba has been able to face these challenges head on and continue to be the leading B2B software provider for the past 11 years. During the collapse of the dot-com era Ariba suffered a blow economically, as did others in the industry, and in effect had reduced the company's size by half (Lau and Wang, 2007), as did everyone else. However, they were able to build upon their core competencies and maintain key personnel, managing knowledge that formed the basis of their competitive advantage.

They were also able to stay ahead of the competition through strategic mergers which enhanced their products and services. These mergers should be credited to its CEOs, Presidents, and Board of Directors. Ariba would continue to enhance its products with the availability of constant upgrades and varieties of new products.

With incredible technology growth and its global demand, came the opportunity for Ariba to expand and acquire a more precise goal and target. Ariba has painted a vision of a world in which spend management would be affordable and available to all types of companies, and released an initial set of integrated, on-demand solutions designed to make this happen (Purdum, 2007). In keeping this promise, Ariba would make on-demand products and subscription-based purchasing software and services available to meet the needs of those mid-market customers not wanting to make huge upfront investments. This strategy of meeting the needs of various types of clients was in some way risky, but Ariba has thrived on making strategic, yet controversial decisions throughout the years. Having gone through ups and downs during the years, they still managed to regain a leadership position even though markets and needs have evolved and changed. Overall, they have been able to provide customers with superb services and innovative products, and reliability is what keeps old customers, and helps to bring in new customers.

There is never a guarantee of success in business. Successful companies also must be surrounded by a committed and devoted management team, supported by well-trained employees. Are these together a recipe for success? We may never know for sure, but taking advice from a company which has been successful since its start, weathered some very tough times, and was able to survive and stay above the rest before seeking out the next realm of opportunity, is certainly an approach that appears to be sound.

## CONCLUSION

Ariba achieved recognition for its *Supplier Network*, an e-business center where millions of buyers and suppliers can electronically transact business online, with the goal of more efficient procurement. In addition, Ariba developed spend management software, and is taking the network mainstream. Ariba's application-driven strategy of an open platform, hosted and implemented by partners with vertical-market domain expertise, has helped to secure them a dominant position in the B2B e-commerce application marketplace.

It is interesting to note that while many firms who came up around the time of Ariba and offered competing solutions, Ariba is one of the few that has survived and thrived, using continually new strategies to stay in business, providing a better customer experience, and utilizing advances in technology and ideas that no other companies dared to try. Ariba has been, and remained a pioneer and a leader in an exceedingly competitive and changing marketplace. Due to increased globalization and deregulation, for a company to succeed, it must have leverage over the impact of competitive forces. Ariba has done a great job in setting themselves apart from their competitors by strategically aligning themselves with their partners, and also expanding its service offerings to a wider range of customers. Ariba's software offerings help companies focus on profitability, and together with its wide array of service options, are customizable for both larger and smaller companies. The firm's products are concrete and customizable, depending on a client's needs. In addition, the product offerings are offered on a common platform, allowing information to travel accurately and quickly through the supply chain.

## REFERENCES


Anderson, J., Opie, G., & Watton, J. (2003). The corporate spend agenda preview. *Business Strategy Review*, *14*(2), 5–7. doi:10.1111/1467-8616.00252

Angeles, R., & Nath, R. (2007). Business-to-business e-procurement: success factors and challenges to implementation. *Supply Chain Management*, *12*(2), 104–115. doi:10.1108/13598540710737299

Anonymous, . (2007). Moving forward by working backwards. *Preview Healthcare Purchasing News*, *31*(7), 64–66.

Ariba, Inc. (2008). Preview contract management. *Resource Guide*, (Supplement), 62.

Arora, A., Greenwald, K., Karthik, R., & Krishnan, R. (2007). Effects of information-revelation policies under market-structure uncertainty. *Management Science*, *53*(8), 1234–1248. doi:10.1287/mnsc.1060.0688

Bannan, K.J. (2008). Ariba creates controls for who sends marketing e-mails when. *B to B Chicago, 93*(10), 22.

Brown, D. (2008). It is good to be green, Environmentally friendly credentials are influencing business outsourcing decisions. *Strategic Outsourcing: an International Journal*, *1*(1), 87. doi:10.1108/17538290810857493

Cerquides, J., López-Sánchez, M., Reyes-Moro, A., & Rodríguez-Aguilar, J. A. (2007). Enabling assisted strategic negotiations in actual-world procurement scenarios. *Electronic Commerce Research*, *7*(3-4), 189–220. doi:10.1007/s10660-007-9007-4

Eschinger, C. (2008, August). No recession in the supply chain arena. *Industry Week*, *257*(8), 56.

Haksoz, C., & Seshadri, S. (2007). Supply chain operations in the presence of a spot market: a review with discussion. *The Journal of the Operational Research Society*, *58*(11), 1412–1429. doi:10.1057/palgrave.jors.2602401

Hosford, C. (2007). Ariba pins turnaround hopes on keeping in touch with customers. *B to B Chicago, 92*(1), 18.

Kinsey, E. P. (2004, Fall). Where has AU the common sense gone? *Mid-American Journal of Business*, *19*(2), 7–11.

Lau, K.-K., & Wang, Z. (2007). Software component models. *IEEE Transactions on Software Engineering*, *33*(10), 709. doi:10.1109/TSE.2007.70726

Marshall, J. (2001, May). A foundation to build on. *Preview By Financial Executive*, *17*(3), 7–13.

Orme, A. M., & Etzkorn, L. H. (2007). A parallel methodology for reduction of coupling in distributed business-to-business e-commerce transactions. *Journal of Electronic Commerce in Organizations*, *5*(3), 52–67.

Purdum, T. (2007). Online marketplace evolution: In their infancy, many online marketplaces kept their focus too narrow. Those that saw the big picture survived. *Industry Week*, *356*(1), 18–19.

Sahay, A. (2007). How dynamic pricing leads to higher profits. *MIT Sloan Management Review*, *48*(4), 53.

Schneider, G. P., & Bruton, C. M. (2008). Using portal web sites in the purchasing function. In *Proceedings of Allied Academies International Conference. Academy of Information and Management Sciences, 12*(2), 42-45.

Tadeschi, B. (2008, November 14). A software strategy helps the little guy buy smarter. *The New York Times*, C9(L).

## ADDITIONAL READING

Angeles, R., & Nath, R. (2007). Business-to-business e-procurement: success factors and challenges to implementation. *Supply Chain Management*, *12*(2), 104. doi:10.1108/13598540710737299

Brown, D. (2008). It is good to be green, environmentally friendly credentials are influencing business outsourcing decisions. *Strategic Outsourcing: an International Journal*, *1*(1), 87. doi:10.1108/17538290810857493

Cerquides, J. (2007). Enabling assisted strategic negotiations in actual-world procurement scenarios. *Electronic Commerce Research*, *7*(3-4), 189–221. doi:10.1007/s10660-007-9007-4

Dai, Q. Z., & Kauffman, R. (2006). To be or not to B2B: Evaluating managerial choices for e-procurement channel adoption. *Information Technology and Management*, *7*(2), 109. doi:10.1007/s10799-006-8103-9

Degwekar, S. (2007). Constraint-based brokering (CBB) for publishing and discovery of web services. *Electronic Commerce Research*, *7*(1), 45–57. doi:10.1007/s10660-006-0062-z

Elmaghraby, W. (2007). Auctions within E-Sourcing events. *Production and Operations Management*, *16*(4), 409–422.

Gayton, C. (2006). Alexandria burned - securing knowledge access in the age of Google. *Vine*, *36*(2), 155. doi:10.1108/03055720610682960

Giampetro, C., & Emiliani, M. (2007). Coercion and reverse auctions. *Supply Chain Management*, *12*(2), 75. doi:10.1108/13598540710737253

Haksoz, C., & Seshadri, S. (2007). Supply chain operations in the presence of a spot market: A review with discussion. *The Journal of the Operational Research Society*, *58*(11), 1412–1429. doi:10.1057/palgrave.jors.2602401

Hartley, J. (2006). Exploring the barriers to the adoption of e-auctions for sourcing. *International Journal of Operations & Production Management*, *26*(1/ 2), 202–221. doi:10.1108/01443570610641675

Henry, C. (2007). Strategy in the media. *Strategy and Leadership*, *35*(4), 52. doi:10.1108/10878570710761417

Holmqvist, M., & Pessi, K. (2006). Agility through scenario development and continuous implementation: a global aftermarket logistics case. *European Journal of Information Systems*, *15*(2), 146. doi:10.1057/palgrave.ejis.3000602

Howard, M. (2005). Collaboration and the '3DayCar': a study of automotive ICT adoption. *Journal of Information Technology*, *20*(4), 245. doi:10.1057/palgrave.jit.2000050

Huang, G. (2007). Do It Yourself (DIY) Portales for developing e-business solutions for small and medium enterprises. *Journal of Manufacturing Technology Management*, *18*(1), 72. doi:10.1108/17410380710717652

Kim, M., & Ahn, J. (2006). Comparison of trust sources of an online market-maker in the e-marketplace: buyer's and seller's perspective. *Journal of Computer Information Systems*, *47*(1), 84–95.

Kulp, S. L. (2006). Using organizational control mechanisms to enhance procurement efficiency: How GlaxoSmithKline improved the effectiveness of e-procurement. *Interfaces*, *36*(3), 209–221. doi:10.1287/inte.1060.0209

Kwasnica, A., & Katok, E. (2007). The Effect of Timing on Jump Bidding in Ascending Auctions. *Production and Operations Management*, *16*(4), 483–494.

Lau, K., & Wang, Z. (2007). Software component models. *IEEE Transactions on Software Engineering*, *33*(10), 709. doi:10.1109/TSE.2007.70726

Orme, A., & Etzkorn, L. (2007). A parallel methodology for reduction of coupling in distributed business-to-business e-commerce transactions. *Journal of Electronic Commerce in Organizations*, *5*(3), 52–67.

Raja, J., & Velmurgan, S. (2008). E-payments: Problems and prospects. *Journal of Internet Banking and Commerce*, *13*(1), 1–18.

Ratnasingam, P. (2007). A risk-control framework for e-marketplace participation: the findings of seven cases. *Information Management & Computer Security*, *15*(2), 149. doi:10.1108/09685220710748029

Rothkopf, M., & Whinston, A. (2007). On e-auctions for procurement operations. *Production and Operations Management*, *16*(4), 404–408.

Sahay, A. (2007). How dynamic pricing leads to higher profits. *MIT Sloan Management Review*, *48*(4), 53.

Sandholm, T. (2006). Changing the game in strategic sourcing at Procter & Gamble: expressive competition enabled by optimization. *Interfaces*, *36*(1), 55–71. doi:10.1287/inte.1050.0185

Schneider, G., & Bruton, C. (2008). Using portal web sites in the purchasing function allied. *Academies International Conference. Academy of Information and Management Sciences, 12*(2), 42-46.

Sia, S., & Soh, C. (2007). An assessment of package-organisation misalignment: Institutional and ontological structures. *European Journal of Information Systems*, *16*(5), 568–583. doi:10.1057/palgrave.ejis.3000700

Sledgianowski, D. (2006). Decisions in IT infrastructure integration: A case study in a global chemical company research note. *Journal of Information Technology Case and Application Research*, *8*(1), 67–72.

Smart, A. (2008). E-business and supply chain integration. *Journal of Enterprise Information Management*, *21*(3), 227. doi:10.1108/17410390810866619

Vaidya, K. (2006). Critical factors that influence e-procurement implementation success in the public sector. *Journal of Public Procurement*, *6*(1/2), 70–99.

## KEY TERMS AND DEFINITIONS

**Acquisitions:** Acquiring control of a corporation, called a target, by stock purchase or exchange, either hostile or friendly.

**Business to Business (B2B):** The exchange of products, services, or information between businesses.

**E-Commerce (electronic commerce or EC):** The buying and selling of goods and services on the Internet.

**E-Payments (online payments, Electronic Payments, Internet Payments, Web Payments, and e Payment):** An electronic payment made via a web browser for goods and services using credit or debit cards.

**E-Procurement:** A system utilizing Internet technology to streamline the purchases of goods and products to reduce costs.

**Supplier Network:** It works with a network of screened and qualified small-scale producers and committed medium-sized suppliers.

**Supply Chain Management (SCM):** The process of strategically managing flows of goods, services and knowledge, along with relationships within and among organizations, to realize greater economic value.

# Chapter 54
# Integrated Optimal Procedure of Internet Marketing

**Lan Zhao**
*Chongqing University, China & SUNY/College at Old Westbury, USA*

## ABSTRACT

*The article focuses on how to integrate all the phases of Internet marketing process into a seamless pipeline. The current techniques used in three main phases: (1) customer targeting; (2) ads piece designing; and (3) marketing budget allocation, are described in detail to reveal the cohering inside of searching optimal marketing strategies.*

## INTRODUCTION

The internet marketing is a comprehensive process that requires the coordination and efficiency of all the marketing departments. The functionalities of the marketing departments include, but are not limited to, identification of consumers, production of ads pieces, and selection of ad strategies.

Internet medium offers a great advantage in data collection. Abundant data allows us to measure the effectiveness of marketing efforts, and further, to model the advertise response as a function of advertising efforts for optimal strategy. Thus, internet marketing is special from the traditional one in the sense that it is data driven; it is able to take advantage of mathematical methods and information technology. In this article, we pinpoint at main phases of the internet advertising process – customer targeting, internet ads production, and optimal budget allocation in internet media and based on them to show the production process of internet marketing which employs data mining, statistic and mathematical modeling, and mathematical algorithms.

The article is organized as follow: (1) Introduction section describes the general perspective of the article; (2) Background section briefs the industrial and academic efforts by others that are related to my position on the topic; (3) Operation Procedure and the Quantitative Method for Each of the Subroutines section describes in detail the mathematical

DOI: 10.4018/978-1-61520-611-7.ch054

models, theorems, and the methods to achieve the goals of internet marketing; (4) Future Research Direction section outlines the trend and remain issues of the topic in this article; and finally (5) is the Conclusion section.

## BACKGROUND

Internet marketing technique consists of database marketing, information depository, statistical modeling, mathematical programming, and search and match techniques.

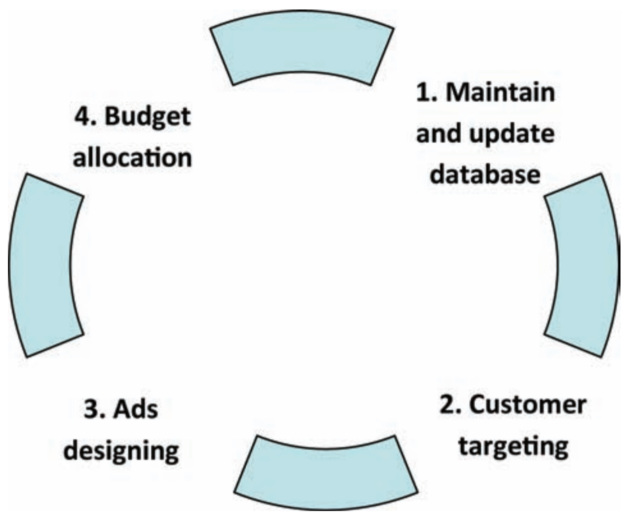
Database marketing started in 1990s. With the development of computer information science and internet, it is now a well developed technique that is used in all kind of marketing. (Jackson & Wang, 1994) The database marketing procedure starts with customer database, and then uses statistical method such as regression, clustering, tree, or neural networking to segment and profile customers according to their demographic, behavioral, and geographic attributes. As result, the targeted customers are identified. Since internet marketing is also data rich, customer targeting functionality of database marketing is adapted in the internet marketing procedure.

After the customers are segmented, next issue is how to communicate with them. On July 2, 2007 Yahoo launched its patent-pending tool, Yahoo! SmartAds (2007) to enhance its online advertising effectiveness. SmartAds takes advertisers' creative campaign elements, automatically converts the elements and offerings into highly customized and relevant display ads by delivering banner ads according to the web surfer's age, gender, location and online activities. Although the methodology behind SmartAds is not fully known by the public and the academic community, people believe that it uses behavioral, demographic and geographic segmentation capabilities for targeting (Story, 2007). SmartAds is currently in its pioneer stage where only Yahoo's travel portal is using it. On other hand, Google's Adsense is a tool to display relevant ads on a webpage. With this tool, the content of a webpage is analyzed to determine a list of one or more topics associated with that webpage. An advertisement, submitted by advertisers, is considered to be relevant to that webpage if it is associated with keywords belonging to the list of one or more topics. One or more of these relevant advertisements may be provided for rendering in conjunction with the webpage or related web pages. The dominant industrial perspective is how to take advantage of searching technologies employed by Search Engines (Langville and Meyer (2006)).

In the academic community, there have been efforts devoted to studying internet marketing via mathematical programming, game theory, statistic predicting, and variational inequalities. In Chickering and Heckerman (2003), to maximize the click-through rate, given inventory-management constraints in the form of advertisement quotas, a system using predictive segments, in conjunction with a linear program to perform the constrained optimization, is developed. Kazienko and Adamski (2007) created the AdROSA system for automatic web ads personalization, which integrates web usage and content mining techniques to better target customers. Zhao and Nagurney (2006, 2008) used variational inequalities in conjunction with mathematical programming for the optimal allocation of marketing budget to variety of market places.

All the above efforts certainly have advanced internet marketing theory and practice. However, since each of them focuses on a specific issue, they failed to demonstrate the cohesive inside of all the aspects. Internet marketing is an integrated process that requires not only the efficiency of each of the phases but also the smoothness of the transition from one phase to another. Thus, this article is to connect all the pieces together for creating the seamless marketing pipeline.

*Figure 1. Internet marketing flow chart*




## OPERATION PROCEDURE AND THE QUANTITATIVE METHOD FOR EACH OF THE PHASES

Internet marketing flow chart is shown as follow:

The database must contain at least three pieces of data: (1) customer attributes data, denoted by variables $x_1, x_2, \ldots, x_N$; (2) marketing elements data denoted by variables $u_1, u_2, \ldots, u_M$ which represent firms marketing offer and efforts such as investments, sale discounts, components of ads pieces, and attributes of web portals, etc.; (3) marketing performance data denoted by variables $y_1, y_2, \ldots, y_K$ which usually represent customer response rate, ROI, or revenue, etc.

Let's explain each phase of the flow chart in details as below.

### Customer Targeting

Targeting refers to address the issue of who will a firm advertise to. In order to target efficiently, firm needs knowledge of its current/potential customers as much as possible, Data mining and statistic methods play an important role here. Once a consumer responses (click / purchase) to ads in internet, his/her attributes and response are recorded in the web log. Based on the web data, statistical models can be used to segment customers. (Jackson & Wang, 1994) The typical methods are clustering and regression methods.

Clustering method segments consumers into clusters. Within each cluster, their attributes $v = (x_{l_1}, x_{l_2}, \ldots\ldots x_{l_j}, y_{m_1}, \ldots y_{m_k})$, where the components of $v$ forms a subset of consumers total attributes and marketing performance data, are similar. Upon Choice of components of $v$ and number of clusters, both governed by business rule, is determined, the algorithm can be applied to consumers in the database to segment them:

Step 1: Choose arbitrarily clusters seeds $v^{01}$, $v^{02}$, …, $v^{0L}$, where L is the number of clusters. Let $t = 0$.

Step 2: Label each point $v$ (consumer) by $r$ as $v^r$ where

$$r = \{ r \mid \| v - v^{tr} \| = \min_{k=1,2,\ldots L} (\| v - v^{tk} \|) \} \qquad (1)$$

There will be L distinct $r$ values, $r = 1,2,\ldots,L$; and suppose that $n_r$ points are label $r$.

Step 3: for each value of label $r$, find the center of the points $v^r$

$$v^{(t+1)r} = \frac{1}{n_r}\sum v^r \tag{2}$$

Step 4: If $\|v^{(t+1)r} - v^{tr}\| \leq \varepsilon \forall r = 1,2,\ldots,L$, then stop, consumers have been segmented into $L$ clusters and go to phase of ads designing.

Otherwise, let $t = t+1$ and go back to Step 2.

The regression method is used to build a response model. The model predicts the probability that individual consumer will respond to the firm's marketing efforts so that the firm can differentiate consumers by their different probability values. Let $p$ be the response probability, then its value is usually predicted by logistic regression: (Walpole et al 2007)

$$\log\frac{p}{1-p} = a_0 + a_1 x_{l_1} + a_2 x_{l_2} + \ldots + a_j x_{l_j} \tag{3}$$

or equivalently,

$$P = \frac{1}{1 + e^{-(a_0 + a_1 x_{l_1} + a_2 x_{l_2} + \ldots + a_j x_{l_j})}} \tag{4}$$

Then, consumers are segmented according to their response probabilities. In industrial practice, they are usually segmented into 10 groups. When the segmentation is completed, go to next phase that is the ads designing.

## Internet Ads Designing

How to design web ads to attract most response within a firm's budget is now a heated issue in internet ad industry due to internet ads high price and declining response rate. This traditionally artistic territory is now explored by mathematicians and computer scientists. They found that, by combination of statistical modeling, mathematical programming, information depository, search and match techniques, the best choice of ads elements such as color, key words, size, position, discount, and launching date, etc., which are denoted by variables $(u_1,u_2,\ldots,u_M)$ in the database, can be obtained to form an optimal ads piece. (Anderson et al. 2006; Hai, Zhao & Nagurney 2009).

The method is described below:

Step 1: Let $A_k^{tl}$ be the initial internet ads pieces for consumer cluster k, composed by $(u_{l_1}^t, u_{l_2}^t, \ldots, u_{l_k}^t)$ which is a subset of a firm's total marketing efforts $(u_1,u_2,\ldots,u_M)$. Suppose that there are $l = 1,2,\ldots,C_k$ ad pieces for cluster k. Optimal ads design starts with initial ads and their components that are inherited from the firm's previous ads elements.

Step 2: establish mathematical model that quantifies the marketing response

$$y_i^k = f(u_{l_1}, u_{l_2}, \ldots, u_{l_k}) \tag{5}$$

where $y_i^k$ is one of marketing performance variable $(y_1,y_2,\ldots,y_K)$. Choice of $y_i^k$ is determined by goal of marketing. Model (5) can be obtained by mathematical methods including, but not limited to, statistical regression, interpolation, or simulation methods by analyzing web data that is related to $A_k^{tl}$, $l=1,2,\ldots,C_k$.

Step 3: to solve the optimization problem below:

$$\begin{aligned} &\max y_i^k = f(u_{l_1}, u_{l_2}, \ldots, u_{l_k}) \\ &s.t.\quad g(u_{l_1}, u_{l_2}, \ldots, u_{l_k}) \leq 0 \end{aligned} \tag{6}$$

where function $g(\cdot)$ is the vector function that defined the constraint of variables. Problem (6) can be solved by mathematical programming method (Bazaraa 2006).

Suppose the solution is $(u_{l_1}^{t+1}, u_{l_2}^{t+1}, ..., u_{l_k}^{t+1})$, then optimal ad $A_k^{(t+1)l_o}$ for cluster *k* is composed by the optimal solution. Create trial ads $A_k^{(t+1)l}$ $l \neq l_o$ for data collecting purpose. Let *t*=*t*+1, update database and go to phase of optimal budget allocation.

When the optimal marketing elements are identified, a firm can provide them to portals like Yahoo to form ads on the fly (20072007Yahoo!, 2007!!), or a firm can compose the optimal ads and provide them to portals like Google to display according to web browsers' attributes.

## Budget Allocation

After identified target and created optimal ad pieces, a firm needs to consider where (websites) and how to deliver the marketing efforts which is measured as amount of investment to realize the marketing objective. The issue of optimal allocation of web ads budget is a convex mathematical programming problem that can be easily modeled and solved by existing statistical and mathematical theory and methods. (Park & Fader 2004; Zhao & Nagurney 2006) Further, there are many firms compete in the internet market. A firm's ads response is affected by competitors marketing efforts as well. Every firm has to maximize its own ads response to win in the competition. As a result, Nash-equilibrium will be reached, at which every firm is at optimal status in the sense that any unilateral change of firm's total ads spending as well as its allocation only makes the firm worse-off. (Zhao & Nagurney 2008)

Let $u = (u_{m_1}, u_{m_2}, ..., u_{m_p})$ be a vector variable that denotes the allocation of the total budget to the internet market places. The total consumers' response $y_r$ (the click-through rate, or purchase, whatever the marketing objective is.) is a concave function of u:

$$y_r = f(u_{m_1}, u_{m_2}, ..., u_{m_p}) \tag{7}$$

and the marginal increment of response per additional internet investment λis an increasing function of total internet investment:

$$\lambda=\lambda(b) \tag{8}$$

where $b = u_{m_1} + u_{m_2} +, ..., +u_{m_p}$ .

A firm's goal is to maximize $y_r$ subject to budget constraint. It is well known in the optimization theory (Bazaraa 2006) that, at the optimum, all marginal responses per addition investment to individual internet market place are equal; those markets with smaller marginal responses will not be invested. When all the firms are competing for the same consumers through the optimization scheme, the equilibrium will be reached that no firm can unilaterally alter its strategy to be better off.

Marginal response is the partial derivatives of $y_r$ defined by (7). If the marginal response is denoted by the vector function

$$g = (\frac{\partial y_r}{\partial u_{m_1}}, \frac{\partial y_r}{\partial u_{m_2}}, ..., \frac{\partial y_r}{\partial u_{m_q}}) \tag{9}$$

Then the procedure that searches for optimal budget and its allocation is described as follow:

Step 1: Let $(u_{m_1}^t, u_{m_2}^t, ..., u_{m_p}^t)$ are initial budget allocation to internet market places.

Step 2: build mathematical model based on the historical data including $(u_{m_1}^t, u_{m_2}^t, ..., u_{m_p}^t)$ that quantifies $y_r$ as a function of budget allocation as described in (7), and take partial derivatives to obtain g that is a function of $(u_{m_1}, u_{m_2}, ..., u_{m_p})$.

Step 3: solve variational inequality

$$\left\langle g(u^*), u - u^* \right\rangle - \left\langle \lambda(b^*), b - b^* \right\rangle \leq 0$$
$$\forall (u,b) \in \{(u,b) \mid u_{m_1} + u_{m_2} + ... + u_{m_q} = b\} \tag{10}$$

solution of (10) is $(u^*, b^*)$. Let $(u^{t+1}, b^{t+1}) = (u^*, b^*)$ and $t = t+1$.

Note that the procedure calculates the size of budget b as well as its allocation. Problem (10) can be solved by iteratively calling mathematical programming methods.

In summary, the procedure starts at data uploading; based on the data, consumers are segmented; for each cluster of consumers, ads elements are selected and ads are composed; then marketing investment strategy are determined. Ads, or the elements, are delivered to portals to attract consumers. When consumers' response data are collected and uploaded to database, next cycle of marketing begins. Thus, marketing becomes a self-learning, self-improving, and cyclical procedure that catches the dynamics of consumers.

## FUTURE RESEARCH DIRECTION

There are issues in the above procedure that remain to be addressed. As described above, to increase the efficiency, a firm needs to model market response as function of marketing elements (offers, investments, etc). However, marketing is a competition, in which all the participating firms efforts impact interactively on consumers. As noted by Reibstein and Wittink (2005), the marketing literatures contain many articles on market response based on both aggregate and disaggregate data. However, there are few papers that deal with competitive reactions. Indeed, as Reibstein and Wittink (2005) further emphasize, "the marketing mix models offered by leading data suppliers often gloss over competitive spending and never include reaction functions." Zhao and Nagurney (2008) tried to address the issue by establishing a variational inequality model that includes competitors' efforts as independent variables, but the difficulty is that competitors' data is usually not accessible; therefore to build such a model seems not practical.

However, the data of consumers' response carries competitors' information since it is the result of the combined impact of all marketers' efforts. Can we use the data to build the estimated response function that contains only the firm's own variables to approximate the true response function that depends on all marketers' efforts? If we do so, are the error of the approximation and its consequences, i.e. the resulted decision based on the estimation, controllable?

The answer for these questions may be found in other fields such as Statistics, Economics, and Operations Research (Zhao & Zhu 2009).

## CONCLUSION

Due to the richness of data, internet marketing can be done as an automatic procedure, within which, each of the phases is carried out quantitatively to ensure the measurability of the efficiency, optimality of decision making, and adjustability to the dynamics of the market places.

Both scholars and marketing practitioners have developed methods for some phases of marketing such as customer targeting, optimal ads design, and optimal budget size and allocation, etc. that take advantage of data depository, statistic and mathematical techniques. This article combines these methods to form an integrated marketing procedure. We demonstrate in detail how each phase is done and how to move from one phase to the next phase. Now it is clear that, to build marketing production pipeline, a firm needs to have database, statistical software, mathematical programming software, and professionals with expertise to guarantee to smoothness and efficiency of the pipeline.

Although this article is about internet marketing, the prospective described here can be applied to marketing in other media as long as the amount of data are able to support the models in each of the phases.

## REFERENCES


Anderson, D., Buchheit, P., Carobus, A. P., Cui, Y., Dean, J. A., Harik, G. R., et al. (2006). *Serving Advertisements Based on Content.* Patent # 7,136,875, US Patent & Trademark Office, Patent Application Full Text and Image Database.

Bazaraa, M. (2006). *Nonlinear Programming: Theory and Algorithms* (3rd ed.). Hoboken, NJ: Wiley.

Chickering, D., & Heckerman, D. (2003). Targeted Advertising with Inventory Management. *Interfaces*, *33*, 71–77. doi:10.1287/inte.33.5.71.19248

Hai, L., Nagurney, A., & Zhao, L. (in press). An Integrated Framework for the Design of Optimal Web Banners. *NETNOMICS: Economic Research and Electronic Networking*.

Jackson, P., & Wang, P. (1994). *Strategic Database Marketing*. New York: McGraw-Hill Professional.

Kazienko, P., & Adamski, M. (2007). AdROSA-Adaptive Personalization of Web Advertising. *Information Sciences*, *177*, 2269–2295. doi:10.1016/j.ins.2007.01.002

Park, Y., & Fader, P. (2004). Modeling Brows Behavior at Multiple Websites. *Marketing Science*, *23*, 280–303. doi:10.1287/mksc.1040.0050

Reibstein, D., & Wittink, D. (2005). Competitive responsiveness. *Marketing Science*, *23*, 280–303.

Story, L. (2007, July 2). Online Customized Ads Move a Step Closer. *New York Times*.

Walpole, R. E., Myers, R. H., Myers, S. L., & Ye, K. (2007). *Probability & Statistics for Engineers & Scientists.* Upper Saddle River, NJ: Prentice Hall.

Zhao, L., & Nagurney, A. (2006). A Network Modeling Approach for the Optimization of Internet-Based Advertising Strategies and Pricing with a Quantitative Explanation of Two Paradoxes. *NETNOMICS: Economic Research and Electronic Networking*, *7*, 97–114. doi:10.1007/s11066-006-9006-y

Zhao, L., & Nagurney, A. (2008). A Network Equilibrium Framework for Internet Advertising: Models, Qualitative Analysis, and Algorithms. *European Journal of Operational Research*, *187*, 456–472. doi:10.1016/j.ejor.2007.03.038

Zhao, L., & Zhu, J. (in press). Modeling Internet Marketing Budget Allocation Strategy: from Practitioner's Perspective. *Annals of Operations Research*.


## KEY TERMS AND DEFINITIONS

**An Internet Marketing Strategy:** is a process that can allow an organization to optimize its internet marketing objective within its limited resources and competitive internet market place.

**Customer Targeting:** refers to going through the steps specifically and clearly profiling the types of customers who will likely to respond the marketing efforts.

**Internet Advertisement Design:** refers to identifying and combining ad elements to form an ad piece that generates internet browsers' response

**Internet Advertisement Elements:** are constituents of an internet advertisement piece. The examples of elements in an advertisement piece include, but not limited to: key words, position, imbedded URL, offer, launching time, duration of display, image, size, and color.

**Internet Advertisement:** is an announcement published in internet media. It may take form of email message, web page, web banner, web link, or web buttons.

**Internet Marketing Budget Allocation:** refers to determining amount of investment on internet marketing as well as allocating the total amount to internet publishers.

**Internet Marketing:** is the marketing of products or services over the Internet.

**Internet Marketing Objective:** is the achievement toward which marketing efforts are directed, it can be the sale of products or services, brand awareness, or return of investment. It can be measured as dollar amount made, number of items sold, number of clicks obtained per unit amount of impressions.

**Internet Marketing Procedure:** is used by marketing managers to control, organize, coordinate, and improve sales and marketing processes.

**Internet Marketing Process:** is a series of actions that involves web and customer data collection and processing, customer segmentation and profiling, internet ads design, internet ads budgeting, and internet publisher selection.

## ENDNOTE

* This article is done while author is visiting Chongqing University as adjunct professor with her sabbatical leaves.

# Chapter 55
# Managerial Succession and E-Business

**Anthonia Adenike Adeniji**
*Covenant University, Nigeria*

## INTRODUCTION

There have been several studies on managerial succession otherwise known as **succession planning** but greater percentage of them focused on succession planning as related to family owned small to medium sized enterprises (SME's), government establishments, effects of succession planning on **performance** and **profitability** of a business organization, CEOs perspectives on planning for succession, family business and **succession planning** to mention just a few (Motwani,et al 2006,Brown 2007, Dunemann & Barreff, 2004).

There is a dearth of research about managerial succession and e-business, in this world of globalization where organizations are clamoring for survival in the globally competitive environment therefore; this chapter will focus on why **succession planning** is crucial in e-business and in the global economy. To do this effectively, available literature will be explored on the key aspects of an effective succession management system, the continuum of succession processes in e-business and in the global world. Also varieties of views and notions of individuals and groups in respect of the key issues to clarify and the key question impacting the design of succession management system in organizations and the **succession planning grid** will be considered.

The views of the academicians and professionals on the succession management process, obstacles to effective succession management in an e-business environment and the key recommendations for succession management to remain competitive and survive in a globally competitive environment will be traced.

DOI: 10.4018/978-1-61520-611-7.ch055

## BACKGROUND

Succession planning in e-business is an issue of growing importance. **Businesses** generate a significant proportion of the economic activity in our countries, and a majority of these businesses are approaching the point where they will be transacting businesses on-line and will most likely by making serious decisions regarding their long time future .The manner in which such large number of potential business successions is managed will impact not only upon these individual businesses and society in which they operate but also upon the global economy .

As a result there is wide spread interest in various aspects of business succession planning and particularly, the central question of, how to do it.

However, some common themes emerge from a study of the succession management literature and the suggested models on offer .The required successor attributes needs to be identified and appropriate processes for selecting and nurturing a suitable successor determined .The timing and the manner of any handover needs to be matched to existing circumstances in the e- business environment .The roles and needs of all important participants should be acknowledged, e- business vision shared by all participants, maintaining good relationships and open communication processes is vital. Finally, the future of the incumbent in relation to the requirements of e-business must be clearly determined and managed.

Succession is the plan an organization employs to fill its most vital leadership and professions positions (Huang,2001).It is the ongoing, purposeful and systematic identification of qualified and appropriate successors to leadership, with a commitment to assessing, developing and investing in organizational leadership to enhance **performance**, development and preparedness (Kim2003; McDonald 2006).According to Michelson(2006),succession planning requires putting the right people on the business, getting the wrong people off the business and positioning the right people in the right seats .Others have argued that **succession planning** is simply having the right people in the right place at the right time(Conger and Fulmer,2003; Rothwell,2005). Succession planning reinforces the desired perceptions of the organization, fosters **employee legitimacy**, builds on the strategic plan to manage the organization through future challenges, meets the demand of the public and addresses the strength and weakness of the organization (Cohn,Khurana and Reeves 2005).

Effective succession management happens when corporations adopt a talent–finding mindset and developing guideline for building a leadership pipeline among which include; focusing on development, identifying linchpin position, making it transparent and measuring progress regularly.

## MAIN FOCUS OF THE ARTICLE

### Reasons Why Succession Planning is Important In E-Business

Scholars and knowledge practitioners' maintain that administrators are ignoring the coming leadership crisis and/or rejecting the imminence of the predicament (Green, 2000; Michelson, 2006; Ospina, 1992).

Consequently, many leaders of organizations lack an **exit strategy**, offer little evidence of a formal transition and treat succession management as nothing more than lining up personnel for vacancies (Michelson, 2006). Four distinct areas of exploration include the development of a succession plan, selection and training of staff, sustainability of the program and its impact on the workforce, and measurement and evaluation of the process in practice.

## Planning and Development of Succession Planning

Succession planning usually begins when an organization initiates a demand forecast to determine overall future workforce needs, as well as succession analysis to predict the number of the employees to staff specific positions (Pynes, 2004). There is no "one best way" of developing, implementing or supporting a succession plan [Karaevli and Hall, 2003]. Therefore, administrators should not rely on an off-the-shelf, one-size-fits-all approach [Cohn, et al 2005]. Succession plans need not be overly complex or difficult [Berchelmann, 2005] and may employ formal versus informal tactical versus strategic [Ospina 1992] or "just-in-time" versus "integrated" methods (Young, 2005). Rothwell, (2005) and Waltuck, (2005) opined that strategic planning results in the socialization, development and advancement of potential high-performing managers.

## Selection and Training

Many organizations fail in succession planning because they get "lost in the tree of **succession planning forest**" [Dessler 2006]. The importance of the identification and development of potential leader is lost among demographic statistics and summary information resulting in a talent shortage [Dychtwald, Erickson &Morrison 2006, Gandossy & Verma, [2006]. Succession planning seeks to resolve this disconnect by creating strong talent pools prepared to become future leaders of the organization. [Dessler 2006].

Organizations globally in an e- business environment are becoming more innovative in recruiting, developing and retaining talent (Patton and Pratt, 2002). Some of the creative ideas implemented include the increased usage of job rotation, establishment of co- managers in critical function to ease older leader into retirement and prepare new leaders for new role, and outsourcing hard- to fill functions and diverting existing managers more strategic role [Green,2000]. In addition, organizations are offering to train their staff on job skills trend will make them relevant and better relate in the competitive global environment (Green, 2000). Thus, the organization offer resources and connections to the global world as well as provide the perfect venue to pursue learning objectives which serve as an excellent strategy for hiring and retaining top talent. (Green, 2000). This is because learning agility is needed in an e-business ever-changing, competitive, chaotic work environment where the differences in defining high-potential employees are as diverse as the organization involved (Karaevli & Hall, 2003).

## Sustainability

Many organizations offer 'employment deals' promoting self-development over management-driven succession with an added emphasis on developing a talent pool that matches preferred competencies necessary for effective future business **performance** in an e-business environment (Waltuck, 2005). The main goal, whether high performances are identified or empowered is to find those employees who have a high sense of job satisfaction, encourage proactive career development and provide growth opportunities to those who are willing or able (Berchelmann, 2005; Karaevli & Hall, 2005).

## Evaluation

Succession plans should provide assessment and measurement over the long-term by establishing core competencies matching the strategic focus of the organization, as well as identifying any gaps that may exist (Conger & Fulmer 2003and McDade, 2004). Succession plans specifically examine the ability of the organization to fill vacancies and respond to the needs in the e-business environment (Conger & Fulmer, 2003) and encourages self determination (Kim, 2003). Succession planners develop a comprehensive, organization-

*Table 1. The continuum of succession processes in e-business*

| |
|---|
| Replacement planning Succession planning Succession management<br>Identify successors. Identify successors. Identify successors.<br>Develop successors. Develop successors.<br>Include all organization levels.<br>Basic Comprehensive |
| Source: Human Resource Management (8th Edition). |

wide, competency-focused, manager-centric career development program relying upon multiple dimensions of feedback (Kim, 2003).

## Reasons Why Succession Planning is Important in E-Business

1. Rapid, radical and discontinuous change.
2. Increasingly complex challenges.
3. Greater leadership responsibility at lower levels.
4. Recruitment and retention of the best talent.

Different succession processes can be placed on a continuum ranging from relatively simplistic end bounded to relatively complex and comprehensive. At the most simplistic end of the continuum is the replacement planning. Replacement planning denotes a minimal succession approach in which successors (i.e. replacements) are identified at the top managerial levels, but there is little or no development of those successors other than ad-hoc on the job experience. The focus is on forecasting with no attention to development issues. **Succession planning** falls near the middle of this continuum of succession planning. It is more systematic and extensive than replacement planning because it is linked with intentional development initiative targeted at successors. However, it is mainly for the top two or three management levels, like replacement planning. Succession management anchors the most comprehensive end of this continuum in that it identifies successors (replacement planning), develops them (succession planning) and it is also directed at all managerial levels. The overarching goal of succession management is to have a pool of or pipeline of prepared leaders and not just a list of prospective candidates across all organizational levels to fill vacancies in key positions when needed.

## Key Questions Impacting the Design of Succession Management System

The followings are the key questions impacting the design of succession management system in organizations operating in an e-business environment that is highly competitive and dynamic.

- What is a key or “corporate –critical” position?
- What constitutes a high potential manager?
- What are the common aspects of exemplary job performance?
- How should the organization fill key positions?
- What percentage of open positions should be filled from within the organization?
- What percentage of key positions should have at least one identified successors?
- How should high-potential manager be prepared for advancement?
- How desirable are international assignments for designated successors?
- How important are individual employee career goals and objectives in the succession management plan?

*Table 2.*

| Potential | Performance | | |
|---|---|---|---|
| | Low | Medium | High |
| High | Demonstrated high potential for advancement but is not meeting current performance expectations.<br>Needs coaching and intervention: Wrong job or wrong boss? | Demonstrated high potential and consistently meet performance expectations.<br>Valued talent who need additional challenge, rewards, recognition or opportunity to develop. | Highest potential for senior leadership position that usually always exceeds performance expectations.<br>Star talent who should be targeted for accelerated development opportunities |
| Medium | Promoting potential one level or lateral move with greater challenge but presently under -performing.<br>Consider coaching or corrective action | Promotion potential one level or lateral move with greater challenge: presently meeting but not exceeding performance expectations.<br>Keep things running but might need additional motivation, greater engagement or additional rewards. | Promotion potential one level or lateral move with greater scope or challenge always meets and usually exceeds expectations.<br>Strong contributor who could have additional developmental challenges to grow and possibly improve potential. |
| Low | Has reached career potential and is not delivering.<br>Counsel or terminate. | Specialized technical talent or has reached career potential but consistently meet performance expectations.<br>Motivate and focus. | Specialized technical talent or has reached career potential but consistently exceeds performance expectations<br>Valuable in developing others; retain and reward. |

## Effective Succession Management Process

This is critical for a successful talent identification process. A climate of honesty, trust and transparency is an important factor in the systems ultimate success. The following are the features of succession management process;

- High level review of the talent pipeline by the CEO and his direct reports.
- Review of each business function and strategic area of focusing on what new capabilities will be needed to deliver this strategy and any new corporate critical roles that will be needed.
- Review of top 200 leaders using the "**nine-box" performance /potential grid**. This is shown in Table 2;
- Development and discussion of succession plans for high and medium risks corporate-critical roles that exist now and are anticipated in the future.
- Development planning for this population.
- Link the plan design to the needs and vision of the CEO, senior management team and the requirements of e-business in the global environment.

However, succession management process includes preparation, planning and development.

Preparation; the goal is to understand the context.

Planning; the goal is to identify positions on talents.

Development; the goal is to prepare and develop talent. The key processes here are assessment, challenge, and support.

## OBSTACLES TO EFFECTIVE SUCCESSION MANAGEMENT

Ultimately, an investment in succession management is an investment in individual and organizational learning, but like many things, this is easier said than done. There are many potential factors that can derail succession management process. Below is the list and brief discussion on some likely culprits:

- Event-based or **episodic thinking**. This implies succession planning as well as leadership development. Both of them are ongoing processes, yet the conventional thinking is that they are addressed episodically. **Succession planning** typically is conducted only once in a year and leadership development is treated as a series of 'loosely coupled' events or episodes, usually in the form of programmes. It is a mistake to try to completely de-couple development from work.
- No strategy for development. What is the organization philosophy of succession management and development? These are the key concerns in terms of presenting and defining the concepts and principles that will serve as the pillars of the conceptual framework for the initiative.
- Assuming it is solely a staff function. In most cases, the human resource function has the primary responsibility for succession management. A common mistake and typical obstacle to effective implementation is failing to engage line management from the onset.
- Over-embedding the initiative in a single champion. Having a champion, especially at top levels, is an important driver for success, however, if the initiative becomes too heavily associated with any one person no matter how high ranking this could lead to follow through problems if that champion derails or leaves the organization.
- Not connecting with strategic business imperatives.

Development for development's sake might be a generally good thing; however it might not be helpful for long-term support. It is easy to lose sight of what specifically needs to be developed and why.

To implement a formal system with lack of fit with the organizational culture.

Trying to implement a formal system with a lot of preparation and paperwork in an informal culture would likely be met with resistance, if not outright hostility introducing an informal system into a highly structured and formal organization may result in the in the initiative not being taken seriously.

## RECOMMENDATION

Succession management can also aid in the recruitment and retention of the talent that is needed to be competitive in the global economic and Electronic business.

However, the followings are the key recommendations for succession management;

- Understand the unique context of your organization.
- Recognize that organization have special challenges and opportunities when it comes to succession management in an E Business environment
- Identify key positions and the talent potentials for these potentials (**Nine-Box Grid**" may be helpful).
- Establish succession plans for key positions that identify at least one and preferable more than one potential successor.
- Engage in detailed developmental planning for the targeted successor populated.
- Use leadership competency models with caution – the future is imperfectly predicted.

- Avoid the basic obstacles to an effective succession management system.
- Work towards continuous succession management system improvement.

## FUTURE RESEARCH DIRECTIVE

It had been said that effective succession planning involves more than just a replacement planning process. It also includes a comprehensive **employee development system**, thus, future researches should focus on development strategies for both the SME'S in their local markets and for the global competition in the international market.

## CONCLUSION

The chapter dwells richly on the succession planning in an e – business environment. It considers the reason why succession planning is important in the global economy, the key aspects of an effective succession management system, the continuum of succession processes in e- business, and the key questions impacting the design of succession management system. Also, the chapter looked at the succession planning grid, the obstacle to effective succession management in an e- business environment and the key recommendation for succession management were given.

## REFERENCES

Berchelmann, D. K. (2005). Succession Planning. *Journal for Quality and Participation*, *28*(3), 11–12.

Brown, M. C. (2007). Administrative Succession and Organizational Performance: The Succession Effect. *Journal of the Social Sciences*, *27*(1), 1–16.

Cohn, J. M., Khurana, R., & Reeves, L. (2005). Growing Talent As If Your Business Depended On It. *Harvard Business Review*, *83*(10), 62–70.

Conger, J., & Fulmer, R. (2003). Developing Your Leadership Pipeline. *Harvard Business Review*, *82*(12), 76–84.

Dessler, G. (2006). *Human Resource Management* (8th Ed.). London: Prentice Hall.

Dunemann, M., & Barreff, R. (2004). Family Business and Succession Planning. *Administrative Science Quarterly*, *25*(1), 26–40.

Dychtwald, K., Erickson, T. J., & Morison, R. (2006). *Workforce Crisis: How to Beat. The Coming Shortage of Skills and Talent.* Boston: Harvard Business School Press.

Gandossy, R. P., & Verma, N. (2006). Passing the Torch of Leadership. *Journal of Leadership*, *40*(1), 37–47.

Green, M. E. (2000). Beware and Prepare: The Government Workforce of The Future. *Public Personnel Management Journal*, *29*(4), 435–447.

Huang, R. J. (2001). Marginal Mentoring, the Effects of Type of Mentor, Quality of Relationship and Program Design on Work and Career Attitudes. *Academy of Management Journal*, *43*, 1177–1194.

Karaevli, A., & Hall, D. T. (2003). Growing Leaders for Turbulent Times. Is Succession Planning Up to The Challenge? *Organizational Dynamics*, *32*, 62–79. doi:10.1016/S0090-2616(02)00138-9

Kim, S. (2003). Linking Employee Assessment to Succession Planning. *Public Personnel Management*, *32*(4), 533–547.

McDade, S. A. (2004). Evaluating Leadership, Development Programs, New Directions for Leadership. *Development. The Leadership Quarterly*, *16*(3), 297–317.

McDonald, R. D. (2006). *Succession Planning is Mission Critical to Achieving Organizational Goals*. Pawcatuck, CT: Pearson Performance Solutions.

Michelson, R. (2006). Preparing Future Leaders for Tomorrow. *The Police Chief*, *73*(6), 16–21.

Motwani, J., Levenbury, N., Schwarz, V., & Blankson, C. (2006). Succession Planning in SMEs. *International Small Business Journal*, *24*(5), 471–495. doi:10.1177/0266242606067270

Ospina, S. (1992). When Managers Don't Plan, Consequences of Nonstrategic Public Personnel Management. *Review of Public Personnel Management*, *12*(2), 52–67. doi:10.1177/0734371X9201200205

Patton, W. D., & Pratt, C. (2002). Assessing the Training Needs of High. Potential Managers. *Public Personnel Management*, *31*(4), 465–484.

Pynes, J. (2004). The Implementation of Workforce and Succession in the Public Sector. *Public Personnel Management*, *33*(4), 389–404.

Rothwell, W. J. (2005). *Effective Succession Planning Ensuring Leadership Continuity and Building Talent Within* (3rd Ed.). New York: American Management Association.

Waltuck, B. (2005). What's the Point of Planning? *Journal for Quality and Participation*, *28*(4), 37–40.

Young, M. B. (2005). Building the Leadership Pipeline in Local State and Federal Government. *Human Resource Services*, *52*, 561–610.

## ADDITIONAL READING

Cantor, P. (2005 January/February). Succession Planning: Often Requested, Rarely Delivered. *Ivey Business Journal*, 1-10.

Cardon, M. S., & Stevens, C. E. (2004). Managing Human Resources in Small Organizations: What Do We Know? *Human Resource Review*, *14*, 294–323.

Church, A. H. (1997). Managerial Self-Awareness in High Performing Individuals and Organizations. *The Journal of Applied Psychology*, *82*, 281–292. doi:10.1037/0021-9010.82.2.281

Cunningham, M. R., & Waker, M. D. (2006). *Succession Planning is Mission Critical to Achieving Organizational Goals*. Pawcatuck, CT: Pearson Performance Solutions.

Day, D. V. (2000). Leadership Development: A Review in Context. *The Leadership Quarterly*, *11*, 581–613. doi:10.1016/S1048-9843(00)00061-8

Diamond, A. (2006). Finding Success Through Succession Planning. *Security Management*, *50*(2), 36–39.

Drath, W. (2001). *The Deep Blue Sea: Rethinking the Source of Leadership*. San Francisco, CA: Jersey-Bass.

Dweck, C. S. (1986). Motivation Process Affecting Learning. *The American Psychologist*, *41*, 1040–1048. doi:10.1037/0003-066X.41.10.1040

Fegley, S. (2006). *SHRM 2006 Succession Planning Survey Report*. Alexandria, VA: Society for Human Resource Management.

Hannum, K. M., Martineau, J. W., & Reinelt, C. (Eds.). (2007). *The Handbook of Leadership Development Evaluation*, San Francisco, CA: Jossey Bass.

Heifetz, R. (1994). *Leadership Without Easy Answers*. Cambridge, MA: Harvard University.

Hollenbeck, G. P., McCall, M. W. Jr, & Silzer, R. F. (2006). Leadership Competency Models. *The Leadership Quarterly*, *17*, 398–413. doi:10.1016/j.leaqua.2006.04.003

Ibarra, P. (2005). Succession Planning: An Idea Whose Time Has Come. *Public Management Journal*, *2*(1), 107–117.

Ip, B., & Jacobs, G. (2006). Business Succession Planning: A Review of the Evidence. *Journal of Small Business and Enterprise Development*, *13*, 326–350. doi:10.1108/14626000610680235

Karaevli, A., & Hall, D. T. (2003). Growing Leaders for Turbulent Times: Is Succession Planning Up to the Challenge? *Organizational Dynamics*, *32*, 62–79. doi:10.1016/S0090-2616(02)00138-9

Lawler, E. E., III, & Worley, C. G. (2006). *Built to Change: How to Achieve Sustained Organizational Effectiveness*. San Francisco, CA: Jossey-Bass.

Lewis, R. E., & Heckman, R. J. (2006). Talent Management: A Critical Review. *Human Resource Management Review*, *16*, 139–154. doi:10.1016/j.hrmr.2006.03.001

McCall, M. W., Jr., Lombardo, M. M., & Marrison, A. M. (1988). *The Lessons of Experience: How Successful Executives Develop on the Job*. Lexington, MA: Lexington Books.

Meister, J. C. (1998). Ten Steps to Creating a Corporate University. *Training & Development*, *52*, 38–43.

Morrow, C. C., Jarrett, M. O., & Rupinski, M. T. (1997). An Investigation of the Effect and Economic Utility of Corporate-Wide Training. *Personnel Psychology*, *50*, 91–119. doi:10.1111/j.1744-6570.1997.tb00902.x

Peterson, D. B. (1996). Executive Coaching at Work: The Art of One-On-One Change. *Consulting Psychology Journal: Practice and Research*, *48*, 78–86. doi:10.1037/1061-4087.48.2.78

Ragins, B. R., Cotton, J. L., & Miller, J. S. (2000). Marginal Mentoring: The Effects of Types of Mentor, Quality of Relationship and Program Design on Work and Career Attitudes. *Academy of Management Journal*, *43*, 1177–1194. doi:10.2307/1556344

Sanders, P. (2007). Once and Again: After Son's Death a Casino Mogul Returns to Helm. *The Wall Street Journal*, 16-17.

Sharma, P., Jess, H., & James, J. (2003). Succession Planning as Planned Behaviour: Some Empirical Results. *Family Business Review*, *16*(1), 1–15. doi:10.1111/j.1741-6248.2003.00001.x

Van Velsor, E., & McCauley, C. D. (2004). Over View of Leadership Development. In C.D. McCauley and E. Van Velsor (Eds.), *The Centre for Creative Leadership Handbook of Leadership Development* (pp. 1-22). San Francisco: Jossey-Bass.

Ward, S. (2007). *Succession Planning*. Retrieved from http://www.sbinfocanada.about.com/od/businessplanning/g/successplanning.htm

Weick, K. E. (1993). The Collapse of Sensemaking in Organization: The Mann Gulch Disaster. *Administrative Service Quarterly*, *38*, 628–652. doi:10.2307/2393339

Weiss, D. S., & Molinaro, V. (2005). *The Leadership Gap: Building Leadership Capacity for Competitive Advantage*. New York: John Wiley and Sons.

## KEY TERMS AND DEFINITIONS

**Competitive Environment:** this is an environment where companies and nations have the opportunity to compete effectively with one another considering the regulations in the environment.

**E-Business:** this is the transacting of business on-line or on the internet.

**Globalization:** this is the interconnectivity of business of nations all over the world. In other words, that all economies are connected to do business together where each will now gain competitive advantage over its products.

**Leadership Pipeline:** this is having a pool of prepared leaders and not just a list of prospective candidates across all organizational levels to fill vacancies in key positions when needed.

**Linchpin Positions:** these are positions between middle to senior management positions that are essential to organization's long term health.

**Managerial Succession:** this is the ongoing, purposeful and systematic identification of qualified and appropriate successors to leadership, with a commitment to assessing, developing and investing in organizational leadership to enhance performance, development and preparedness.

**Replacement Planning:** this is the minimal succession approach in which successors (i.e replacements) are identified at the top managerial levels, but there is little or no development of those successors other than ad-hoc on the job experience.

**Successor:** this is when a person comes after and takes the place of somebody.

# Chapter 56
# E-Business and Web Accessibility

**Panayiotis Koutsabasis**
*University of the Aegean, Greece*

## INTRODUCTION

E-business has developed due to the fast penetration of the Web to human activities ranging from work and education to news and entertainment. The power of the Web is in its universality, and, in principle, everyone can access e-business websites and benefit from available information, products and services. However, in practice, universal access to the Web - and subsequently e-business websites - is not merely an issue of availability or technical development.

Web accessibility emphasizes the incorporation of requirements of people with special needs to the design of Internet applications. Notwithstanding these requirements, the spectrum of accessibility concerns is even larger, for example if we think about the changing form of the computer and how people work and communicate: access is not required only from a PC, but also users are on the move and use other access devices (in terms of both hardware and software).

Research on Web accessibility has produced a wide range of results that are also used in mainstream Web design to promoted good design practice. These can be briefly outlined in terms of related legislation that aims at encouraging the development of accessible Web applications, open recommendations for accessible Web design, various accessibility evaluation tools that check – to some extend - the conformance of websites to the aforementioned specifications and various related open standards that promote accessibility.

Despite the large amount of work on Web accessibility, the vast majority of e-business websites are still not accessible. A report of accessible Internet shopping (Shindler, 2003) which involved 17 major high-street companies concluded that after the companies attempt to make their online shopping facilities accessible to people with disabilities during the period between August 2000 and June 2003 only

DOI: 10.4018/978-1-61520-611-7.ch056

five companies out of the seventeen examined, managed to pass the Watchfire Bobby test. The study of Loiacono and McCoy (2006) on evaluating Web accessibility in a large number of websites indicates that a poor 23% of federal homepages are accessible, while this percentage falls down to 11% for non-profit organisations and a totally disappointing 6% for corporate homepages.

The goals of the article are to:

- Argue for the importance of Web accessibility in e-business websites by reviewing related work and its impact at the technical, social, economic and legislative level and identifies typical accessibility problems of e-business websites;
- Propose measures for reaching and maintaining a good level of Web accessibility in terms of the specifications, design and evaluation phases of a user-centred approach to systems development. The proposed measures provide practical guidance to e-business applications stakeholders including managers, designers and developers.

## PERSPECTIVES ON WEB ACCESSIBILITY

Accessibility has received several interpretations in related work. The W3C Web Accessibility Initiative (http://w3c.org/wai) defines Web accessibility as a set of "*strategies, guidelines and resources that make the Web accessible to people with disabilities*", highlighting that accessibility is not simply a technical development issue. The Wikipedia definition on accessibility reveals another dimension of the same coin: "*Web accessibility refers to the practice of making Web pages accessible to people using a wide range of user agent devices, not just standard web browsers. This is especially important for people with disabilities which require such devices to access the Web*". This perspective provides the dimension of good user-based design of the Web that supports different access contexts and multiple device operability with the Web. The Webaim initiative about Web accessibility (http://webaim.org) refers to accessibility noting that: "*(with the advent of the Web) ... at the click of a mouse, the world can be "at your fingertips"—that is, if you can use a mouse... and if you can see the screen... and if you can hear the audio.*" Many other definitions of Web accessibility can be found in related initiatives and literature, which fall under three diverse ends that are briefly outlined below:

- **Accessibility as technology and network effectiveness:** in its most basic sense, accessibility is considered as synonymous to the technical capability to access the Internet. Related metrics of accessibility in this respect are the characteristics of network connection and of the software applications used. This is obviously a limited interpretation of accessibility: the availability of technology does not guarantee that people will use it.
- **Accessibility as good Web content design and implementation practice:** accessibility promotes the syntactic understandability of Web content by multiple access devices (e.g. see Viorres et al, 2003), enables content transformation to other formats and media, and eases the task of customization of presentation to user needs and preferences.
- **Accessibility as advanced personalization of content and services:** this approach promotes the semantic understandability of information from users with varying profiles and cognitive requirements and allows for dynamic system responses to user actions.

A mainstream conception about designing for accessibility is that design projects usually result to constrained solutions addressing very specific requirements of people with special needs. Indeed, as Keates and Clarkson (2003) remark in the context of inclusive design, "*traditionally, design research tends to focus on accommodating single, primarily major, capability losses*." Despite that some design solutions may indeed have specialized characteristics, the awareness created about the requirements of people with disabilities is radically changing the overall approach to address accessibility. People with special needs are not interested in specialized solutions, for various reasons, ranging from social acceptance to aesthetics, but require access to mainstream designs that may be used by as many people as possible. As noted by Paddison and Engefield (2003) "*it is not enough to follow accessible guidelines and make the appropriate technical accessibility changes... people with special accessibility needs should be considered as a distinct user profile with their own requirements, within a user-centered design process*."

## RE-THINKING ACCESSIBILITY FOR E-BUSINESS: ASSOCIATED BENEFITS

There are many arguments for incorporating the requirements of people with disabilities to product and systems design in general (for further analysis see for example Paddison and Engefield, 2003). The ethical stand that calls for providing equal opportunities to all has for long ceased to be the main argument, since that there are numerous examples of people with special needs that are contributing in a distinguished way to society. The need to incorporate the requirements of people with disabilities to design has been identified in many countries in terms of legal frameworks. Despite that e-business websites do not need yet to conform to this legislation, doing so will gain them a competitive advantage both in terms of social responsibility and technical excellence.

The business prospects of incorporating accessibility can be identified in various ways. To start with, people with special needs are not simply those that suffer from permanent disabilities but also other groups such as the aging population. The percentage of people with disabilities in most countries ranges between 10% and 20% of the population (United Nations Statistics on Disability: http://unstats.un.org). The age group over 60 is the most rapidly growing and there is a large overlap between the groups of elderly and disabled. Furthermore, the percentage of elderly people that will be using ICT (Information and Communication Technologies) by 2020 will increase considerably since current ICT users will have grown older by that date. This rise in the elderly population and the envisaged use of ICT by this group of people signify that if not now, in the near future the ICT companies should provide mainstream technology and Web-based services that address fully the requirements of people with special needs.

Further to these arguments, perhaps the most important misconception about accessibility is that it does refer <u>only</u> to people with special needs. Designing for accessibility addresses other user access issues as well, such as for example, performance for low network speed, usable access under constrained environmental conditions, and variable, personalised contexts of use. Thus, "special needs" may not simply denote irreparable physical constraints, but actually include many other, temporal or permanent, limitations of access that may be related to various factors, such as user mobility, access from alternate devices, the work environment conditions and the context of use. A few examples of contexts of use where accessible design can overcome include "handicapping" situations where customers may:

- Not be in a position to hear spoken information – e.g. noisy environment
- Not be in a position to see visual information – e.g. while driving a car

- Not be able to use the mouse (pointing device) or keyboard – e.g. a temporal injury, or a mobile device
- Not understand the language used – e.g. foreign customers
- Be using a text-only screen, or screens with small screen analysis and a few colours - e.g. a mobile or household device

Thus, from a technical point of view, designing for accessibility promotes good technical design and implementation that has obvious implications for maintenance and extensibility, which is a critical aspect of e-business websites that often need to update the content and look & feel with new products and styles respectively. Actually, accessibility concerns are relevant to the mainstream design process, rather than the design for specific groups of people only, emphasising the design of alternate, rather than specialised, means, modes and forms of access.

## MEASURES TO MANAGE AND MAINTAIN A GOOD LEVEL OF WEB ACCESSIBILITY IN E-BUSINESS APPLICATIONS

A number of important steps for the management of accessibility include: identifying accessibility requirements and specifications; applying rigorous and frequent Web accessibility assessment and re-design, if needed; and forming a Web accessibility policy to be consistently followed. These steps are briefly discussed below.

### Identifying Relevant Accessibility Requirements and Specifications

User accessibility requirements can be identified when accessibility is included into the goals of a user centred design approach. Web accessibility specifications include:

- The US Rehabilitation Act (http://www.section508.gov);
- Open recommendations for accessible Web design such as the W3C.WAI Web Content Accessibility Guidelines (http://www.w3.org/WAI/intro/wcag) that are of particular interest to B2C (Business to Consumer) e-business websites;
- Various accessibility evaluation tools that check – to some extend - the conformance of websites to the aforementioned specifications (for a good overview of these tools see: http://www.w3.org/WAI/ER/tools/complete);
- Various related open W3C standards that promote accessibility including, among others: CSS (Cascading Style Sheets), XSLT (eXtended Stylesheet Language Transformations), SVG (scaleable Vector Graphics), SMIL (Synchronized Multimedia Integration Language) and the Device Independence Activity that builds on previous CC/PP recommendation.

Currently, there are many accessibility (and usability) evaluation groups that offer consultancy on accessibility as well as conduct fast assessments of an e-business website at a reasonable cost of a few hundred dollars. Keeping in mind the social and economic benefits of accessibility, this cost should not be considerable even for small in size online enterprises.

### Web Accessibility Assessment and Re-Design Process

A fast assessment of Web accessibility is possible by using free accessibility tools (technical accessibility conformance to guidelines) and applying simple heuristics (manual, expert-based accessibility inspection). However, a thorough approach on accessibility assessment and redesign mainly requires another important element in the process: that of user involvement through user testing.

## Tool-Based Accessibility Conformance to Guidelines

Accessibility evaluation tools scan the source code of a web page using interpretations of either WCAG or the United States Rehabilitation Act Section 508 standard. The use of these tools is the first step for accessibility evaluation since that they can quickly identify accessibility problems that can be identified at the level of the source code of a web page and produce reports with accessibility errors and warnings. These tools save the designer from the task to inspect source code for the evaluation of accessibility and provide a first account of accessibility problems. However they cannot provide a complete account of accessibility problems mainly because accessibility is not a solely technical issue, but primarily requires human judgement. According to Webaim (http://www.webaim.org) of the combined 65 checkpoints in WCAG 1.0 Priority 1 through Priority 3, only nineteen can be partially evaluated automatically.

Currently there are many accessibility evaluation tools available, both free and commercial (for a review see: http://www.webaim.org/articles/freetools) to the degree that methods that enable their comparison have been proposed (Brajnik, 2004). A major problem for accessibility tools is that their vast majority are designed for fast evaluations of single web pages. Currently, research on the design of new generation accessibility tools attempts to address these concerns such as the MAGENTA tool (Leporini et al, 2006) and the BenToWeb benchmarking tools that will include the aforementioned capabilities (Herramhof et al, 2006). Also, some proprietary solutions have appeared like Oracle's e-business suite accessibility (2008). Both types of works need also to be tested in practice though.

## Expert (Manual) Accessibility Inspection

Manual evaluation includes a number of steps that must be followed by a designer to check the accessibility of web pages according to guidelines. These steps are another essential task of accessibility evaluation that can assess the accessibility in terms of the aspects that require human judgement. Such aspects include for example that alternative text for images substantially describes the meaning of an image in textual form, in case this is needed (i.e. when the image conveys information and is not used for other purposes such as decoration) and that the use of colours promotes accessibility of text and images if viewed in a constrained context of use (e.g. when printed by a black and white printer).

Expert inspections of accessibility can identify a considerable number of problems that are not possible to find by using accessibility tools alone. Typical inspections of Web accessibility include:

- Inspection of human checks for accessibility according to the WCAG guidelines: WCAG explicitly refers to accessibility issues that require human check and provides techniques that can assist expert evaluators
- Inspection of accessibility following simple heuristics: there is a number of empirical heuristics that complements the list provided by WeC.WAI, such as: turning frames off; turning sound off; navigating without a pointing device; accessing the website via multiple browsers; accessing the website via text browsers; accessing the website via a voice browser; test with different screen resolution; and others.

The expertise required to conduct accessibility evaluation is wide-ranging, including both organisational and technical skills. According to the W3C.WAI (http://w3c.org/wai) an accessibility evaluator should have "*an understanding of Web technologies, evaluation tools, barriers that people with disabilities experience, assistive technologies and approaches that people with disabilities use, and accessibility guidelines and techniques*."

### User Testing Of Accessibility

The involvement of users with disabilities is an important aspect of accessibility evaluation. Explicit user involvement is usually neglected in software development and maintenance practice mainly due to arguments related to the increase of costs and delivery times; some practitioners even doubt the usefulness of user involvement and instead promote training programmes instead. However careful user involvement has various advantages such as: increasing the amount of knowledge gained about a software development and maintenance project; identifying the advisability of target system components, which saves the project team from unneeded effort; contributing to system acceptability; reducing training costs; and assisting the identification of a wide range of usability problems. These advantages are particularly important for e-business websites that are interested to provide information and services to the widest range of potential users.

In the context of Web accessibility, user testing with people with disabilities contributes to a better understanding of accessibility issues by all people involved, and especially Web developers. For example, having Web developers see people with disabilities accessing a Web page with a voice browser makes them immediately identify related accessibility problems that their website may have such as the inappropriateness or absence of alternative text, the ordering of controls in a form, and others. Certainly, a user-centred accessibility evaluation will not be effective unless the site is already at a minimum level of accessibility. Furthermore, including users into the accessibility evaluation process can also identify various usability problems. Analytic methods and guidelines for involving users in accessibility evaluation include the work of Gappa and Nordbrock (2004) and Petrie et al (2006).

## Web Accessibility Policy

In order to reach and maintain a good level of Web accessibility, e-business websites need to establish a Web accessibility policy that will be applied during the design, development and update of their website. Currently, web accessibility policies have been established for a number of, mainly academic and governmental, websites and in a few e-business systems that are designed with the participation of organisations of people with disabilities, such as the RNIB (e.g. Gladstone et al, 2002).

An important issue for the design of the Web accessibility policy is what standards, guidelines, methods and processes to identify from related work. Indeed, there is ongoing work in all these respects (for a review see Gulliksen et al, 2004). However, the common basis for the standardisation aspects of the work related to Web accessibility is the W3C.WAI guidelines for the accessibility of Web content, authoring tools and user agents. W3C is the leading open standards (they are not called standards, but recommendations) organisation for Web technologies and their recommendations are the outcome of an open international process with participation from industry and academia.

## SUMMARY AND CONCLUSION

The article argued for the need to include accessibility concerns into the lifecycle of e-business websites and proposed several measures to need to be taken up in order to ensure that Web accessibility is incorporated to the daily operation of e-business applications. There are many reasons for e-business websites to become accessible. The social responsibility of e-business companies requires that they provide accessible Web-based information and services. The market segment of people with disabilities including the elderly is too large to be ignored; these people want to autonomously access and use e-business. The robustness of the technical design when accessibility is taken into account is another major argument for taking up this approach. Last but not least, there are already legal frameworks for governmental organizations to apply accessibility to their design; e-business websites may need to follow up in order to ensure that there are equal obligations for all in terms of their legal responsibilities.

## REFERENCES


Brajnik, G. (2004). Comparing accessibility evaluation tools: a method for tool effectiveness. *Universal Access in the Information Society*, *3*(3), 252–263. doi:10.1007/s10209-004-0105-y

Darzentas, J. S., & Darzentas, J. (2004) Socially responsible design or just good sense? The role of education and research in getting the message across. In *ETHICOMP 2004*, 14-16 April, Syros, Greece (pp. 237-249).

*E-Business Suite Accessibility*. (2008 July). An Oracle White Paper. Retrieved December 12, 2008, from http://www.oracle.com/accessibility/collateral/ebs-accessibility-white-paper.pdf

Gappa, H., & Nordbrock, G. (2004). Applying Web accessibility to Internet portals. *Universal Access in the Information Society*, *3*(1), 80–87. doi:10.1007/s10209-003-0070-x

Gladstone, K., Rundle, C., & Alexander, T. (2002). Accessibility and Usability of eCommerce Systems. In K. Miesenberger, J. Klaus, & W. Zagler (Eds.), *ICCHP 2002* (LNCS 2398, pp. 11–18). Berlin: Springer-Verlag.

Gulliksen, J., Harker, S., & Vanderheiden, G. (2004). Guidelines, standards, methods and processes for software accessibility (Special issue editorial). *Universal Access in the Information Society*, *3*(3-4), 1–5. doi:10.1007/s10209-003-0068-4

Herramhof, S., Petrie, H., Strobbe, C., Vlachogiannis, E., Weimann, K., Weber, G., & Velasco, C. A. (2006). Test Case Management Tools for Accessibility Testing. In J. Klaus, K. Miesenberger, D. Burger & W. Zagler (Eds.), *Computers Helping People with Special Needs. Proceedings of 10th International Conference, ICCHP 2006*, Linz, Austria, 12-14 July 2006.

Keates, S., & Clarkson, P. J. (2003). Countering Design Exclusion Through Inclusive Design. In *CUU'0*3, November 10-11, 2003, Vancouver, British Columbia, Canada. Retrieved from http://www.acm.org

Leporini, B., Paterno, F., & Scorcia, A. (2006). Flexible tool support for accessibility evaluation. *Interacting with Computers*, *18*(5). doi:10.1016/j.intcom.2006.03.001

Loiacono, E. T., & McCoy, S. (2006). Website accessibility: a cross-sector comparison. *Universal Access in the Information Society*, *6*(4), 393–399. doi:10.1007/s10209-005-0003-y

Paddison, C., & Englefield, P. (2003). Applying Heuristics to Perform a Rigorous Accessibility Inspection in a Commercial Context. In *CUU'0*3, Nov. 10-11, 2003, Vancouver, Canada.

Petrie, H., Hamilton, F., King, N., & Pavan, P. (2006). Remote Usability Evaluations with Disabled People. In *CHI'2006*, Montréal, Quebec, Canada, April 22–27, 2006.

Shindler, J. (2004). *The Accessibility of Online Internet Shopping: An analysis and evaluation of the policies of seventeen major high street companies*. University of Salford.

Viorres, N., Koutsabasis, P., Arnellos, A., Darzentas, J. S., Velasco, C., Mohamad, Y., et al. (2003). An Approach for Personalisation and Content Adaptation of Internet Applications based on User and Device Profiles. In *Proceedings of HCI International 2003*, 24-26 June 2003, Heraklion, Crete.

## KEY TERMS AND DEFINITIONS

**Accessibility Specifications:** an organised, validated and testable set of (among others) principles, guidelines, techniques, examples that have to be followed by design practitioners to ensure accessibility.

**Accessibility:** the property of a designed artifact to be usable, manipulable and undestandable by all people regardless temporal or permanent injuries or disabilities.

**Expert (Manual) Web Accessibility Inspection:** a generic category of accessibility evaluations that mainly includes experts that review a website for accessibility flaws on the basis of their knoweldge fo accessibility and with reference to accessibility specifications.

**Inclusive Design:** or Design for all: the practice of designing for all people as potential users, thus including the requirements of people with disabilities.

**People in Handicapping Situations:** people that face temporal disabilities mainly due to factors related to temporal injuries, the access context or the environment in which they are situated in.

**User Testing of Web Accessibility:** a generic category of accessibility evaluations that mainly includes user interaction with the web site and recording of accessibility flaws.

**Web Accessibility Evaluation Tool:** a software tool that checks the conformance of a web page to a set of Web accessibility specifications (that can be tested automatically)

**Web Accessibility Policy:** a set of practices for the design, development and update of a website that ensure that Web accessibility is maintained through time.

**Web Accessibility:** accessibility of (any type of) a website.

# Chapter 57
# Understanding the Use of Business-to-Employee (B2E) Portals in an Australian University though the Management Lens:
## A Qualitative Approach

**Md Mahbubur Rahim**
*Monash University, Australia*

**Mohammad Quaddus**
*Curtin University, Australia*

**Mohini Singh**
*RMIT University, Australia*

## INTRODUCTION

The application of the Internet for commercial purposes has led to different types of e-business initiatives, which have been widely discussed in the scholarly literature and trade magazines. However, it is the Business-to-Consumers (B2C) and Business-to-Business (B2B) e-businesses that have so far dominated discussion in the contemporary literature. These two types of e-business initiatives collectively are believed to have enormous impact on business practices, industry structure and our society at large. On the other hand, Business-to-Employee (B2E), which represents an employee centric e-business initiative (Turban et al., 2008), is relatively less recognized in extant literature. Despite little attention given to B2E e-business, it represents an emerging area which has the potential to benefit businesses and IT vendors alike (Rahim and Singh, 2007). For businesses, B2E e-business solutions can act as a source of competitive advantage through retention of satisfied workforce (Hansen and Deimler, 2001). The IT vendors are currently competing to capture market share by offering various types of innovative web-based B2E solutions (e.g. employee portals, e-HR systems and ESS). According to several industry sources, an increased growth has been observed in the demand for various types of B2E products (Killen Associates Report, 2006; Merrill Lynch Capital Markets cited

DOI: 10.4018/978-1-61520-611-7.ch057

in Brooks, 2004; and Banks, 2004). Yet, despite industry forecasts, the use of B2E e-business solutions by employees has largely been ignored in the current scholarly IT/e-business literature. This lack of attention is possibly due to the implicit assumption made in the literature (due to media hype) that employees would happily embrace and use B2E systems once these technologies are introduced in organisations. We however disagree with this view and argue that evaluation of the use of B2E solutions by employees represents a key research concern because the benefits arising from the introduction of such solutions are unlikely to be realised when they are not satisfactorily diffused among employee community. Therefore, managers need to be aware of the factors that may potentially affect the use of B2E e-business systems in organisational settings.

We acknowledge that existing literature has reported the attempts made by several scholars (e.g. KieBling and Kostler, 2002; Gounaris and Dimitriadis, 2003; Holsapple and Sasidharan, 2005) who have studied such aspects as portal usability and portal design challenges associated with various types of online B2C interactive portals (e.g. tourist portals, citizen portals) which have some degree of similarity with B2E systems. Despite this similarity, clear differences still exist because unlike B2C portals the users are employees not external customers who need to be provided with access to organisational internal controls, and many different types of services, and more in-depth information of B2E systems. Therefore, as the motivations and purposes of B2E systems are different (although many of the underlying technical issues are similar), we can expect that the usage behaviour of B2E systems by employees is different from that of users of online B2C service portals. Consequently, although the findings of these scholars are useful they are not directly applicable to B2E systems context without further empirical confirmation. Recognising this difference is important because little (if any) research attention has been given to understand use of B2E systems.

In this article, we thus report the experience of a large Australian university in introducing an employee portal. In particular, we analyse the views of the portal steering committee (who represent the interests of the university senior management) relating to the portal usage behaviour of university staff and identify the key factors which they believe to have contributed to employees' low usage practices of portals. Identifying factors from the perspective of senior management is important because unlike other employees (who act as ordinary users) they have better understanding of the strategic rationale for the introduction of portal initiatives in organisational settings. We argue that it is this focus of trying to understand B2E systems use from the viewpoint of senior management that sets our study apart from other existing adoption studies on online B2C service oriented systems which primarily adopt the viewpoint of actual users rather than the strategic management of the organisation which introduces their online systems. Hence, we contribute to literature by highlighting the views from a major stakeholder (i.e. senior management) in relation to B2E systems adoption.

Our article is organised as follows. First, we review e-business and human resources literature in which the notion of employee oriented e-business systems has been discussed. Consistent with our objectives, we however restrict our literature review attention to those studies which adopted the perspective of organisational management and then identify the research gaps and broad research concerns. Next, our research approach is described. Following that, the background of the participating tertiary educational institution is presented. Next, empirical evidence collected from the institution is described and discussed in light of the existing literature. Finally, the contributions of our research are highlighted and areas of possible further investigations are mentioned.

## BACKGROUND LITERATURE: AN ANALYSIS

### E-Business Literature

A review of literature on B2E e-business systems identifies two specific research aspects: *organisational adoption decisions of B2E e-business systems, and business impact from the adoption of B2E e-business systems.* We now summarise the key findings about these aspects below:

- **Organisational adoption decisions of B2E e-business systems:** In general, factor-based studies were undertaken to address these issues. In their studies, Sugianto et al. (2005) and Rahim (2007) identified several critical success factors that influence an organisation's decision to introduce a B2E system. These factors include perceived organisational need, cost, management support, IT expertise of organisations and portal complexity. In general, these factors were drawn from the diffusion of innovation and IT/IS implementation literature sources. Although the factor-based research is useful the findings of these authors are based on a single case study, they are quite difficult to generalise for organisations operating in other industry settings.
- **Business impact from the adoption of B2E e-business systems:** Business impact is generally expressed in terms of benefits for employees and organisational perspective. In general, benefits resulting from B2E e-business systems usage have traditionally been the key focus of practitioner oriented literature. Many short business articles have been published explaining how such systems can provide benefits to organisations. The commonly cited benefits in these articles include: cost savings, greater employee productivity, and satisfied workforce among others (HP Report, 2001), BioSensors International (Sun Microsystems, 2001) and Bank Indonesia (Praweda, 2001).

Some of the claims made in the business articles have been substantiated to an extent by e-business scholars who analysed the perceptions of the senior management on the benefits from B2E systems adoption. For instance, Rahim (2006) and Rahim & Singh (2007) reported the benefits of traditional web-enabled B2E systems for both employees and their organisations. In their study, Scornvacca et al. (2006) examined the organisational impact of a mobile B2E application in a New Zealand restaurant. In another study, Rangone (2006) looked at the characteristics and benefits offered by mobile B2E applications in some Italian companies. It is interesting to note that the empirical evidence from these studies suggests a reduction in cost cutting but mixed findings were found with regard to benefits experienced by individuals using B2E systems.

### Human Resource Literature

The adoption of various forms of employee related information systems (e.g. HRIS, e-ESS, online recruitment systems, e-HR systems) has been widely discussed in the HR literature. This stream attempts to understand the context necessary for the successful adoption of employee oriented systems and their potential impact on organisational effectiveness. Typical works representing this group include those of Kavanagh et al. (1990), Kinnei & Arthurs (1993), Jones & Arnett (1994), Pitman (1994), Lin (1997), Ball (2001) and Teo et al. (2001). This list is by no means exhaustive. Drawing on the findings of these studies, we identify top management support, employee training, support from the IT department, support for the HR staff, e-HR system characteristics, and total number of people employed by organisations to be important factors in the existing literature.

### Gaps in the Literature

It is implicitly assumed in the above-mentioned streams of literature that adoption decisions made by senior management is likely to lead to wide spread diffusion of portal technologies among workforce. Hence, scholars have stopped short of measuring the B2E portal usage pattern of employees in organisations. As a result, factors affecting B2E portals use is not clearly known. In response to this gap, we have initiated this research to identify how various factors have influenced use of B2E portals by employees within a large Australian university. In doing so, we adopt an exploratory research approach, use the factors (identified above) as a template to guide our research, and analyse the importance of these factors from the viewpoint of senior management who are responsible for implementing B2E systems in the participating organisation.

## RESEARCH APPROACH

### Selection of Case Study Approach

As our research is exploratory in nature, and we wanted to discover insightful explanations regarding the influence of factors affecting B2E portals usage, we have adopted a single case study approach. Our choice is consistent with the views expressed by Zikmund (1997) and Yin (2003) and who argued that case study approach is suitable to explore a problem situation where little is known.

### Choice of Case Organisation

The participating case organisation is a large Australian university; its selection is guided by the illustrative strategy principle (Veal, 2005) because of our intention to illustrate the effects of factors which could be observed in an organisation that has made a serious attempt to introduce a B2E e-business system. Moreover, B2E portals are reported to have recently been initiated by some leading Australian universities (Tojib et al., 2005), and hence a case organisation from the tertiary industry is quite suitable as they tend to have distributed workforce in many campuses.

### Case Study Participants

The development of the employee portal at the participating institution was monitored by Portal steering committee which includes senior members drawn from various functional areas. These members have in-depth knowledge of the strategic vision behind introducing the portal. As these members were intimately involved with how the portal project was conceived and eventually developed, we have conducted in-depth interviews with those members to identify their views about portal usage by employees in the university. A total of five members from the portal steering committee participated including CIO, three senior IT managers, and a senior university official who served as the chair of the portal steering committee. Based on our in-depth interviews with these members, a set of factors which they believed to have contributed to the low usage of employee portal were identified and later discussed in light of the existing literature.

### Data Analysis

Each interview with portal steering committee members lasted for about an hour, was tape recorded, and subsequently transcribed. Interview transcripts were later sent to the interviewees for review and were revised based on their responses. The revised interview transcripts were analysed using a coding scheme which was prepared based on interview protocol. Using this coding scheme, each interview script was examined by two members of the research team. Any differences were resolved through mutual discussion.

Established methodological guidelines suggested by Pare (2004) and Yin (2003) were applied to generate reliable findings. Data collected through interviews were analysed using the pattern matching logic (Yin, 2003) which enabled us to compare the pattern of outcomes of portal usage factors reported in the existing literature with the pattern of outcomes deduced from the case data collected through verbal interviews and other documentary sources of the university.

## EMPIRICAL FINDINGS

Our discussions with the interviewees and review of the university portal evaluation report indicate the presence of a low level of portal use by university employees. Employees are reported to access portals infrequently and a section of the employees even do not use it at all. The chair of the portal steering committee acknowledged this situation and remarked:

*At the moment, our staff haven't got the buy-in to the portal. I think that probably less than 20% of staff use it as daily log on basis.*

The CIO of the university also recognised the low use of the portal by the university employees and commented:

*I must admit that our staff are not too big in the portal usage, they do not consider it to be very useful.*

The view about low usage of the portal by various types of university staff is also highlighted in the usability report which describes low inclination prevailing among the university employees for using the portal. In-depth discussions with the key informants indicate the presence of two major factors which they believe to have contributed to the limited use of the portal by employees. These include: *low portal value perceived by employees* and *declined management support for the portal project*. Each factor is explained below.

**Low portal value perceived by employees**: Rich insights were obtained from the key informants about why they think university employees may have perceived the portal to have low value for their work. In particular, deficiencies in three areas of the portal were identified: absence of killer applications, lack of relevant information, and multiple sources for employees to access relevant information.

The portal does not contain enough attractive applications for encouraging staff to use it more frequently. At present, the portal contains only four major applications (i.e. e-mail, library access, HR applications, and an online application to support flexible learning and teaching of units) for which employees use the portal. Apart from these, no major applications addressing employee benefits (e.g. superannuation, online training courses, online purchase from university utility and book shops) were included to attract greater usage of the portal by employees. The influence of the lack of killer applications into the portal on employees' low usage is explained by a senior It manager as follows:

*Only about 20% of staff use portals. So the pick-up among our staff is much lower, and large part of that because the killer functions (e.g. HR) that we would like to have there are not there.*

Furthermore, the portal does not contain adequate relevant information for three major categories of university staff (i.e. research staff, administrative staff and academics). For example, the research staff of the university need to know who else is involved in the research activities they are involved with and what latest research findings are available and where they are available. The portal provides little assistance to address these concerns which are of significance to research staff. According to the chair of the portal steering committee:

*Our research staff has got a huge area of need of finding out what other people are doing for research. But inadequate research contents were included in the portal for them.*

The deficiency of the portal to provide support for the research staff is also acknowledged by another senior IT manager who commented:

*We did very little for the research portfolio at the moment and that's something is seen as a big failing of the portal.*

For teaching staff, although the portal provides them with an access to online student learning system to organise the contents of the units they teach, however it does not provide online resources (e.g. electronic databases) required to facilitate their teaching needs. In other words, enough relevant contents were not made available within the portal to make it more appealing to teaching staff. This limitation is recognised by the director of the IT applications services who made the following remarks:

*Relevant contents are not there for teaching staff. Our IT staff need to make the content available which takes time….At the moment, the contents are not very interesting to them.*

Another observation is that a large portion of information relevant to university employees that can be accessed through the portal is also available in the websites of their respective faculties or administrative units. For example, a large pool of information needed by the library staff is available in the library website and hence there is no motivation for the library staff to find that information through the portal. The multiple sources of content availability is thus a barrier for the portal to attract high portal usage. According to the chair of the portal steering committee:

*Many staff say that they have no motivations to use the portal because all the necessary information can be found in their faculty intranet-based web-pages. Why would they use a portal when they have got a perfectly good faculty website that contains necessary information?*

This concern is shared by a senior IT manager who commented:

*I must admit that our staff do not consider portal as very useful. The contents are not very interesting to them and our problem is we have got multiple intranets but not a single one which would converge everything.*

These views are also highlighted in the usability report which explains that general staff in particular prefer to use the university website to find out information related to their work rather than rely on the portal to locate that information. This is because they are more familiar with their departmental web sites and hence consider it to be the quickest way to identify relevant information. Therefore, the presence of multiple intranet systems within the university means that there are usually multiple ways to find information and services which in turn discourage employees to use the portal.

**Declined management support for the portal project:** According to the steering committee members, management support was initially quite high for the introduction of the portal but gradually diminished as a change in senior management took place. Two members of the university's senior management team who were involved at the portal initiation stage, were strong supporters for implementing the portal. However, they had left the university while the portal was in the implementation stage. The attitude of the new senior management team members towards the portal was not as aggressive as it was at the outset of the portal project. Consequently, even though the portal project began with considerable momentum and strategic vision to support the flexible learning and teaching environment of the university; that enthusiasm soon waned and the focus had shifted to matters relating to operations and maintenance of the portal. This sentiment is expressed by the CIO as follows:

*Main driving force for this portal project came from the office of the Deputy Vice Chancellor which provided the portal project with academic credibility. They could see the academic value of what we were doing and their involvement was critical to this project. However, the DVC and his associates have left this university and there has been a decrease in the enthusiasm of the high level management for the portal project.*

Hence, adequate funding to include attractive contents and services in the portal could not be secured from the senior management. The budget allocated for the portal is currently being consumed by maintenance work, leaving very little for developing new features that would enhance the value of the portal to employees. This sentiment is expressed by the chair of the portal steering committee as follows:

*"We need millions. We need funding to replace the in-house built portal. We probably need to buy commercial package or at least step-up the resources for the portal to grow. So, this is another stick in the mud, we are waiting for this to happen."*

## DISCUSSION

There is a general consensus among the portal committee members about the limited use of the portal by university staff. It is clear from this research that value of the system plays an important role in wining users. The case study evidence indicates that the limited perceived usefulness of the portal can be satisfactorily explained by: *the lack of adequate killer applications, absence of relevant information in the portal, and the continued availability of employee task related information from non-portal sources.* This finding is consistent with the views expressed in the IS/IT implementation literature. According to Davis (1989) and Adams et al. (1992), perceived system usefulness is a dominant determinant of technology acceptance by individuals. Thus, for the B2E portal context, we argue that the lack of necessary core services and the absence of relevant information have created a negative perception among employees about the merits of the portal; this in turn has led to the low use of the portal. In addition, the availability of useful information for employees from multiple sources further reduced the value contribution of portals. This particular aspect has not been highlighted in the existing literature and represents a genuine contribution of our study as it has implications for university-wide policy formulation with regard to control and storage of information.

We have also found that management support (to make the portal truly useful) which was initially quite high for the portal project had later declined during the course of the project as a result of the change in senior level management team. The new management withdrew the patronage needed to include relevant contents and applications into the portal. Consequently, adequate funding which was initially committed for the portal project was not eventually assigned to the project. The shift in the level of financial support given to the portal project due to a change of management patronage is an interesting observation which is not always explicitly reported in the existing literature. We however acknowledge that many scholars such as Ewusi-Mensah (2003), Karimi et al. (2001) and Sauer (1993) have identified inadequate allocation of funding by senior management to be a critical factor that slows the uptake of innovative IT applications in organisational settings as those applications lack attractive functionalities.

We further argue that inadequate management support for the portal initiative has enabled employees to access relevant information from non-portal sources (i.e. web sites of individual functional units). This has been possible due to the lack of management recognition of the need for a single web strategy for the entire university within which the portal development should be conducted. At present, the university does not have a clearly documented strategy for the portal. According to the chair of the portal steering committee:

*We need a clear strategy about how portal and many fragmented faculty initiated intranets can interact. We need a strategy in place in support of which we should put information into the portal so that the employees use that.*

According to the key informants, even though the initial motivation of the portal was to support the flexible learning and teaching program, the actual development of the portal was hardly directed by this strategic goal. Without a clear direction, each individual faculty and administrative units thus have developed their own internal intranet websites incorporating contents which they believed to be relevant for their own staff. The absence of a clear web strategy has created an environment in which portals are often considered by employees to be redundant, and hence employees use their own faculty or administrative units' websites for related contents and services bypassing the portal. This finding too is consistent with the broad observations made in the IS/IT adoption literature in which scholars (e.g. Nidumolou, 1995; King and Teo, 2000; Salmela and Turunen, 2003) argue that senior management should take responsibility for ensuring IT applications acceptance (thus success) by setting a clear vision, communicating that vision with employees and participating in the organisational IT strategy process. In this particular university, we have observed evidence suggesting the lack of top management's intention to engage in portal strategy process and their lack of support and commitment to roll out fully functional portal for employees by authorising necessary funding for training and relevant content access.

## CONCLUSION

Unlike other popular types of e-business initiatives, B2E represents an under-researched (but important) initiative in which many organisations worldwide have made considerable investment. As such, despite its potential impact on organisations and their workforces, inadequate attention has been paid by e-business scholars to fully understand how the usage of B2E e-business systems is affected in organisational settings. Contrary to the scholarly literature, contemporary e-business trade literature has discussed the merits of commercially available B2E e-business products which promotes the view that employees would rush to using various types of B2E e-business solutions when they are introduced in organisations. We disagree with this view by critically analysing the experience of a large Australian university that has introduced an employee portal in recent years. We also offer rich explanations into how the employee portal usage in that particular university has been affected by a set of organisational factors and discuss those factors in light of the existing literature.

We report that despite maintaining a reasonable size IT department which developed an in-house portal solution for the use of the participating university, the uptake of the portal by various categories of employees within that particular university is less than satisfactory. We then identify the factors which the portal steering committee members think have contributed to the limited usage of the portal. In doing so, we provided rich insights into the factors that have slowed down acceptance and subsequent use of the portal by employees. We observe that these key factors are involved that negatively influenced the usage of the employee portal: perceived low value of the portal by employees, change in management support for the portal, and multiple sources of information availability for employees. These findings (although are not entirely new in the IT implementation literature), their relevance to the B2E portal context represents our major contribution to knowledge as an evaluation of the factors influencing portal usage is not readily available. However, the discovery of maintaining multiple sources of information and lack of developing an organisation wide policy for employee task related information storage and retrieval (which also contributes to the literature) represents a genuine contribution pf this study. We thus claim that our study will alert the e-business and IT managers of those organisations which are seriously contemplating the introduction of employee portals. Also, a discussion on the B2E portal presented in this chapter makes a contribution to a niche area of e-business theory.

There are several directions in which our study can be further improved. We do not claim generalisability of our findings as they are rooted in a single case study. Further effort needed to replicate this research across various private sectors. Likewise, we also argue that future studies should collect views from employees about the factors affecting their usage of portal and compare their views with those identified from the management.

## REFERENCES


Adams, D. A., Nelson, R. R., & Todd, P. A. (1992). Perceived usefulness, ease of use, and usage of information technology: a replication. *MIS Quarterly*, 227–247. doi:10.2307/249577

Ball, K. S. (2001). The use of human resource information systems: a survey. *Personnel Review*, *30*(6), 677–693. doi:10.1108/EUM0000000005979

Banks, J. (2004). Integrating people and content with business processes. In *2nd annual conference on Corporate Portal World Australia*, Sydney, Australia.

Brooks, M. (2001) Communications - General Productivity Gains with Employee Portals. *Communication & Benefits Management,* (Spring), 35-39.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 319–340. doi:10.2307/249008

Ewusi-Mensah, K. (2003). *Software development failures*. Cambridge, MA: MIT Press.

Hansen, M., & Deimler, M. (2001). Cutting costs while improving morale with B2E management. *MIT Sloan Management Review*, *43*(1), 96–100.

Jones, M. C., & Arnett, K. P. (1994). Linkages between the CEO and the IS environment: An empirical assessment. *Information Resources Management Journal*, *7*(1), 20–33.

Karimi, J., Somers, T., & Gupta, Y. (2001). Impact of IT management practices on customer service. *Journal of Management Information Systems*, *17*(4), 125–158.

Kavanagh, M. J., Gueutal, H. G., & Tannenbaum, S. (1990). *Human resource information systems: development and application*. Boston: PWS-Kent Publishing Co.

Killen & Associates Report. (2001). *Business-to-employees Communication: The competitive edge for tomorrow's global enterprises*. Killen & Associates, USA.

King, W., & Teo, T. (2000). Assessing the impact of proactive versus reactive modes of strategic information systems planning. *Omega*, *28*, 667–679. doi:10.1016/S0305-0483(99)00079-1

Kinnei, N., & Arthurs, A. (1993). Will personnel people ever learn to love the computer? *Personnel Management*, *25*(6), 46–51.

Lin, C. Y. Y. (1997). Human resource information systems: Implementation in Taiwan. *Human Resource Management*, *5*(1), 57–72.

Pare, G. (2004). Investigating Information Systems with Positivist Case Study Research. *Communications of the AIS*, *13*, 233–264.

Pitman, B. (1994). Critical success factors to organizational change . *Journal of Systems Management*, *45*(9), 40.

Rahim, M. M. (2006). Understanding adoption and impact of b2e e-business systems: lessons learned from the experience of an Australian university. In *Proceedings of the sixth Collaborative Electronic Commerce Research (CollECTeR)*, Adelaide, Australia.

Rahim, M. M. (2007). Factors Affecting Adoption of B2E E-Business Systems: A Case of the Australian Higher Education Industry. In *Proceedings of the Pacific Asia Conference on Information Systems*, July 4-6, New Zealand.

Rahim, M. M., & Singh, M. (2007). Understanding benefits and impediments of B2E e-business systems adoption: Experiences of two large Australian universities. *Journal of Internet Commerce*, *6*(2), 3–17. doi:10.1300/J179v06n02_02

Rangone, A. (2006). B2E mobile internet: An exploratory study of Italian companies. *Business Process Management Journal*, *2*(3), 330–333. doi:10.1108/14637150610667999

Salmela, H., & Turunen, P. (2003). Competitive implications of information technology in the public sector. *International Journal of Public Sector Management*, *16*(1), 8–26. doi:10.1108/09513550310456391

Sauer, C. (1993). *Why information systems fail: A case study approach*. Henley-on-Thames, UK: Alfred Waller.

Scornavacca, E., Prashad, M., & Lehmann, H. (2006). Exploring the organisational impact and perceived benefits of wireless personal digital assistants in restaurants. *International Journal of Mobile Communications*, *4*(5), 558–567.

Sugianto, L., Rahim, M. M., & Alahakoon, D. (2005). B2E Portal Adoption: A conceptual model. In *Proceedings of the International Conference on Information and Automation* (ICIA2005), December 15-18, Colombo, Sri Lanka.

Teo, T. S. H., Lim, G. S., & Fedric, A. A. (2007). The adoption and diffusion of human resources information systems in Singapore. *Asia Pacific Journal of Human Resources*, *45*(91), 44–62. doi:10.1177/1038411107075402

Teo, T. S. H., Soon, L. G., & Fedric, S. A. (2001). Adoption and impact of human resource information systems. *Research and Practice in Human Resource Management*, *9*(1), 101–117.

Tojib, D. R., Sugianto, L. F., & Rahim, M. M. (2005). A New Framework for B2E Portal Development. In *IEEE International Conference on e-Technology, e-Commerce and e-Service*, Hong Kong.

Turban, E., King, D., Lee, J., & Viehland, D. (2008). *Electronic Commerce: A Managerial Perspective*. Upper Saddle River, NJ: Prentice Hall.

Veal, A. J. (2005). *Business Research Methods*. New South Wales, Australia: Pearson Education Australia.

Yin, R. K. (2003). *Case Study Research: Design and Methods* (3rd Ed.). Thousand Oaks, CA: Sage Publications, Inc.

Zikmund, W. G. (1997). *Business Research Methods* (5th Ed.). Orlando, FL: Dryden Press.

## KEY TERMS AND DEFINITIONS

**Business-to-Employee (B2E):** It represents an employee centric e-business initiative. Typical examples include various types of innovative web-based B2E products including employee portals, e-HR systems and ESS.

**Portal:** It is defined as a web site or service that offers a broad array of resources and services (e.g. e-mails, search engines, online shopping malls) to individuals. The first web portals were online services, such as AOL, that provided access to the Web.

**Usage Factors:** They represent the conditions that influence the use of an IT application. These conditions can be related to technology (e.g. ease of use, complexity) and organisation (e.g. top management support).

# Chapter 58
# Understanding the Use of Business-to-Employee (B2E) Portals in an Australian University through the Employee Lens:
## A Quantitative Approach

**Md Mahbubur Rahim**
*Monash University, Australia*

**Mohammad Quaddus**
*Curtin University, Australia*

**Mohini Singh**
*RMIT University, Australia*

## INTRODUCTION

The focus of the existing body of e-business literature is primarily directed at Business-to-Consumers (B2C) and Business-to-Business (B2B) forms of e-business. In contrast, Business-to-Employee (B2E) is relatively less highlighted in the scholarly literature. Despite the lack of attention given to B2E systems, it represents an emerging area which has the potential to have a major impact on organisations. In general, B2E systems use intra-business networks allowing organisations to provide useful services, information, or products to their disperse employees (Turban et al., 2008). By providing easy access to relevant information, services, and products, B2E systems help in creating satisfied workforce that is expected to be more loyal to organisations (Dube, 2005). These systems also help organisations in reducing their administrative costs by streamlining employee related process (Singh, 2005) and eliminating expenses related to paperwork, postage, printing and travel (Killen Associates Report, 2001). Adoption of B2E e-business systems can even assist organisations in outperforming competitors by connecting their employees together (Hansen and Deimler, 2001).

Recognising the above mentioned benefits, an increase in the demand for various types of B2E e-business solutions is noted by several industry reports (Killen Associates Report, 2006; Merrill Lynch

DOI: 10.4018/978-1-61520-611-7.ch058

Capital Markets cited in Brooks, 2004; and Banks, 2004). Regrettably, despite a growing demand for implementing B2E solutions, their usage in organisational settings has not been critically analysed and reported in the current scholarly literature. We argue that evaluation of the use of B2E solutions by employees represents a key research concern because the benefits arising from the introduction of such solutions are unlikely to be realised when they are not satisfactorily diffused among employee community. Therefore, managers need to be aware of the factors that may potentially affect the use of B2E e-business systems in their organisations. Against this background, we report the experience of a large Australian university in introducing an employee portal (a popular form of B2E e-business system) by analysing the perceptions of a segment of university staff about the influences of popularly discussed factors on their portal usage behaviour. Our findings provide interesting interpretations of the influence of several factors on the low usage of portal by employees. More specifically, we find that portal usefulness is a complex construct that fundamentally consists of two dominant dimensions (i.e. perceived collaboration usefulness and perceived information communication usefulness) – both of which are in turn influenced by management support. The discovery of these dimensions represents a major contribution of our work.

Our paper is organised as follows. First, we review various streams of literature related to B2E and similar other systems. Next, building on literature review and our prior research in this area, we identify a range of factors that may potentially affect use of B2E systems by employees. Then, our research approach is described. Next, background of the participating university is described. Then, the survey findings are presented and discussed in light of the existing e-business and IS/IT implementation literature. Finally, our contributions are highlighted and future directions of our research are indicated.

## BACKGROUND LITERATURE: AN ANALYSIS

As the literature on B2E e-business systems is limited, we have consulted several related streams of literature to identify how various factors may influence the use of employee-oriented IT systems in organisational settings. These include: e-business literature, human resources (HR) literature, sales force automation (SSA) literature, diffusion of innovation and IS/IT implementation literature. In the following sub-sections, we provide a brief but insightful review of the key findings from each stream from the perspective of employees using some forms of B2E systems.

### E-Business Literature

Existing e-Business literature cites the works of several scholars who have studied such aspects as usability and design challenges associated with various types of B2C interactive portals (e.g. Kiebling and Kostler, 2002; Gounaris and Dimitriadis, 2003; Holsapple and Sasidharan, 2005) tourist portals, citizen portals) which have some degree of similarity with employee portals. We acknowledge this similarity but argue that distinct differences exist between B2C portals and employee portals in such areas as type of users (external customers vs employees), degree of access given to organisational controls via portals (limited for customers vs high for internal employees), and type of services and information offered (e.g. superannuation is not relevant for customers but of importance to employees). Therefore, as the motivations and purposes of employee portals are different than B2C interactive portals (although many of the underlying technical issues are similar), we can expect that the usage behaviour of portals by employees is different from that of the users of B2C portals. Consequently, we have restricted our literature review attention to the B2E systems only.

A review of the B2E systems related studies reported identifies three specific research aspects that have received interest from scholars: *organisational adoption decisions of B2E systems, benefits arising from the adoption of B2E systems, and employee satisfaction with B2E systems*. The first two aspects are usually examined from management perspective. Typical works representing the first two aspects include those of Scornvacca et al. (2006), Rahim (2007), and Rahim and Singh (2007). The third aspect of this stream has adopted the viewpoint of individual employees about the success B2E systems. Several authors have measured success in terms of satisfaction and investigated employee satisfaction with various forms of B2E systems in terms of a model involving several factors. For example, Huang et al. (2004) analysed satisfaction of employees with a B2E benefit system at a Taiwanese company and found that such factors as convenience, interface, accuracy, price and security affected employee satisfaction with that application. In another study, Sugianto & Tojib (2006) proposed a conceptual model to measure user satisfaction with employee portal and identified nine factors that could affect employee satisfaction with portals. In a subsequent study, Tojib and Sugianto (2007) empirically tested that model in a large Australian university setting and found that five factors including usefulness, ease of use, portal design, confidentiality and convenience affected user satisfaction with employee portals.

## Human Resource Literature

The adoption of various forms of employee related information systems (e.g. HRIS, e-ESS, online recruitment systems, e-HR systems) has been discussed in the HR literature. A group of HR scholars (e.g. Teo et al., 2007; Stone et al., 2007) have focused on the acceptance and usage of HR information systems from the perspective of individual employees. They found individual characteristics of employees and their attitudes to be the determinants of employees' acceptance and subsequent usage of HR related information systems.

## Sales Automation Literature

A large portion of this stream addresses the factors that influence individual sales employee's decisions to use automated systems. Typical works include those of Parthasarathy and Sohi (1997), Speier and Venkatesh (2002) and Schillewaert et al. (2005) among others. In general, these studies acknowledge that perceived usefulness is a major factor to affect actual use of automation systems by sales employees. In addition, the importance of demographic profile of sales force on their acceptance and even use of sales automation technologies is also noted.

## IS/IT Implementation Literature

Davis (1989) and Davis et al. (1989) proposed Technology Adoption Model (TAM) to address why users accept or reject information technologies. The model suggests that perceived ease of use and perceived usefulness are the two most important factors in explaining use of information technologies by individuals. More recently, a new version of TAM known as TAM2 is proposed by Venkatesh and Davis (2000) which includes subjective norms and was tested with longitudinal research designs. Many authors have applied TAM model in explaining use of various types of business IT applications. However, analysis of empirical research with TAM is not totally conclusive.

## Diffusion of Innovation Literature

The adoption and diffusion of innovation literature examines how an innovation spreads through the market from the time of introduction. However, if an innovation meets resistance from consumers, the adoption process can be expected to begin only after this resistance has been overcome. If the resistance cannot be broken down, adoption slows down and the innovation is likely to fail. According to Rogers (2003), rejection to an innovation often takes place even after an innovation has been adopted by individuals. Two important reasons were identified for innovation rejection: a) an innovation is rejected as a result of dissatisfaction with its performance, and b) when an innovation which was initially found to be attractive was eventually observed to be incompatible with the beliefs of individuals. An early study by Rogers (2003) found acceptance and resistance to usage to innovation are related to an individual's innovativeness.

### Gaps in the Existing Literature

These five streams of literature recognise that a number of factors influence an individual employee's decision to accept and use an IT application. They include demographic characteristics of employees, employee readiness, technological sophistication of employees, system usefulness as perceived by employees, perceived ease of use, attitudes of employees towards the IT system among others. We note that it is implicitly assumed in the e-business literature that adoption decisions made by senior management is likely to lead to wide spread diffusion of B2E technologies among workforce. Hence, scholars have stopped short of calling a measurement of B2E systems' usage pattern of employees in organisations. We acknowledge that the factors identified from various B2E related streams of literature are useful for understanding the usage of these systems by employees. However, as research into this area is virtually non-existent, it is necessary to dedicate further research effort examining the use of B2E portals. In keeping with this call, this research was undertaken to identify how various factors have influenced use of B2E portals by employees within a large Australian university. In doing so, we have adopted an exploratory research approach and use the factors (identified above) and in our prior studies as a template to guide our research.

## RESEARCH APPROACH

### Choice of Case Organisation

The participating case organisation is a large Australian university; its selection is guided by the illustrative strategy principle (Veal, 2005) because of our intention to illustrate the effects of factors which could be observed in an organisation that has made a serious attempt to introduce a B2E system. Moreover, B2E portals are reported to have recently been initiated by some leading Australian universities (Tojib et al., 2005), and hence an organisation from the tertiary industry is quite suitable as they tend to have distributed workforce in many campuses.

### Sample Size

A survey questionnaire was developed which included a set of items that operationalise several factors which were short-listed based on our prior qualitative research (Rahim et al., 2009) and literature review. This questionnaire was distributed among 500 staff of the participating university. A total of 161 responses were received yielding a response rate of 32.2%.

### Scale Development

Drawing on our experience of a prior qualitative research (Rahim et al., 2009) in which several key informants from the portal steering committee were involved, a total of three factors (e.g. perceived portal usefulness, perceived management support, and perceived training) were included in a survey questionnaire (along with four other factors short listed from the literature review). The survey questionnaire included the items for measuring 7 factors. In this article, we however

*Table 1. Sources of the items for measuring factors*

| Factors | No. of Items | Sources |
|---|---|---|
| Perceived portal usefulness | 9 | Yang et al. (2005) and developed by authors |
| Perceived management support | 3 | Developed by the authors |
| Perceived training | 2 | Developed by the authors |
| Use of portal | 1 | Hartwick and Barki (1994) |

restrict our focus to only those 3 factors which were reported to be highly important by the key informants reported in our previous work (Rahim et al., 2009). A summary of how these three factors were measured is shown in Table 1 and a theoretical justification in support of the relationship between these factors and the employee use of B2E portals is given in Appendix-A. Each item was measured on a scale of 1 to 5, where 1 means strongly disagree, 2 means disagree, 3 means neutral, 4 means agree and 5 means strongly agree. The dependent variable (use of B2E portal) was measured on a five-point interval scale where 1 means never use, 2 means at least once in 3 months, 3 means at least once a month, 4 means at least once a fortnight, and 5 means at least once a week. The survey instrument was reviewed by three domain experts and several changes were incorporated.

To address validity of the instrument containing 14 items measuring 3 factors (listed in Table 1), an exploratory factor analysis was carried out. The results (shown in Appendix-B) are quite interesting as a 4 factor solution was produced. A close look at the factor analysis results indicate that out of 14 items, 2 were removed as they loaded heavily on more than 2 factors (Hair et al., 2006). However, an interesting observation is that perceived portal usefulness can be considered to be of two types: *perceived collaboration usefulness* and *perceived information communication usefulness*.

Reliability of the items which were eventually retained after factor analysis were evaluated using Cronbach alpha (Nunnaly, 1978) and are found to be quite satisfactory as they had values over .70 and are shown in Table 2.

## EMPIRICAL FINDINGS

The survey results report a low use of the employee portal as the mean use is found to be 3.29 (on a scale of 1 to 5). This means that employees do not regularly use the portal. In fact, they use portals at least once a fortnight. The mean use of the portal is found to vary depending on gender, role of

*Table 2. Reliability results of the scales used for the factors*

| Factors | Items included | Reliability (Cronbach alpha) |
|---|---|---|
| Perceived collaboration usefulness | 5 items<br>PU1, PU3,PU4, PU7,PU9 | .769 |
| Perceived information communication usefulness | 3 items<br>PU2, PU5, PU6 | .70 |
| Perceived training | 2 items<br>PT1, PT2 | .743 |
| Perceived management support | 2 items<br>MS2, MS3 | .816 |

*Table 3. Mean use of employee portals by employees*

| Demographic Characteristics | Mean use | t-value | df | p-value |
|---|---|---|---|---|
| Gender<br>Male<br>Female | 3.39<br>3.19 | 1.062 | 159 | .290 |
| Job Role<br>Managerial<br>Non-managerial | 3.16<br>3.30 | -.480 | 159 | .632 |
| Job Type<br>Academic/research<br>Administration | 3.44<br>3.13 | 1.59 | 159 | .112 |

employees (i.e. managerial and non-managerial), and type of employee (i.e. academic/research, administration). However, the differences are not statistically significant (as shown in Table 3). Moreover, the use of portal is not high across any of these demographic categories of employees as the mean portal use is far less than 4.0. We therefore suggest the presence of an overall low trend of portal use among university employees.

An interesting observation is that 9% of surveyed employees do not use the portal at all, and that another 19% employees use the portal once in a 3-month. In other words, 28% of employees have no or little interactions with the portal. In contrast, only 20% employees use the portal on a regular basis (at least once a week). Thus, these findings collectively are indicative of the limited usage of the portal by university employees.

The mean values of the three independent factors (shown in Table 2) are shown in Table 4. The only benefits that employees experienced are their ability to access information and use that information in support of communication with others. In contrast, the portal is considered to have limited value from the perspective of exploring collaboration, acquiring work related items (via online ordering) and locating role specific information.

Table 4 further suggests that employees perceived a disappointingly low level of support by their senior management in terms of organising employee training (mean: 2.02) and workshops

*Table 4. Mean rating of employee perceptions about portal*

| **Item descriptionPerceived Portal Usefulness: Information Search & Communication Value** | **Mean Rating** |
|---|---|
| PU1: The portal helps me efficiently carry out work related communication | 3.53 |
| PU2: The portal provides me with ready access to information sources | 3.37 |
| PU3: The portal reduces the time spent on HR related activities | 3.51 |
| PU4: The portal provides me with accurate information to fulfil my needs | 3.71 |
| PU5:The portal provides single point of access to work related information | 3.16 |
| **Perceived Portal Usefulness: Collaboration Value** | |
| PU6: The portal offers collaboration facility with other employees | 2.75 |
| PU7: The portal helps me quickly acquire work related items (e.g. online ordering) | 2.34 |
| PU8: The portal provides role-specific (e.g. managerial, academic, administrative) information | 3.04 |
| **Perceived Portal Training** | |
| PT1: I was provided with the necessary training to use the portal | 2.02 |
| PT2: I attended workshops to learn how to use the portal | 1.80 |
| **Management Support** | |
| MS1: My management supports regular updating of the portal features | 2.88 |
| MS2: My management supports regular updating of relevant information in the portal | 3.07 |

*Table 5. Results of regression analysis for portal usage*

| | Unstandardized Coefficients | | Standardized Coef-ficients | t | Sig. |
|---|---|---|---|---|---|
| | B | Std. Error | Beta | B | Std. Error |
| (Constant) | .503 | .427 | | 1.178 | .241 |
| CollUsflns | .428 | .110 | .329 | 3.899 | .000 |
| InfoUsflns | .212 | .104 | .171 | 2.041 | .043 |
| Training | .019 | .097 | .016 | .197 | .844 |
| MgmtSup | .043 | .088 | .042 | .494 | .622 |
| Adjusted R Square = 16.4%, F = 7.882, p = .000 | | | | | |

(mean: 1.80) to help employees learn more about the potential merits of the portal. On the matter of management support for portal, the survey findings clearly indicate that employees were unhappy with the support they believed their management has offered to make the portal useful for employees. Employee responses indicate that university management was not seen to have supported regular updating of the relevant information in the portal (mean: 2.88) and inclusion of useful services through the portal (mean: 3.07).

We have conducted regression analysis (as shown in Table 5) and found that portal usage is significantly explained by both dimensions of portal usefulness. In contrast, perceived training support and management support were not found to have an effect on employees' portal usage. However, another two rounds of regression analysis was then conducted to find how perceived training and management support affect both dimensions of portal usefulness. The results (Tables 6 and 7) indicate that management support is strongly related to both dimensions of regression analysis.

## DISCUSSION

The limited usage of portal among university employees is surprising given the fact that portal is in use for about 5 years. The perceptions of employees about low portal value perceived by employees shed some light to understand the low usage of portals. Regression analysis confirms that both dimensions of portal usefulness are significantly related to the employees' portal usage. This observation is supportive of our previously reported qualitative investigation (Rahim et al., 2009) conducted at the same university from the perspective of the portal steering committee as well as is consistent with the views expressed in the IS/IT implementation literature. According to Davis (1989) and Adams et al. (1992), perceived

*Table 6. Results of regression analysis for portal usefulness (information & communication value)*

| | Unstandardized Coefficients | | Standardized Coeffi-cients | t | Sig. |
|---|---|---|---|---|---|
| | B | Std. Error | Beta | B | Std. Error |
| (Constant) | 2.814 | .207 | | 13.575 | .000 |
| training | -.062 | .069 | -.069 | -.904 | .368 |
| management | .256 | .059 | .330 | 4.319 | .000 |
| Adjusted R Square = 9%, F = 9.34, p = .000 | | | | | |

Table 7. Results of regression analysis for portal usefulness (collaboration)

| | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|
| | B | Std. Error | Beta | B | Std. Error |
| (Constant) | 1.806 | .227 | | 7.946 | .000 |
| training | .138 | .075 | .141 | 1.837 | .068 |
| management | .215 | .065 | .254 | 3.316 | .001 |
| Adjusted R Square = 9.6%, F = 8.43, p = .000 | | | | | |

system usefulness is a dominant determinant of technology acceptance by individuals. Likewise, many scholars who examined sales force automation systems adoption (e.g. Parthasarathy and Sohi; 1997; Speier and Venkatesh, 2002) have reported that employees were reluctant to use IT applications when those applications were not perceived useful by them in performing their tasks. Thus, for the B2E portal context, we argue that the lack of necessary core services for collaboration and the inability of portal to offer role specific information together have created a negative perception among employees about the usefulness of the portal; this in turn has led to the low use of the portal.

Although management support did not contribute directly to portal usage but it is significantly related to both dimensions of portal usefulness. This suggests that employees felt that management support for the portal was low as the portal contents and features were not only inadequate but were also infrequently updated. In other words, the lack of management's intention to understand how employees would like to use the portal in support of their work is seen to be a major barrier to enhance functionalities of the portal. Our argument is consistent with those of Ewusi-Mensah (2003), Karimi et al. (2001) and Sauer (1993) who identified inadequate involvement of senior management as a critical factor that slows the uptake of innovative IT applications in organisational settings.

According to the regression analysis, the training needs of employees were not adequately addressed by management (as the means score shown in Table 4 are very low), it had no significant effect on both their portal use and the perceived functionalities included in the portal. This is possibly because the portal is easy to use and understand and employees who have high computer literacy did not require much training support. We thus conclude that even though perceived low portal usefulness appear to be the immediate determinant of employees' low portal use, it is the absence of full commitment and involvement of the senior management that contributed to the perceived limited usefulness. The degree to which portal usefulness is perceived was influenced by the understanding of management about how employees would like to use portal to facilitate their work. We thus call for the greater participation of management in support of portal usage. We suggest that senior management should take responsibility for ensuring IT applications acceptance (thus success) by setting a clear vision, communicating that vision with employees and participating in the organisational IT strategy process. Our position is in agreement with the views of Yehon et al. (2000) and Kerans (2007) who strongly recommend top management support and participation in creating a positive internal environment to facilitate acceptance of IT projects in organisational settings.

## CONCLUSION

Unlike other popular types of e-business initiatives, B2E represents an under-researched (but important) initiative in which many organisations worldwide have made considerable investment. As such, despite its potential impact on organisations and their workforces, inadequate attention has been paid by e-business scholars to fully understand how the usage of B2E e-business systems is affected in organisational settings. Contrary to the scholarly literature, contemporary e-business trade literature has discussed the merits of commercially available B2E e-business products. However, it is inappropriate to assume that employees would rush to using various types of B2E solutions when they are introduced in organisations. We thus critically analyse the experience of a large Australian university in which the uptake of the portal by employees was found to be less than satisfactory. We also identify the factors which have contributed to the limited usage of the portal. In doing so, we provide rich insights into the role of these factors for slowing down use of the portal by employees. Although these factors have been reported in various streams of related literature, their application to B2E portal context has not been explicitly discussed. Thus, a major contribution of our study is to reinforce the explanatory ability of the factors to satisfactorily describe the problematic situation of the portal used within the participating university. In addition, we have contributed to literature by discovering two specific dimensions of portal usefulness (i.e. perceived collaboration usefulness and perceived information communication usefulness) and interpreting their relationships with management support. This particular observation has not been reported in the literature. To sum up, we believe that our study will alert the e-business and IT managers of those organisations which are seriously contemplating the introduction of employee portals.

Our study however has some limitations. We have not examined the influence of employees' personal traits (e.g. innovativeness, techno-phobic or self-willed) in explaining their low use of the portal. Further studies are recommended to address how these aspects may affect employees' use of the portal. In addition, we have not considered the notion of '*customer activity life cycle'* in helping identify key services to be offered via the employee portal and its possible influence on portal usage. Further studies are recommended to examine this interesting aspect. Finally, there is a need to replicate this study in other industry sector to determine whether there is any influence of industry context on the factors affecting the uptake of portals by employees.

## REFERENCES

Adams, D. A., Nelson, R. R., & Todd, P. A. (1992). Perceived usefulness, ease of use, and usage of information technology: a replication. *MIS Quarterly*, 227–247. doi:10.2307/249577

Banks, J. (2004). Integrating people and content with business processes. In *2nd annual conference on Corporate Portal World Australia*, Sydney, Australia.

Brooks, M. (2001). Communications - general productivity gains with employee portals. *Communication & Benefits Management*, Spring, 35-39.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 319–340. doi:10.2307/249008

Davis, F. D., Bagozzi, R. P., & Warshaw, P. (1989). User acceptance of computer technology: a comparison of two theoretical models. *Management Science*, 985–989.

Dube, L., Bourhis, A., & Jacob, R. (2005). The impact of structuring characteristics on the launching of virtual communities of practice. *Journal of Organizational Change Management*, *18*(2), 145–166. doi:10.1108/09534810510589570

Ewusi-Mensah, K. (2003). *Software Development Failures*. Cambridge, MA: MIT Press.

Gounaris, S., & Dimitriadis, S. (2003). Assessing service quality on the web: evidence from business-to-consumer portals. *Journal of Services Marketing*, *17*(5), 529–548. doi:10.1108/08876040310486302

Hansen, M., & Deimler, M. (2001). Cutting costs while improving morale with B2E management. *MIT Sloan Management Review*, *43*(1), 96–100.

Hartwick, J., & Barki, H. (1994). Explaining the role of user participation in information system use. *Management Science*.

Hawking, P., Foster, S., & Stein, A. (2004). E-HR and employee self service: a case study of a Victorian public sector organisation. *Journal of Issues in Informing Science and Information Technology*, 1, 017-1026.

Holsapple, C. W., & Sasisharan, S. (2005). The dynamics of trust in B2C e-commerce: a research model and agenda. *ISeB*, *3*, 377–403. doi:10.1007/s10257-005-0022-5

Huang, J. H., Jin, B. H., & Yang, C. (2004). Satisfaction with business-to-employee benefit systems and organizational citizenship behaviour - an examination of gender differences. *International Journal of Manpower*, *25*(2), 195–210. doi:10.1108/01437720410535990

Karimi, J., Somers, T., & Gupta, Y. (2001). Impact of IT management practices on customer service. *Journal of Management Information Systems*, *17*(4), 125–158.

Kavanagh, M. J., Gueutal, H. G., & Tannenbaum, S. (1990). *Human Resource Information Systems: Development and Application*. Boston: PWS-Kent Publishing Co.

Kearns, G. S. (2007). How the internal environment impacts information systems project success: An investigation of exploitative and explorative firms. *Journal of Computer Information Systems*, 63–73.

KieBling. W., & Kostler, G. (2002). Preference SQL: design, implementation, experiences. In *Proceedings of the 28$^{th}$ VLDB Conference*, Hong Kong.

Killen Associates Report. (2001). *Business-to-employees Communication: The competitive edge for tomorrow's global enterprises*. Killen & Associate, USA..

King, W., & Teo, T. (2000). Assessing the impact of proactive versus reactive modes of strategic information systems planning. *Omega*, *28*, 667–679. doi:10.1016/S0305-0483(99)00079-1

Lin, C. Y. Y. (1997). Human resource information systems: Implementation in Taiwan . *Human Resource Management*, *5*(1), 57–72.

Mahmood, M. A., & Mann, G. J. (1993). Measuring the organizational impact of information technology investment: an exploratory study. *Journal of Management Information Systems*, *10*(1), 97–122.

Moore, G. C., & Benbasat, I. (1991). Development of an instrument to measure the perceptions of adopting an information technology innovation. *Information Systems Research*, *2*(3), 192–222. doi:10.1287/isre.2.3.192

Nunnaly, J. C. (1978) *Psychometric Theory.* New York: McGraw-Hill.

Parthasarathy, M., & Sohi, R. F. S. (1997). Sales force automation and the adoption of technological innovations by sales force: Theory and implications. *Journal of Business and Industrial Marketing*, *12*(3/4), 96–208. doi:10.1108/08858629710188036

Pitman, B. (1994). Critical success factors to organizational change. *Journal of Systems Management*, *45*(9), 40.

Rahim, M. M. (2006). Understanding adoption and impact of b2e e-business systems: lessons learned from the experience of an Australian university. In *Proceedings of the sixth Collaborative Electronic Commerce Research (CollECTeR)*, Adelaide, Australia.

Rahim, M. M. (2007). Factors affecting adoption of B2E e-Business systems: A case of the Australian higher education industry. In *Proceedings of the Pacific Asia Conference on Information Systems*, July 4-6, New Zealand.

Rahim, M. M., & Singh, M. (2007). Understanding benefits and impediments of B2E e-business systems adoption: Experiences of two large Australian universities. *Journal of Internet Commerce*, *6*(2), 3–17. doi:10.1300/J179v06n02_02

Ram, S. (1989). Successful innovation using strategies to reduce consumer resistance: An empirical test. *Journal of Product Innovation Management*, *6*, 20–34. doi:10.1016/0737-6782(89)90011-8

Rangone, A. (2006). B2E mobile internet: An exploratory study of Italian companies. *Business Process Management Journal*, *2*(3), 330–333. doi:10.1108/14637150610667999

Rogers, E. M. (2003). *Diffusion of Innovations*, New York: Free Press.

Sauer, C. (1993). *Why Information Systems Fail: A Case Study Approach*. Henley-on-Thames, UK: Alfred Waller.

Schillewaert, N. (2005). The adoption of information technology in the sales force. *Industrial Marketing Management*, *34*, 323–336. doi:10.1016/j.indmarman.2004.09.013

Scornavacca, E., Prashad, M., & Lehmann, H. (2006). Exploring the organisational impact and perceived benefits of wireless personal digital assistants in restaurants. *International Journal of Mobile Communications*, *4*(5), 558–567.

Singh, M. (2005). Business to employee (B2E) e-management. Sixth International Working for E-Business Conference, Melbourne, Australia.

Speier, C., & Venkatesh, V. (2002, July). The hidden minefields in the adoption of sales force automation technologies. *Journal of Marketing*, *66*, 98–111. doi:10.1509/jmkg.66.3.98.18510

Stone, D. L., Stone-Romero, E. D. F., & Lukaszewski, K. (2006). Factors affecting the acceptance and effectiveness of electronic human resources systems. *Human Resource Management Review*, *16*, 229–244. doi:10.1016/j.hrmr.2006.03.010

Sugianto, L., Rahim, M. M., & Alahakoon, D. (2005). B2E portal adoption: A conceptual model. In *Proceedings of the International Conference on Information and Automation* (ICIA2005), December 15-18, Colombo, Sri Lanka.

Sugianto, L., & Tojib, D. (2006). Modeling user satisfaction with an employee portal. *International Journal of Business and Information*, *1*(2), 239–255.

Teo, T. S. H., Lim, G. S., & Fedric, A. A. (2007). The adoption and diffusion of human resources information systems in Singapore. *Asia Pacific Journal of Human Resources*, *45*(91), 44–62. doi:10.1177/1038411107075402

Teo, T. S. H., Soon, L. G., & Fedric, S. A. (2001). Adoption and impact of human resource information systems. *Research and Practice in Human Resource Management*, *9*(1), 101–117.

Tojib, D., & Sugianto, L. (2007). The development and empirical validation of the B2E portal user satisfaction (B2EPUS) scale. *Journal of Organizational and End User Computing*, *19*(3), 1–18.

Tojib, D. R., Sugianto, L. F., & Rahim, M. M. (2005). A new framework for B2E Portal development. In *IEEE International Conference on e-Technology, e-Commerce and e-Service*, Hong Kong.

Turban, E., King, D., Lee, J., & Viehland, D. (2008). *Electronic Commerce: A Managerial Perspective*. Upper Saddle River, NJ: Prentice Hall.

Veal, A. J. (2005). *Business Research Methods*. NSW: Pearson Education Australia.

Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology adoption model: Four longitudinal field studies. *Management Science*, *46*(2), 86–204. doi:10.1287/mnsc.46.2.186.11926

Yetton, P. A., Martin, R., Sharma, R., & Johnston, K. (2000). A model of information systems development project performance. *Information Systems Journal*, *10*, 263–289. doi:10.1046/j.1365-2575.2000.00088.x

## KEY TERMS AND DEFINITIONS

**Business-to-Employee (B2E):** It represents an employee centric e-business initiative. Typical examples include various types of innovative web-based B2E products including employee portals, e-HR systems and ESS.

**Portal:** It is defined as a web site or service that offers a broad array of resources and services (e.g. e-mails, search engines, online shopping malls) to individuals. The first web portals were online services, such as AOL, that provided access to the Web.

**Usage Factors:** They represent the conditions that influence the use of an IT application. These conditions can be related to technology (e.g. ease of use, complexity) and organisation (e.g. top management support).

## APPENDIX-A: DEVELOPMENT OF RESEARCH HYPOTHESES

Perceived system usefulness: According to the dictionary meaning, a system may be termed useful if it is valuable or productive. This interpretation is consistent with the views expressed by Davis (1989) and other leading scholars who describe perceived usefulness as an individual's belief that performing a specific behaviour will lead to favourable outcome. The outcome may involve tangible benefits such as some form of economic gains or work performance improvement and intangible benefits like greater work satisfaction. In the context of the B2E portal, customised services and easy access to relevant information would create a positive perception of employees about the merits of portal. This perception of the portal's quality would lead to greater use of the portal. When a portal provides relevant information to the employees for them to perform better by accomplishing tasks effectively and efficiently, the portal would be perceived as a tool for gaining work related benefits. As a result, the following proposition is put forward:

**H1:** Perceived system usefulness (PSU) has a positive influence on employee portal usage

Perceived Training: Although not mentioned in core theories, training is often considered to be a great facilitator of the use of IT-enabled applications. According to Mahmood & Mann (1993), training positively affects use of IT applications because it helps improve users understanding on how to use the application to their advantage. Thus, for the B2E portal, when employees think that they were provided with adequate training to use the system without "breaking" it, they would be more confident about using it to their advantage. Thus, the following proposition is developed:

**H2:** Provision of employee training is positively related with the portal usage by employees

Management support for portal: Senior management should authorise addition of new sources of information (both internal and external) and services, and encourage improving features of portals to meet employees' needs. This creates a positive impression on employees with respect to the management's interest is supporting the portal. By creating an evolving portal, management can ensure that employees' information demands are best met. Employee's perception of degree of support provided by their senior management to the portal would thus help ensure better use of the portal.

**H3:** Perceived management support for portal project will positively affect portal usage of employees

## Appendix-B: Results of Factor Analysis

*Table 8.*

| Item Code | Item description | Component | | | |
|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 |
| PU1 | The portal helps me efficiently carry out work related communication | .633 | | | |
| PU2 | The portal offers collaboration facility with other employees | | .774 | | |
| PU3 | The portal provides me with ready access to information sources which enables me to find job related information quickly | .751 | | | |
| PU4 | The portal reduces the time spent on HR related activities (i.e. via employee self-service) | .703 | | | |
| PU5 | The portal helps me quickly acquire work related items (e.g. office stationery) | | .841 | | |
| PU6 | The portal provides role-specific (e.g. managerial, academic, administrative) information | | .690 | | |
| PU7 | The portal provides me with accurate information to fulfil my needs | .751 | | | |
| PU9 | The portal provides single point of access to work related information | .718 | | | |
| PT1 | I was provided with the necessary training to use the portal | | | | .856 |
| PT2 | I attended workshops to learn how to use the portal | | | | .910 |
| MS2 | My organization regularly updates the features of the portal | | | .879 | |
| MS3 | My organization updates relevant information on the portal regularly | | | .974 | |
| | Eigenvalues | 3.56 | 1.94 | 1.35 | 1.21 |
| | % variance | 29.7 | 16.1 | 11.30 | 10.14 |
| | KMO measure of sampling adequacy | .709 | | | |
| | Bartlett's Test of Sphericity | Approx. Chi-Square = 589.34<br>Df = 66, Sig = .000 | | | |

# Chapter 59
# An Exploratory Study on the User Adoption of Central Cyber Government Office of the Hong Kong Government

**Kevin K.W. Ho**
*The University of Guam, Guam*

**Calvin Chun Yu**
*The Hong Kong University of Science and Technology, Hong Kong*

**Michael C.L. Lai**
*Hong Kong Police Force, Hong Kong*

## ABSTRACT

*This chapter investigates those factors affecting the user adoption of the Intranet Portal of the Hong Kong Government, a.k.a., Central Cyber Government Office (CCGO). The authors conducted a survey study in 2004 and they interviewed some of the users to collect their feedbacks on the user adoption of CCGO based on the premises of the Technology Acceptance Model (TAM). Based on the results of their survey and interviews, the authors noted that civil servants of Hong Kong demonstrated strong reluctance to adopt CCGO.*

## INTRODUCTION

"**E-Government**" is a mission-critical visionary issue faced by the public sector as it pushed the delivery of public services to a new quality standard through a new set of delivery means. However, many of the stakeholders found it hard to fully embrace this new mode of service delivery. Through the provision of e-services, stakeholders of government services expect that e-services can improve the efficiency of government departments (Gore, 1993; Information Technology and Broadcasting Bureau (ITBB), 1998). Indeed, information systems (IS) researchers have investigated the impact of information technology (IT) in public sector since the late 1970s, when personal computers were launched (Kraemer, 1977; Danziger et al., 1978). For recent research studies, their main

DOI: 10.4018/978-1-61520-611-7.ch059

focus is on the impact of Internet on the public sector, especially on the impact on the interaction among government departments and members of the public, i.e. citizens and business firms (or Government-to-Citizen, G2C, and Government-to-Business, G2B) (Devadoss, et al., 2002; Golden, et al., 2003). However, not too many studies are focused on the impact of Internet technology on the interaction among users within government departments (or Government-to-Employee, G2E, and Government-to-Government, G2G). Hence, the aim of this study is to analyze this impact of Internet technology on the interaction between the Government and its internal users.

The focus of this chapter is to examine the user adoption of the Intranet portal of the Hong Kong Government. We choose Hong Kong Government as our subject of study because it has been ranked amongst the top few countries in the Asia-Pacific Region and the seventh in the worldwide "Overall Maturity in e-Government" (Accenture, 2004). This indicates that Hong Kong is one of the pioneers in developing **e-Government** projects in the region. Hence, the result obtained will be very useful reference for policymakers and various stakeholders especially in the Asia-Pacific Region. We hope that our results can help policymakers to realign their internal IT strategies and fine-tune their **e-Government** policies.

## BACKGROUND

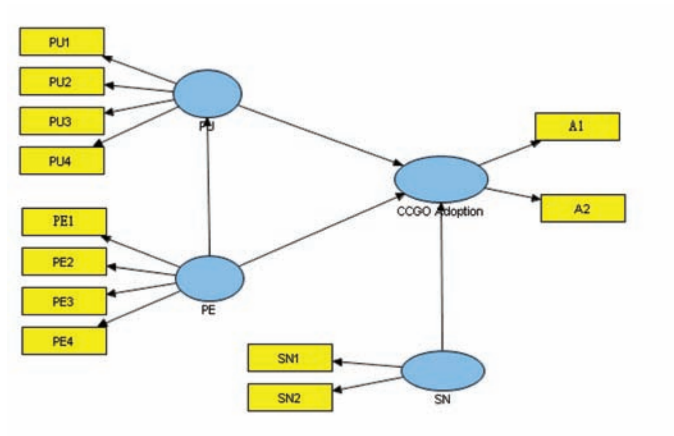
To improve the internal communication within the government, the Hong Kong Government has developed an Intranet portal, i.e. the Central Cyber Government Office (CCGO), to facilitate internal communication and information flow. The CCGO used the Government Communication Network (GCN) to disseminate internal information, which had around 50,000 users when we conducted our study in 2003/2004, i.e. around 1/3 of the civil service workforce, and is now developed into a system, which provides a wide range of e-services and disseminates information within the government (HKG, 2009). With more knowledge on the user acceptance of the CCGO, researchers, government officers, and the management of private sectors can gain insights on how to develop a more user-focused Intranet portal for their users. Our research was developed based on the **Technology Acceptance Model (TAM)**, which is the most common model used for analyzing user adoption of IT projects (Davis, 1989; Davis et al., 1989). In particular, we would like to address the following three research questions:-

(1) Does **perceived usefulness** (PU) affect the user adoption of Government Intranet portal?
(2) Does **perceived ease of use** (PE) affect the user adoption of Government Intranet portal?
(3) Does **subjective norm** (SN) affect the user adoption rate of Government Intranet portal?

## Literature Review on Technology Acceptance Model (TAM)

In this study, we use the **Technology Acceptance Model (TAM)** (Davis, 1989; Davis et al., 1989; Venkatesh et al., 2003) to investigate the user adoption attitude of civil servants towards Government-to-Employee (G2E) Intranet portal. TAM is an information system theory derived from the **Theory of Reasoned Action** (TRA). The standard TAM has independent two constructs, i.e. **Perceived Usefulness** (PU) and **Perceived Ease of Use** (PE), and one dependent construct, i.e. Adoption Intention (A). PU is "the degree to which a person believes that using a particular system would enhance his/her job performance" whereas PE is "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989). In previous years, numerous studies have employed the TAM to investigate the user adoption studies on various

*Figure 1. Research model on the TAM study on CCGO*




information systems (Adams et al., 1992; Davis, 1989; Davis, et al. 1989), such as ERP (Amoako-Gyampah & Salam, 2004), Internet banking (Tan & Teo, 2000), small business (Thong, 1999), etc. Based on the results of prior research studies on TAM, we develop our first set of hypotheses, which describe the relationships amongst these constructs for civil servants in using CCGO:

**H1.1:** When civil servants have a higher level of PU on CCGO, they will have a higher intention to adopt CCGO.
**H1.2:** When civil servants have a higher level of PE on CCGO, they will have a higher intention to adopt CCGO.
**H1.3:** When civil servants have a higher level of PE on CCGO, they will also have a higher level of PU on CCGO.

In our model, we also adapted the **Subjective Norm** (SN) from TRA and **Theory of Planned Behavior** (TPB) (Ajzen, 1991) as the third independent construct, which has positive impact on the adoption intention. SN is "the person's perception that most people who are important to him think he should or should not perform the behavior in question" (Fishbein & Ajzen, 1975). Thus, the second set of hypothesis is developed below:

**H2:** When civil servants have a higher level of SN on CCGO, they will have a higher intention to adopt CCGO.

Figure 1 summarizes our research model.

## THE EMPIRICAL STUDY ON USER ADOPTION OF CCGO

### Methodology

In this study, we collected the feedback of civil servants through a survey. It was conducted in several government departments, with an aim to investigate the adoption intention of CCGO. The survey last for 4 months from November 2003 to February 2004, and was conducted six months before the major upgrade of CCGO. The major system upgrade involved the launching of e-Leave (a leave application system) and departmental portals, and the extension of IT facilities from top management to the middle management, which increases the number of users from 1/10 of the workforce to around 1/3 of the workforce. Apart from conducting the survey, we also randomly interviewed ten civil servants and collected their feedbacks on the general impressions and expectations of G2E and G2G applications.

*Table 1. Factor loading of the survey instrument*

| | A | PE | PU | SN | *t*-value | Composite Reliability |
|---|---|---|---|---|---|---|
| A1 | **0.94** | | | | 63.66 | 0.91 |
| A2 | **0.88** | | | | 16.90 | |
| PE1 | | **0.84** | | | 28.61 | 0.88 |
| PE2 | | **0.80** | | | 14.75 | |
| PE3 | | **0.86** | | | 26.30 | |
| PE4 | | **0.74** | | | 10.89 | |
| PU1 | | | **0.87** | | 29.92 | 0.92 |
| PU2 | | | **0.83** | | 16.42 | |
| PU3 | | | **0.91** | | 36.71 | |
| PU4 | | | **0.82** | | 18.11 | |
| SN1 | | | | **0.97** | 6.41 | 0.92 |
| SN2 | | | | **0.88** | 5.16 | |

## Design of the Survey Instrument

The questionnaire for the survey on CCGO was adapted from Davis (1989), and a pilot test was conducted which involved 12 doctoral students, of which two of them were part-time doctoral students who were civil servants. The composition of our pilot respondents enabled us to ensure that the views from both IS researchers and civil servants could be included. Pilot respondents took around 8 minutes to complete the questionnaire. Modifications in the wording and the general flow of the questionnaire were made. All questions in the finalized questionnaire were measured on a 5-point Likert scale.

After finalizing the questionnaire, we telephoned the office managers of various government departments and invited them to participate in the survey. Some departments, including the police department, post office and several public schools had agreed to participate in our survey. In total, we received 197 usable responses.

## Data Analysis

As reported by Gefen et al. (2000), Partial Least Square (PLS) is a better structural equation modeling (SEM) tools for exploratory study compared with LISREL. Hence, we used SmartPLS Version 2.0 (Ringle, et al., 2005) to analyze the survey data collected. Table 1 reports the loading of measurement items on their latent constructs, with *t*-values and composite reliability; and the correlation matrix is reported at Table 2. As *t*-values are significant, we can conclude that convergent validity is achieved for our survey. For discriminant validity, it is noted that all items are having loading higher than 0.7 on their associated factors, and are having a low loading on other factors. Hence, these factors are deemed reliable as suggested by Nunnally (1978). Also, the square root of each latent construct's Average Variance Extracted (AVE), i.e. the bolded figure on the correlation matrix, is much larger than the correlation of the construct concerned with other constructs, we can conclude that discriminant validity is also achieved.

The result of PLS is reported at Figure 2. It is shown that the first sets of hypotheses, which are derived from the TAM, are supported by our empirical data. However, it is shown that H2 is not supported by our data. In our model, we suggest that **subjective norm** will have a positive relationship with the adoption of CCGO. How-

*Table 2. Correlation matrix of the contructs*

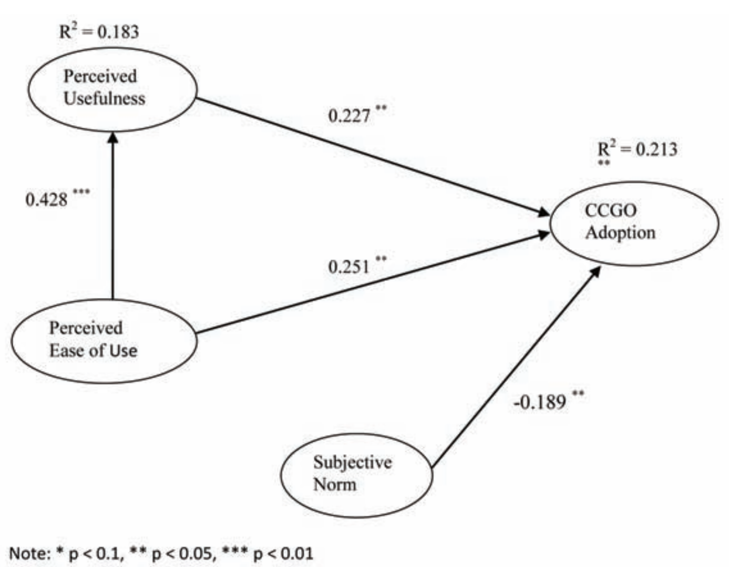
| | A | PE | PU | SN |
|---|---|---|---|---|
| A | **0.91** | 0 | 0 | 0 |
| PE | 0.37 | **0.81** | 0 | 0 |
| PU | 0.34 | 0.43 | **0.86** | 0 |
| SN | -0.22 | -0.12 | -0.02 | **0.92** |

ever, the result obtained is a significant negative relationship.

## Interview with Civil Servants

After conducting the survey, we randomly interviewed 10 subjects (6 males and 4 females) and collected their feedbacks on CCGO. First, we noticed that quite a number of them thought that even though applications in CCGO helped them to obtain information faster, they had to adapt to an office environment, which required them to respond more quickly than before. They indicated that this increased their working pressure. Secondly, the frontline and junior management users suggested that the report format of these applications were standardized and with limited customization capacity. Hence, they needed to download the files and to customize them offline. Take the financial reporting module as an example, users could have limited rights to select the content to be included in the report online. However, they could not add any footnotes or highlight any important features there. If they wished to do so, they needed to download the file in CSV (comma separated value) format and add the notes offline. Hence, additional time would be required for such customization. However, as the management expected that these users could provide a faster service after the implementation of these **e-Government** systems, they had to complete their tasks under a very tight schedule.

*Figure 2. Empirical result of the TAM study on CCGO*



Last but not least, some interviewees expressed the situation that as some senior colleagues still preferred to read reports and to communicate in a paper-based format, they were required to put in double-effort, i.e. to coordinate with some stakeholders electronically and to coordinate with others using a paper-based medium. Hence, in addition to handling paper channel only as in the past, they had to handle paper channel, electronic channel and to integrate the returns obtained from the two channels. This had more than doubled their efforts and had given them an impression that CCGO had worsened their working environment.

## Discussion

In this study, we observe that the user adoption intention of CCGO was low. Originally, we expected that the user adoption rate for CCGO would be higher as it had been in place for 8 years and was designed to suit the general business needs of government departments. However, our result shows that civil servants did not like to use CCGO as much as we think. Based on our findings, it shows that PE has a significant positive impact on PU, and PE and PU both have significant positive impacts on CCGO adoption. Therefore, we have our first three hypotheses (i.e. H1.1 to H1.3) developed based on TAM supported empirically. However, we noted that SN has a significant negative impact on CCGO adoption, which is opposite to our expectation and hence, Hypothesis 2 is not supported.

According to our interviews with civil servants, we observed that even though the top management was eager to implement CCGO, most officers (and especially those from the frontline and in the middle management) had a general impression that CCGO would bring an additional workload and burden to them, instead of helping them to resolve their problems. Thus, their impression is just the opposite as predicted as the impact of SN on the user adoption of CCGO. This might explain why we have observed a negative result for the impact of SN to the user adoption of CCGO.

There are some issues in this study. As an exploratory study, this research first focused on a metropolitan city, i.e. Hong Kong. The positive issue is that Hong Kong is one of the forerunners of **e-Government** and we are in the view that that the observations in Hong Kong are applicable and useful for other countries which are still developing the **e-Government** Strategy. However, as different countries are at different stages in the development of **e-Government** projects and have different kinds of information and reports published in the past few years, the result of this study may not be directly comparable to other countries.

## IMPLICATION AND RECOMMENDATIONS

The negative impact of SN on the user adoption of CCGO implies that its design and implementation focused more on a top-down approach such that the priority has been accorded to satisfying the management vision of **e-Government** while paying insufficient attention to the user perceptions at the operation level. It is understandable that top-down approach is required to kick off those major **e-Government** initiatives to break the old procedures and operational bureaucracies. However, the formation of negative SN would unavoidably undermine the management effort in achieving their **e-Government** vision. In this connection, we have three recommendations for the relevant policy makers.

Firstly, while it is beneficial to deploy some sample applications in CCGO for demonstrating its benefits, CCGO should focus on implementing a flexible infrastructure to let user departments to customize for their own needs instead of implementing actual solutions. This strategy empowers the user departments to develop solutions that suit their own specific needs while providing a fundamental infrastructure as motivations. In addition, CCGO should also define the interoperability standard across departments so that further integration and interconnectivity among departments could be facilitated.

Secondly, pilot projects should be conducted in the largest government departments, e.g. Hong Kong Police, Housing Department, Education Department etc., as testing points for the new CCGO enhancements. These large departments are more sophisticated in terms of operation so it is more likely for them to encounter problems in the pilots. Given their sizable operation, they have more resources in tackling the relevant issues in the pilot projects. This should help improve the quality and relevance of the system in the early stage of development. In addition, with the largest department running pilot projects could give other smaller departments more confidence in adopting the final enhanced CCGO as the largest departments have setup role models and have gathered relevant experience for their reference.

The last but not the least, it is strongly recommended that the management involved the users at different levels of operations at a very early development stage when CCGO would be further enhanced or revamped. This would empower the end users to participate and to get involved so that project ownership could be established more easily. This should be helpful in alleviating the negative SN at the operation level.

## FUTURE RESEARCH DIRECTIONS

For future research, it is suggested that a cross-country study should be conducted so that a cross-country analysis can be compiled to further validate the theoretical model.

## CONCLUSION

In conclusion, this study brings some insight for IT policy makers when they develop their Intranet applications. Even though Hong Kong is one of the forerunners in **e-Government**, it is observed that it is unable to bring develop an Intranet systems, which has a high adoption rate by its internal users.

Therefore, it is suggested that policy makers should try to understand their internal customers more before implementing the system. This can help to improve user adoption of these internal applications and improve the efficiency and effectiveness of government through **e-Government** initiatives.

## REFERENCES


Accenture. (2004). *E-Government leadership: Engaging the customer*. Retrieved March 31, 2009, from http://nstore.accenture.com/acn_com/PDF/Engaging_the_Customer.pdf

Adams, D. A., Nelson, R. R., & Todd, P. A. (1992). Perceives usefulness, ease of use and usage of information technology: A replication. *MIS Quarterly*, *16*(2), 227–247. doi:10.2307/249577

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*(2), 179–211. doi:10.1016/0749-5978(91)90020-T

Amoako-Gyampah, K., & Salam, A. F. (2004). An extension of the Technology Acceptance Model in an ERP implementation environment. *Information & Management*, *41*(6), 731–745. doi:10.1016/j.im.2003.08.010

Danziger, J. N., Kraemer, K. L., & King, J. L. (1978). An assessment of computer technology in U.S. local government. *Urban Systems*, *3*(1), 21–37. doi:10.1016/0147-8001(78)90004-9

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, *13*(3), 318–339. doi:10.2307/249008

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science*, *35*(8), 982–1003. doi:10.1287/mnsc.35.8.982

Devadoss, P. R., Pan, S. L., & Huang, J. C. (2002). Structural analysis of e-government initiatives: A case study of SCO. *Decision Support Systems*, *34*(3), 253–269. doi:10.1016/S0167-9236(02)00120-3

Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention, and behavior: An introduction to Theory and Research*. Reading, MA: Addison-Wesley.

Gefen, D., Straub, D., & Boudreau, M.-C. (2000). Structural equation modeling and regression: Guidelines for research practice. *Communications of the Association for Information Systems*, 4.

Golden, W., Hughes, M., & Scott, M. (2003). The role of process evolution in achieving citizen-centered e-government. In *Americas Conference on Information Systems 2003 Proceedings*, Tampa, Florida.

Gore, A. (1993). *Reengineering through information technology*. Accompanying Report of the National Performance Review. Washington, DC: Office of the Vice President.

Hong Kong Government (HKG). (2009). *IT infrastructure and standards – Infrastructure for e-government – Central Cyber Government Office*. Retrieved March 31, 2009, from http://www.ogcio.gov.hk/eng/infra/eccgo.htm

Information Technology and Broadcasting Bureau (ITBB). (1998). *Digital 21: Hong Kong Special Administrative Region Information Technology Strategy*. Retrieved March 31, 2009, from http://www.info.gov.hk/digital21/eng/related_documents/download/e-digital21.pdf

Kraemer, K. L. (1977). Local government, information systems, and technology transfer: Evaluating some common assertions about computer application transfer. *Public Administration Review*, *37*(4), 368–382. doi:10.2307/974867

Nunnally, J. C. (1978). *Psychometric Theory* (2nd ed.). New York: McGraw-Hill.

Ringle, C. M., Wende, S., & Will, A. (2005*). SmartPLS 2.0 (beta)*. Retrieved from www.smartpls.de

Tan, M., & Teo, S. H. (2000). Factors influencing the adoption of Internet banking. *Journal of the Association for Information Systems, 1*.

Thong, Y. L. (1999). An integrated model of information systems adoption in small businesses. *Journal of Management Information Systems*, *15*(4), 187–214.

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, *27*(3), 425–478.

## ADDITIONAL READING

### Technology Acceptance Model (TAM), Theory of Reasoned Action (TRA) and Theory of Planned Behavior (TPB)

Adams, D. A., Nelson, R. R., & Todd, P. A. (1992). Perceives usefulness, ease of use and usage of information technology: A replication. *MIS Quarterly*, *16*(2), 227–247. doi:10.2307/249577

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*(2), 179–211. doi:10.1016/0749-5978(91)90020-T

Amoako-Gyampah, K., & Salam, A. F. (2004). An extension of the Technology Acceptance Model in an ERP implementation environment. *Information & Management*, *41*(6), 731–745. doi:10.1016/j.im.2003.08.010

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, *13*(3), 318–339. doi:10.2307/249008

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science*, *35*(8), 982–1003. doi:10.1287/mnsc.35.8.982

Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention, and behavior: An introduction to Theory and Research*, MA: Addison-Wesley.

Tan, M. & Teo, S. H. (2000). Factors influencing the adoption of Internet banking. *Journal of the Association for Information Systems, 1*, Article 5.

Thong, Y. L. (1999). An integrated model of information systems adoption in small businesses. *Journal of Management Information Systems*, *15*(4), 187–214.

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, *27*(3), 425–478.

### E-Government

Accenture (2004). E-Government leadership: Engaging the customer. Retrieved March 31, 2009, from http://nstore.accenture.com/acn_com/PDF/Engaging_the_Customer.pdf

Andersen, K. V., & Henriksen, H. Z. (2005). The first leg of e-government research: Domains and application areas 1998-2003. *International Journal of Electronic Government Research*, *1*(4), 26–44.

Asgarkhani, M. (2005). Digital government and its effectiveness in public management reform. *Public Management Review*, *7*(3), 465–487. doi:10.1080/14719030500181227

Danziger, J. N., Kraemer, K. L., & King, J. L. (1978). An assessment of computer technology in U.S. local government. *Urban Systems*, *3*(1), 21–37. doi:10.1016/0147-8001(78)90004-9

Davison, R. M., Wagner, C., & Ma, L. C. K. (2005). From government to e-government: A transition model. *Information Technology & People*, *18*(3), 280–299. doi:10.1108/09593840510615888

Devadoss, P. R., Pan, S. L., & Huang, J. C. (2002). Structural analysis of e-government initiatives: A case study of SCO. *Decision Support Systems*, *34*(3), 253–269. doi:10.1016/S0167-9236(02)00120-3

Ebbers, W. E., & van Dijk, J. (2007). Resistance and support to electronic government, building a model of innovation. *Government Information Quarterly*, *24*(1), 554–575. doi:10.1016/j.giq.2006.09.008

Evans, D., & Yen, D. C. (2005). E-Government: An analysis for implementation: Framework for understanding cultural and social impact. *Government Information Quarterly*, *22*(3), 354–373. doi:10.1016/j.giq.2005.05.007

Flak, L. S., & Rose, J. (2005). Stakeholder governance: Adapting stakeholder theory to e-government. *Communications of the Association for Information Systems*, 16.

Golden, W., Hughes, M., & Scott, M. (2003). The role of process evolution in achieving citizen-centered e-government. In *Americas Conference on Information Systems 2003 Proceedings*, Tampa, Florida.

Gore, A. (1993). *Reengineering through information technology*. Accompanying Report of the National Performance Review. Washington, DC: Office of the Vice President.

Grant, G., & Chau, D. (2005). Developing a generic framework for e-government. *Journal of Global Information Management*, *13*(1), 1–30.

Grönlund, Ä., & Horan, T. A. (2005). Introducing e-Gov: History, definition, and issues. *Communications of the Association for Information Systems*, *15*(39), 713–729.

Heeks, R., & Bailur, S. (2006). Analysing eGovernment research: Perspectives, philosophies, theories, methods and practice. *iGovernment Working Paper Series*. Manchester, M13 9QH, UK, Institute for Development Policy and Management.

Ho, K. K. W. (2007). The e-Government development, IT strategies and Portals of Hong Kong SAR Government. *International Journal of Cases on Electronic Commerce*, *3*(2), 71–89.

Ho, S. Y., & Ho, K. K. W. (2006). A study on the information quality satisfaction of communication portals in the Hong Kong Government, *Proceedings of 2006 IRMA International Conference*, in Washington D.C., U.S.A.

Kraemer, K. L. (1977). Local government, information systems, and technology transfer: Evaluating some common assertions about computer application transfer. *Public Administration Review*, *37*(4), 368–382. doi:10.2307/974867

Singh, H., Amit, D., & Damien, J. (2007). Country-level determinants of e-government maturity. *Communications of the Association for Information Systems*, 20.

Yong, J. S. L. (Ed.). (2005). *Enabling public service innovation in the 21st Century: E-Government in Asia*. Singapore: Marshall Cavendish.

## KEY TERMS AND DEFINITIONS

**Electronic Government (e-Government):** Electronic Government (e-Government) is referring to the use of information technology to provide government services online, which aims to provide faster and better services for stakeholders. It can be divided into four basic categories, viz. Government to Citizen (G2C), Government-to-Business (G2B), Government-to-Government (G2G), and Government-to-Employee (G2E).

**Perceived Ease of Use (PE):** Perceived Ease of Use (PE) is one of the independent constructs in the Technology Acceptance Model (TAM). It is "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989).

**Perceived Usefulness (PU):** Perceived Usefulness (PU) is one of the independent constructs in the Technology Acceptance Model (TAM). It is "the degree to which a person believes that using a particular system would enhance his/her job performance" (Davis, 1989).

**Subjective Norm (SN):** Subjective Norm (SN) is one of the independent constructs of the Theory of Reasoned Action (TRA). It is "the person's perception that most people who are important to him think he should or should not perform the behavior in question" (Fishbein & Ajzen, 1975).

**Technology Adoption Model (TAM):** Technology Acceptance Model (TAM) is an information systems (IS) research model, which is developed by Davis (1989). The original TAM has three constructs, viz., two independent contructs, Perceived Usefulness (PU), and Perceived Ease of Use (PE), and the dependent construct, User Acceptance (UA). While both independent constructs have positive impacts on the dependent construct, PE also has positive impact on PU.

**Theory of Planned Behavior (TPB):** Theory of Planned Behavior (TPB) reflects the relationship between Behavioral Intention (BI) and Behavior (as dependent constructs) with Attitude Towards Act or Behavior (AB), Subjective Norm (SN) and Perceived Behavioral Control (Ajzen, 1991).

**Theory of Reasoned Action (TRA):** Theory of Reasoned Action (TRA) reflects the relationship between Behavioral Intention (BI) (as dependent construct) with Attitude towards Act or Behavior (AB) and Subjective Norm (SN). Prior research has shown that that $BI = \beta_1 AB + \beta_2 SN$ (Fishbein & Ajzen, 1975).

## APPENDIX: SAMPLE QUESTIONNAIRE

### Perceived Usefulness of CCGO (PU)

PU1. Using CCGO improves my job performance.
PU2. Using CCGO in my job increases my productivity.
PU3. Using CCGO enhances my job effectiveness.
PU4. I find CCGO useful in my job.

### Perceived Ease of Use of CCGO (PE)

PE1. My interaction with CCGO is clear and understandable.
PE2. Interacting with CCGO does not require lots of my mental effort.
PE3. I find CCGO easy to use.
PE4. I find it easy to get CCGO to do what I want to do.

### Subjective Norms of CCGO (SN)

SN1. People who influence my behaviour think that I should use the system.
SN2. People who are important to me think that I should use the system.

### Adoption Intention of CCGO (A)

A1. Assuming I have access to CCGO, I intend to use CCGO.
A2. Given that I have access to CCGO, I predict that I would use CCGO.
(1 = Disagree, 5 = Agree)

# Chapter 60
# An Exploratory Study on the Information Quality Satisfaction of Central Cyber Government Office of the Hong Kong Government

**Kevin K.W. Ho**
*The University of Guam, Guam*

## ABSTRACT

*Information quality is critical for a communication portal because there are myriad information types, including textual, audio, video and other complex information types, which an organization has to manage. In this chapter, the author examine the information quality satisfaction of the Central Cyber Government Office (CCGO), which is a communication portal developed by the Hong Kong Government. A survey study was conducted to investigate how users evaluate the information quality of CCGO. This portal case is interesting because: (1) Hong Kong Government has invested millions of US dollars in its implementation; and (2) the number of potential users is huge (over 140,000) in 2007.*

## INTRODUCTION

To keep governments operating smoothly, swift but careful fine-tuning of public policies and strategies are required. This situation creates a demand for establishing a seamless information flow between government agencies. To facilitate such information exchange, there is a global trend for governments to take advantages of information and Internet technologies for providing their services online. This can improve both efficiency and service quality of business processes within governments. Therefore, in previous years, many governments have heavily invested in information technology infrastructures and software applications. Taking Hong Kong as an example, this Far Eastern metropolitan invested over US$100M per year in its **e-Government** projects since 2000. For the seven-year period between April 1999 and March 2006, Hong Kong Government invested US$1,094.4M in information technology (Ho, 2007). This huge investment helps Hong Kong to advance to one of the top countries/cities in the

DOI: 10.4018/978-1-61520-611-7.ch060

maturity of **e-Government** development (Accenture, 2004; Melitski et al., 2005).

Among these US$1,094.4M invested by the Hong Kong Government, 16% was invested in those projects related to the development of IT infrastructure and software applications, which aimed to support Government-to-Government (G2G) and Government-to-Employee (G2E) transactions (Ho, 2007). In this study, we investigate the impact of **information quality** on the **user satisfaction** of one of the key G2G and G2E applications in Hong Kong, i.e., the Intranet portal of the government, a.k.a. the Central Cyber Government Office (CCGO).

## BACKGROUND

### Central Cyber Government Office (CCGO)

In 2000, the Hong Kong Government launched its Intranet communication portal, the Central Cyber Government Office (CCGO), for its employees (HKG, 2009). This portal is designed for disseminating information within the government. It also acts as a hub for linking up services provided to internal customers from different government agencies. Its function is similar to GovHK, (http://www.gov.hk), the **e-Government** one-stop portal for members of the public developed by the Hong Kong Government. Users can access to CCGO via their network terminals, which are connected to the government Intranet. Apart from acting as a communication portal, CCGO also provides other add-on services, ranged from simple search functions, such as telephone directory and glossaries, to bulletin boards and discussion forums. Plus, CCGO acts as a platform for G2E and G2G applications. New applications, such as the electronic leave application system, electronic payroll system, and departmental portals were launched in the past few years (HKG, 2009).

In this study, we examine the **user satisfaction** on this Intranet portal. We choose CCGO as the focus of our study based on the following reasons. First, the Hong Kong Government is one of the pioneers in implementing **e-Government** projects in the world and ranked the seventh in the worldwide "Overall Maturity in **e-Government**" (Accenture, 2004). Thus, we conjuncture CCGO would be well designed. Second, the number of users of CCGO is huge. When we conducted our study in 2003/2004, the number of users of CCGO was around 50,000, i.e. 1/3 of the staff force. In the past few years, its user population has increased to 140,000 and it is now accessible by nearly all civil servants. With more knowledge on how **information quality** factors affecting **user satisfaction** on CCGO, business firms and governments can obtain insights on how to develop their own communication portals. Therefore, we aim at addressing the following research questions:

(1) How does **information accuracy** (Ac) affect the **user satisfaction** of Government Intranet portal?
(2) How does **presentation format** (P) affect the **user satisfaction** of Government Intranet portal?
(3) How does **information timeliness** (Ti) affect the **user satisfaction** of Government Intranet portal?
(4) How does **content relevancy** (C) affect the **user satisfaction** of Government Intranet portal?

### Literature Review on Information Quality

Information Systems (IS) researchers study the relationship between **information quality** and **user satisfaction** for over 30 years (Melone, 1990). Bailey and Pearson (1983) studied **user satisfaction** and developed 39 factors for measuring computer **user satisfaction**. These factors include **information quality** constructs. Srinivasan (1985) examined the implementation of computerized modeling systems of 29 organizations. He noticed that system effectiveness can be measured by **information quality** constructs. In addition, DeLone and McLean (1992) noted that **information quality** is one of the six dimensions, which has a significant impact on the success of information systems.

IS researchers also develop theoretical models and methodologies to explain the impact of **information quality** on **user satisfaction** (Lee et al., 2002), systems development and implementation (Shim & Min, 2002; Mahmood, 1987), and data integrity (Lee et al., 2004). New methods, such as structural equation modeling (SEM) (Bharati, 2003; Khalil & Elkordy, 2005), elaboration-likelihood model (ELM) (Bhattacherjee & Sanford, 2006), and experiments (Aladwani, 2003), are used for analyzing this impact.

With the rapid development of e-commerce in recent years, IS researchers begin to investigate the impact of **information quality** on the user acceptance and satisfaction on e-commerce websites and portals. Negash et al. (2003) and Shih (2004) studied the impact of **information quality** on the effectiveness of web-based customer support system and the user acceptance of e-shopping respectively. Sullivan and Walstrom (2001) studied the impact of **information quality** on the consumer perception on the e-commerce website. Also, Park and Kim (2006) studied the impact of **information quality** on information satisfaction on e-commerce in Korea. Plus, Cheung and Lee (2005) studied the asymmetric effects of website attributes on **user satisfaction**.

IS researchers also investigate the impact of **information quality** on **e-Government** for more than 10 years. Cykana et al. (1996) discussed the data quality management guidelines used by the Department of Defense and reported that **information accuracy**, completeness, consistency, **information timeliness**, uniqueness and validity are the core factors of data quality requirements. In addition, Aladwani (2002) studied the **user satisfaction** on the information systems in public organizations in Kuwait.

In this study, we include the four basic **information quality** constructs in our model, i.e. **information accuracy** (Ac), **presentation format** (P), **information timeliness** (Ti), and **content relevancy** (C). Table 1 reports the related prior studies. Based on the result of Doll and Torkzadeh (1998), we conjuncture the level of **user satisfaction** (S) is positively related to these four constructs. Thus, we have the following four hypotheses:

**H1.1:** When **information accuracy** is at a higher level on the Intranet portal, civil servants will have a higher level of **user satisfaction** on the Intranet portal.
**H1.2:** When **content relevancy** is at a higher level on the Intranet portal, civil servants will have a higher level of **user satisfaction** on the Intranet portal.
**H1.3:** When **presentation format** is at a higher level on the Intranet portal, civil servants will have a higher level of **user satisfaction** on the Intranet portal.
**H1.4:** When **information timeliness** is at a higher level on the Intranet portal, civil servants will have a higher level of **user satisfaction** on the Intranet portal.

We also conjuncture some of these information quality constructs are depended on other constructs. Thus, we developed the following six self-explanatory hypotheses:

**H2.1:** When **content relevancy** is at a higher level on the Intranet portal, **information accuracy** will also at a higher level.
**H2.2:** When **presentation format** is at a higher level on the Intranet portal, **information accuracy** will also at a higher level.

*Table 1. Information quality constructs used in the study*

| Constructs | Prior Studies |
|---|---|
| **Information Accuracy** (A) | Bailey & Pearson (1983)<br>Cykana et al. (1996)<br>Doll & Torkzadeh (1998)<br>Mahmood (1987)<br>Miller & Doyle (1987)<br>Srinivasan (1985) |
| **Presentation Format** (P) | Doll & Torkzadeh (1998)<br>Cykana et al. (1986) |
| **Information Timeliness** (T) | Bailey & Pearson (1983)<br>Cykana et al. (1996)<br>Doll & Torkzadeh (1998)<br>Mahmood (1987)<br>Miller & Doyle (1987)<br>Srinivasan (1985) |
| **Content Relevancy** (C) | Bailey & Pearson (1983)<br>Doll & Torkzadeh (1998)<br>Miller & Doyle (1987)<br>Srinivasan (1985) |

**H2.3:** When **presentation format** is at a higher level on the Intranet portal, **content relevancy** will also at a higher level.
**H2.4:** When **information timeliness** is at a higher level on the Intranet portal, **information accuracy** will also at a higher level.
**H2.5:** When **information timeliness** is at a higher level on the Intranet portal, **content relevancy** will also at a higher level.
**H2.6:** When **information timeliness** is at a higher level on the Intranet portal, **presentation format** will also at a higher level.

Figure 1 summarizes our research model.

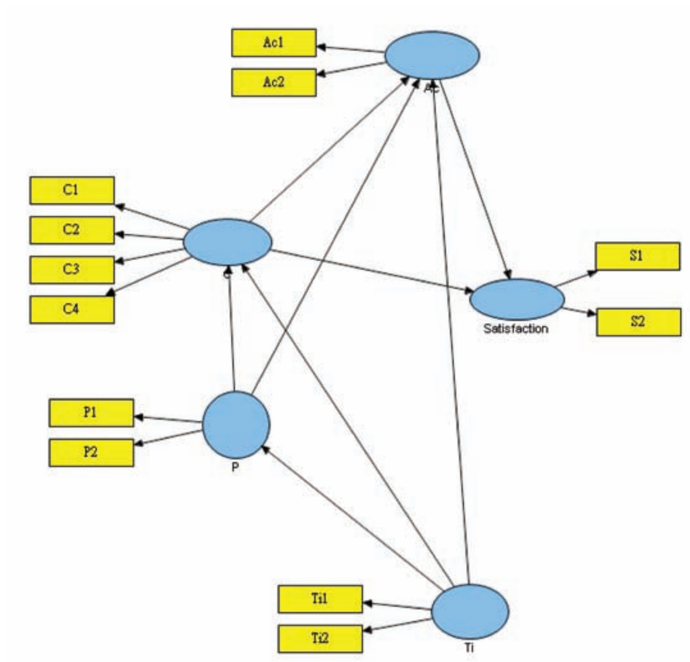
## THE EMPIRICAL STUDY ON USER SATISFACTION ON CCGO

### Methodology and the Design of the Survey Instrument

The survey on the **user satisfaction** on CCGO was administered from late 2003 to early 2004, which was lasted for 12 weeks. The questionnaire is adapted from the scale developed by Doll and Torkzadeh (1988) and Lee et al. (2002), which measures **information quality** from the systems. A pilot test was conducted with a panel of 12 doctoral students. Two of the panelists were also government officers (i.e. part-time doctoral students). Hence, both the views of IS researchers and civil servants were considered when we refined the questionnaire. The respondents took approximately 10 minutes to complete the questionnaire, which consisted of 12 questions, on a 5-point Likert scale.

We invited various government agencies to participate in this study. Agencies from education sector, disciplined force, and post office took part in this study. We conducted the survey on site and distributed paper questionnaires. Each survey session was conducted on company time and a member of our research team explained the purpose of the survey and answered any questions raised by respondents on site. A total of 197 usable responses were collected.

*Figure 1. Research model of the study*




## Data Analysis

To analysis our research model, we used Structural Equation Modeling (SEM) technique to analyze our data collected. As suggested by Gefen et al. (2000), Partial Least Square (PLS) method is more suitable for exploratory study. Therefore, we used SmartPLS Version 2.0 (Ringle, et al., 2005) to conduct our analysis. Table 2 reports the loading of measurement items, and the correlation matrix

*Table 2. Factor loading of the survey instrument*

| | S | Ac | C | P | Ti | *t*-value | Composite Reliability |
|---|---|---|---|---|---|---|---|
| Ac1 | | **0.95** | | | | 71.85 | 0.95 |
| Ac2 | | **0.95** | | | | 69.70 | |
| C1 | | | **0.85** | | | 25.21 | 0.89 |
| C2 | | | **0.88** | | | 30.00 | |
| C3 | | | **0.76** | | | 9.59 | |
| C4 | | | **0.77** | | | 15.36 | |
| P1 | | | | **0.93** | | 69.63 | 0.93 |
| P2 | | | | **0.93** | | 62.77 | |
| S1 | **0.91** | | | | | 51.50 | 0.89 |
| S2 | **0.88** | | | | | 28.81 | |
| Ti1 | | | | | **0.94** | 77.38 | 0.93 |
| Ti2 | | | | | **0.93** | 50.40 | |

*Table 3. Correlation matrix of the contructs*

| | Ac | C | P | S | Ti |
|---|---|---|---|---|---|
| A | **0.95** | | | | |
| C | 0.66 | **0.82** | | | |
| P | 0.74 | 0.72 | **0.93** | | |
| S | 0.64 | 0.59 | 0.61 | **0.90** | |
| Ti | 0.57 | 0.63 | 0.63 | 0.50 | **0.94** |

is reported at Table 3. As shown in Table 2, as all *t*-values are significant, convergent validity is achieved. It is also noted that all items have high loadings (>0.70) on their associated factors, and have low loadings on other factors. Plus, the square root of each latent construct's Average Variance Extracted (AVE), i.e. the bolded figure on the correlation matrix, is much larger than the correlation of the construct concerned with other construct. Therefore, we can conclude that discriminant validity is also achieved (Nunnally, 1978).

The result of PLS is at Figure 2, with the results summarized at Table 4. The $R^2$(adj) values obtained for various paths are ranged from 0.395 to 0.591, which are acceptable. As shown in Table 4, we observe that **information accuracy** (H1.1) and **content relevancy** (H1.2) are the two significant factors, which have positive effects on **user satisfaction**. It is also observed that **information accuracy** is depended on **content relevancy** (H2.1) and **presentation format** (H2.2); **content relevancy** is depended on **presentation format** (H2.3) and **information timeliness** (H2.5); and **presentation format** is depended on **information timeliness** (H2.6).

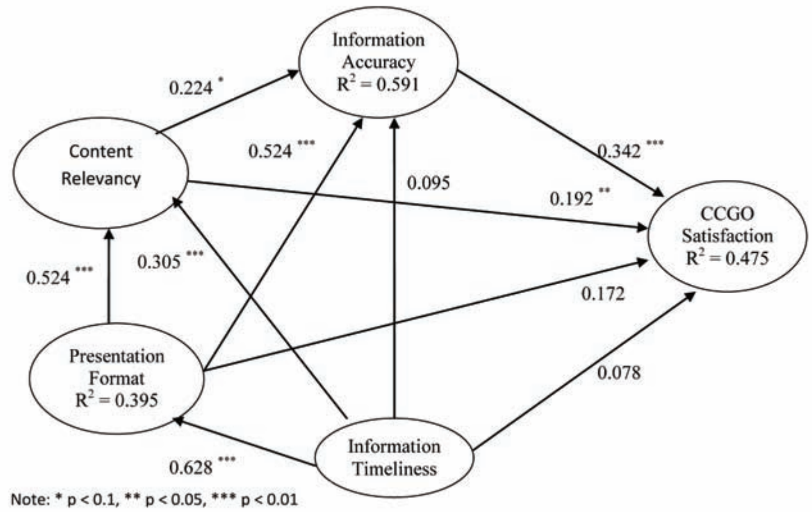
## Discussion

With plenty of in-house IT and development resources, the Hong Kong Government was one of the first municipal governments to implement an advanced communication portal. The benefits of CCGO include more secure creation of and access to information, versioning, information audit trails, approval paths, secured distribution, and workflow and collaboration automation. The major drawback of it is the high software and implementation costs, which costs millions of US dollars.

In our model, we conjuncture that all four information quality constructs would have significant impacts on **user satisfaction** on CCGO. However, our result shows that **information accuracy** and **content relevancy** are the two factors, which have direct impacts on the **user satisfaction** of CCGO. While the other two factors, viz. **presentation formats** and **information timeliness** do not have direct impact on the **user satisfaction** of CCGO, they have indirect impacts on the **user satisfaction** of CCGO as they are the factors affecting **information accuracy** (for **presentation format**) and **content relevancy** (for both **presentation format** and **information timeliness**). In brief, all the four **information quality** constructs are either having direct or indirect impacts on **user satisfaction**. Hence, it is suggested that the management of public and private sectors should take these four issues when they decide their Intranet portal.

To further collecting feedback from users of CCGO, 10 of the survey subjects, including six males and four females, were informally interviewed. They reckoned that as CCGO users, they had a concerned on **information accuracy** and **content relevancy** of the information presented in CCGO. It is because these information were essential for them in their daily work, and they might need to use these information to prepare reports for internal (i.e. other civil servants within

*Figure 2. Empirical result of the information quality satisfaction study on CCGO*




the government) and external (i.e. members of the public) clients. However, they had less concerns on the **presentation format**. Concerning **information timeliness**, we observed a very interesting observation. We notice that government officers in Hong Kong felt that it was a burden to receive timely information. This is probably due to an adaptation problem as Hong Kong Government had just moved from paper-base information flow to paperless mode. As a result, civil servants were adjusting their mindset from a slow paper-based information flow to a fast Intranet-fuelled system. This brought a paradigm shift to the civil servants when we conducted our study. Therefore, it is also suggested that the management should take into account of the feeling of the users.

## FUTURE RESEARCH DIRECTIONS

For further research directions, it is suggested that a comparative study could be conducted for

*Table 4. Path coefficients*

| Path | Coefficient | t-value | $R^2$ (adj) | Supported? |
|---|---|---|---|---|
| Ac → S (H1.1) | 0.342 | 3.75 *** | 0.475 | **Yes** |
| C → S (H1.2) | 0.192 | 2.12 ** | | **Yes** |
| P → S (H1.3) | 0.172 | 1.46 | | No |
| Ti → S (H1.4) | 0.078 | 0.88 | | No |
| C → Ac (H2.1) | 0.224 | 1.88 * | 0.591 | **Yes** |
| P → Ac (H2.2) | 0.524 | 5.01 *** | | **Yes** |
| Ti → Ac (H2.4) | 0.095 | 1.22 | | No |
| P → C (H2.3) | 0.524 | 6.34 *** | 0.569 | **Yes** |
| Ti → C (H2.5) | 0.305 | 3.25 *** | | **Yes** |
| Ti → P (H2.6) | 0.628 | 10.28 *** | 0.395 | **Yes** |

comparing the development of Intranet portal for business and government agencies. Also, it is also worthy to conduct multi-country studies on the **user satisfaction** on Intranet portal and investigate whether cultural difference would have a significant impact on this issue.

## CONCLUSION

Our study conducted a survey in a number of government departments to examine the **information quality** satisfaction of an in-house developed communication portal by the Hong Kong Government. **Information quality** is critical for a communication portal because there are myriad information types, including textual, audio, video and other complex information types, which an organization has to manage. Results show that all four **information quality** constructs are important **information quality** factors, which have either direct or indirect impacts on **user satisfaction** on the Intranet portal. We suggest public and business organizations should take into account of the impact of **information quality** on the **user satisfaction** of their portals when they design their Intranet portals.

## REFERENCES

Accenture (2004). E-Government leadership: Engaging the customer. Retrieved March 31, 2009, from http://nstore.accenture.com/acn_com/PDF/Engaging_the_Customer.pdf

Aladwani, A. M. (2002). Organizational actions, computer attitudes, and end-user satisfaction in public organizations: An empirical study. *Journal of End User Computing*, *14*(1), 42–49.

Aladwani, A. M. (2003). A deeper look at the attitude-behavior consistency assumption in information systems satisfaction research. *Journal of Computer Information Systems*, *44*(1), 57–63.

Bailey, J. E., & Pearson, S. W. (1983). Development of a tool for measuring and analyzing computer user satisfaction. *Management Science*, *29*(5), 530–545. doi:10.1287/mnsc.29.5.530

Bharati, P. (2003). People and information matter: Task support satisfaction from the other side. *Journal of Computer Information Systems*, *43*(2), 93–102.

Bhattacherjee, A., & Sanford, C. (2006). Influence process for information technology acceptance: An elaboration likelihood model. *MIS Quarterly*, *30*(4), 805–825.

Cykana, P., Paul, A., & Stern, M. (1996). DoD guidelines on data quality management. *Proceedings of the Conference on Information Quality*, Cambridge, MA, 154-171.

DeLone, W. H., & McLean, E. R. (1992). Information systems success: The quest for the dependent variable. *Information Systems Research*, *3*(1), 60–95. doi:10.1287/isre.3.1.60

Doll, W. J., & Torkzadeh, G. (1988). The measurement of end-user computing satisfaction. *MIS Quarterly*, *12*(2), 259–274. doi:10.2307/248851

Gefen, D., Straub, D., & Boudreau, M.-C. (2000). Structural equation modeling and regression: Guidelines for research practice. *Communications of the Association for Information Systems*: Vol. 4, Article 7. from http://aisel.aisnet.org/cais/vol4/iss1/7

Ho, K. K. W. (2007). The e-Government development, IT strategies and portals of Hong Kong SAR Government . *International Journal of Cases on Electronic Commerce*, *3*(2), 71–89.

Hong Kong Government (HKG). (2009). *IT infrastructure and standards – Infrastructure for e-government – Central Cyber Government Office*. Retrieved: March 31, 2009, from http://www.ogcio.gov.hk/eng/infra/eccgo.htm

Khalil, O. E. M., & Elkordy, M. M. (2005). EIS information: Use and quality determinants. *Information Resources Management Journal*, *18*(2), 68–93.

Lee, Y. W., Pipino, L., Strong, D. M., & Wang, R. Y. (2004). Process embedded data integrity. *Journal of Database Management*, *15*(1), 87–103.

Lee, Y. W., Strong, D. M., Kahn, B. K., & Wang, R. Y. (2002). AIMQ: A methodology for information quality assessment. *Information & Management*, *40*(2), 133–146. doi:10.1016/S0378-7206(02)00043-5

Mahmood, A. (1987). Systems development methods – A comparative investigation. *MIS Quarterly*, *11*(3), 293–311. doi:10.2307/248674

Melitski, J., Holzer, M., Kim, S.-T., Kim, C. G., & Rho, S. Y. (2005). An e-Government assessment of municipal web sites. *International Journal of Electronic Government Research*, *1*(1), 1–19.

Melone, N. P. (1990). A theoretical assessment of the user-satisfaction construct in information systems research. *Management Science*, *36*(1), 76–91. doi:10.1287/mnsc.36.1.76

Miller, J., & Doyle, B. A. (1987). Measuring effectiveness of computer-based information systems in the financial services sector. *MIS Quarterly*, *11*(1), 107–124. doi:10.2307/248832

Negash, S., Ryan, T., & Igbaria, M. (2003). Quality and effectiveness on Web-based customer support systems. *Information & Management*, *40*(8), 757–768. doi:10.1016/S0378-7206(02)00101-5

Nunnally, J. C. (1978). *Psychometric theory* (2nd edition). New York: McGraw-Hill.

Park, C. H., & Kim, Y. G. (2006). The effect of information satisfaction and relational benefit on consumers' online shopping site commitments. *Journal of Electronic Commerce in Organizations*, *4*(1), 70–90.

Ringle, C. M., Wende, S., & Will, A. (2005): SmartPLS 2.0 (beta), www.smartpls.de.

Shih, H. P. (2004). An empirical study on predicting user acceptance of e-shopping on the Web. *Information & Management*, *41*(3), 351–368. doi:10.1016/S0378-7206(03)00079-X

Shim, S. J., & Min, B. K. (2002). Organizational factors associated with expert systems implementation. *Journal of Computer Information Systems*, *42*(4), 71–76.

Srinivasan, A. (1985). Alternative measures of system effectiveness: Associations and implications. *MIS Quarterly*, *9*(3), 243–253. doi:10.2307/248951

Sullivan, J. R., & Walstrom, K. A. (2001). Consumer perspectives on service quality of electronic commerce web sites. *Journal of Computer Information Systems*, *41*(3), 8–14.


## ADDITIONAL READING

### E-Government


Accenture. (2004). *E-Government leadership: Engaging the customer*. Retrieved March 31, 2009, from http://nstore.accenture.com/acn_com/PDF/Engaging_the_Customer.pdf

Andersen, K. V., & Henriksen, H. Z. (2005). The first leg of e-government research: Domains and application areas 1998-2003. *International Journal of Electronic Government Research*, *1*(4), 26–44.

Danziger, J. N., Kraemer, K. L., & King, J. L. (1978). An assessment of computer technology in U.S. local government. *Urban Systems*, *3*(1), 21–37. doi:10.1016/0147-8001(78)90004-9

Davison, R. M., Wagner, C., & Ma, L. C. K. (2005). From government to e-government: A transition model. *Information Technology & People*, *18*(3), 280–299. doi:10.1108/09593840510615888

Devadoss, P. R., Pan, S. L., & Huang, J. C. (2002). Structural analysis of e-government initiatives: A case study of SCO. *Decision Support Systems*, *34*(3), 253–269. doi:10.1016/S0167-9236(02)00120-3

Ebbers, W. E., & van Dijk, J. (2007). Resistance and support to electronic government, building a model of innovation. *Government Information Quarterly*, *24*(1), 554–575. doi:10.1016/j.giq.2006.09.008

Evans, D., & Yen, D. C. (2005). E-Government: An analysis for implementation: Framework for understanding cultural and social impact. *Government Information Quarterly*, *22*(3), 354–373. doi:10.1016/j.giq.2005.05.007

Flak, L. S., & Rose, J. (2005). Stakeholder governance: Adapting stakeholder theory to e-government. *Communications of the Association for Information Systems*, 16.

Golden, W., Hughes, M., & Scott, M. (2003). The role of process evolution in achieving citizen-centered e-government. In *Americas Conference on Information Systems 2003 Proceedings*, Tampa, Florida. Retrieved March 31, 2009, from http://aisel.aisnet.org/amcis2003/100

Gore, A. (1993). *Reengineering through information technology*. Accompanying Report of the National Performance Review. Washington, DC: Office of the Vice President.

Grant, G., & Chau, D. (2005). Developing a generic framework for e-government. *Journal of Global Information Management*, *13*(1), 1–30.

Grönlund, Ä., & Horan, T. A. (2005). Introducing e-Gov: History, definition, and issues. *Communications of the Association for Information Systems*, *15*(39), 713–729.

Heeks, R., & Bailur, S. (2006). Analysing eGovernment research: Perspectives, philosophies, theories, methods and practice. *iGovernment Working Paper Series*. Manchester, M13 9QH, UK, Institute for Development Policy and Management.

Ho, K. K. W. (2007). The e-Government development, IT strategies and Portals of Hong Kong SAR Government. *International Journal of Cases on Electronic Commerce*, *3*(2), 71–89.

Ho, S. Y., & Ho, K. K. W. (2006). A study on the information quality satisfaction of communication portals in the Hong Kong Government. In *Proceedings of 2006 IRMA International Conference*, Washington, DC.

Kraemer, K. L. (1977). Local government, information systems, and technology transfer: Evaluating some common assertions about computer application transfer. *Public Administration Review*, *37*(4), 368–382. doi:10.2307/974867

Melitski, J., Holzer, M., Kim, S.-T., Kim, C. G., & Rho, S. Y. (2005). An e-Government assessment of municipal web sites. *International Journal of Electronic Government Research*, *1*(1), 1–19.

Melone, N. P. (1990). A theoretical assessment of the user-satisfaction construct in information systems research. *Management Science*, *36*(1), 76–91. doi:10.1287/mnsc.36.1.76

Singh, H., Amit, Das, & Damien, Joseph. (2007). Country-level determinants of e-government maturity. *Communications of the Association for Information Systems*, 20.

Yong, J. S. L. (Ed.). (2005). *Enabling public service innovation in the 21st Century: E-Government in Asia*. Singapore: Marshall Cavendish.

## User-Satisfaction and Information Quality

Aladwani, A. M. (2002). Organizational actions, computer attitudes, and end-user satisfaction in public organizations: An empirical study. *Journal of End User Computing*, *14*(1), 42–49.

Aladwani, A. M. (2003). A deeper look at the attitude-behavior consistency assumption in information systems satisfaction research. *Journal of Computer Information Systems*, *44*(1), 57–63.

Bailey, J. E., & Pearson, S. W. (1983). Development of a tool for measuring and analyzing computer user satisfaction. *Management Science*, *29*(5), 530–545. doi:10.1287/mnsc.29.5.530

Bharati, P. (2003). People and information matter: Task support satisfaction from the other side. *Journal of Computer Information Systems*, *43*(2), 93–102.

Bhattacherjee, A., & Sanford, C. (2006). Influence process for information technology acceptance: An elaboration likelihood model. *MIS Quarterly*, *30*(4), 805–825.

Cheung, C. M. K., & Lee, M. K. O. (2005). The Asymmetric Effect of Website Attribute Performance on Satisfaction: An Empirical Study. In *Proceedings of the 38th Annual Hawaii International Conference on System Sciences*, Waikoloa, Hawaii.

Cykana, P., Paul, A., & Stern, M. (1996). DoD guidelines on data quality management. *Proceedings of the Conference on Information Quality*, Cambridge, MA, 154-171.

DeLone, W. H., & McLean, E. R. (1992). Information systems success: The quest for the dependent variable. *Information Systems Research*, *3*(1), 60–95. doi:10.1287/isre.3.1.60

Doll, W. J., & Torkzadeh, G. (1988). The measurement of end-user computing satisfaction. *MIS Quarterly*, *12*(2), 259–274. doi:10.2307/248851

Fisher, C., Lauría, E., Chengalur-Smith, S., & Wang, R. (2008). *Introduction to Information Quality*. Cambridge, MA: M.I.T. Information Quality Program Press.

Jin, X.-L., Cheung, C. M. K., Lee, M. K. O., & Chen, H. (2008). User Information Satisfaction with a Knowledge-Based Virtual Community: An Empirical Investigation. *In Emerging Technologies and Information Systems for the Knowledge Society*. Berlin: Springer.

Khalil, O. E. M., & Elkordy, M. M. (2005). EIS information: Use and quality determinants. *Information Resources Management Journal*, *18*(2), 68–93.

Lee, Y. W., Pipino, L., Strong, D. M., & Wang, R. Y. (2004). Process embedded data integrity. *Journal of Database Management*, *15*(1), 87–103.

Lee, Y. W., Strong, D. M., Kahn, B. K., & Wang, R. Y. (2002). AIMQ: A methodology for information quality assessment. *Information & Management*, *40*(2), 133–146. doi:10.1016/S0378-7206(02)00043-5

Mahmood, A. (1987). Systems development methods – A comparative investigation. *MIS Quarterly*, *11*(3), 293–311. doi:10.2307/248674

Miller, J., & Doyle, B. A. (1987). Measuring effectiveness of computer-based information systems in the financial services sector. *MIS Quarterly*, *11*(1), 107–124. doi:10.2307/248832

Negash, S., Ryan, T., & Igbaria, M. (2003). Quality and effectiveness on Web-based customer support systems. *Information & Management*, *40*(8), 757–768. doi:10.1016/S0378-7206(02)00101-5

Park, C. H., & Kim, Y. G. (2006). The effect of information satisfaction and relational benefit on consumers' online shopping site commitments. *Journal of Electronic Commerce in Organizations*, *4*(1), 70–90.

Shih, H. P. (2004). An empirical study on predicting user acceptance of e-shopping on the Web. *Information & Management*, *41*(3), 351–368. doi:10.1016/S0378-7206(03)00079-X

Shim, S. J., & Min, B. K. (2002). Organizational factors associated with expert systems implementation. *Journal of Computer Information Systems*, *42*(4), 71–76.

Srinivasan, A. (1985). Alternative measures of system effectiveness: Associations and implications. *MIS Quarterly*, *9*(3), 243–253. doi:10.2307/248951

Sullivan, J. R., & Walstrom, K. A. (2001). Consumer perspectives on service quality of electronic commerce web sites. *Journal of Computer Information Systems*, *41*(3), 8–14.

Wang, R., & Strong, D. (1996). Beyond accuracy: What data quality means to data consumers. *Journal of Management Information Systems*, *12*(4), 5–34.

Wang, R. Y., Pierce, M. E., Stuart, E., & Madnick, E. S. (2005). *Information Quality*. Armonk, NY: M.E. Sharpe.

## KEY TERMS AND DEFINITIONS

**Content Relevancy:** Content Relevancy is "the degree of congruence between what the user wants or requires and what is provided by the information products and services" (Bailey & Pearson, 1983). It is one of the elements of Contextual data quality (Wang & Strong, 1996).

**Electronic Government (e-Government):** Electronic Government (e-Government) is referring to the use of information technology to provide government services online, which aims to provide faster and better services for stakeholders. It can be divided into four basic categories, viz. Government to Citizen (G2C), Government-to-Business (G2B), Government-to-Government (G2G), and Government-to-Employee (G2E).

**Information Accuracy:** Information Accuracy relates to "the correctness of the output information" (Bailey & Pearson, 1983). It is one of the elements of intrinsic data quality (Wang & Strong, 1996).

**Information Quality:** Information quality is "the quality of the information that the systems produces" (DeLone & McLean, 1992). It can further divided into four data quality (DQ) categories, viz. Intrinsic DQ, Contextual DQ, Representational DQ, and Accessibility DQ (Wang & Strong, 1996).

**Information Timeliness:** Information Timeliness relates to "the availability of the output information at a time suitable for its use" (Bailey & Pearson, 1983). It is one of the elements of Contextual data quality (Wang & Strong, 1996).

**Intranet Portal:** Intranet Portal is a gateway on the Intranet developed by an organization, which unifies access to all information and applications related to the daily operation of the organization.

**Presentation Format:** Presentation Format is the measure of how "the output is presented in a useful format and whether the information is clear" (Doll and Torkzadeh, 1998)

## APPENDIX: SAMPLE QUESTIONNAIRE

### User Satisfaction of CCGO (S)

S1. The system is successful.
S2. I am satisfied with the system.

### Information Accuracy (Ac)

Ac1. The system is accurate.
Ac2. I am satisfied with the accuracy of the system.

### Presentation Format (P)

P1. The output is presented in a useful format.
P2. The information is clear.

### Information Timeliness (Ti)

Ti1. I get the information you need in time.
Ti2. The system provides up-to-date information.

### Content Relevancy (C)

C1. The system provides the precise information you need.
C2. The information content meets your needs.
C3. The system provides reports that seem to be just about exactly what I need.
C4. The system provides sufficient information.
(1 = Disagree, 5 = Agree)

# Chapter 61
# Visual Merchandising in Online Retailing Based on Physical Retailing Design Principles

**Tony Pittarese**
*East Tennessee State University, USA*

## ABSTRACT

*Effective design guidelines aid in the creation of successful online stores. One possible resource to aid in formulating effective online store design guidelines is found in principles and practices of physical retailers. In particular, physical store merchandising techniques provide a significant body of research from which online store guidelines may be constructed. By examining the research literature and common practices of physical retailers, online retailers may glean new and interesting ideas upon which to base guidelines for online store design.*

## INTRODUCTION

While retailing on the World Wide Web began in the United States in the mid-1990's (Netscape Communications Corporation, 1997; Petrak, 2000; Zakon, 2002), traditional store-based retailing has been practiced for centuries. Although some have argued for starting with a "blank slate" strategy when building online retailing research (Childers, Carr, Peck, & Carseon, 2001), it would be unwise for those studying online retailing to disregard the decades of research that exists in traditional retailing (Chen, Gillenson, & Sherrell, 2002; Hübscher, Pittarese, & Lanford, 2002; Pittarese, 2003). Research focusing particularly on the use of physical retail merchandising techniques in e-Commerce is currently underdeveloped.

Early research in physical store merchandising can be traced to the 1960's. During this time researchers first began to focus on how the display and presentation of products in the selling environment could be used to enhance sales (K. Cox, 1964, 1970; Kotzan & Evanson, 1969). **Merchandising**, defined as "the activities required in the attempt to make a product interesting to buyers" (Rosenberg, 1995), encompasses areas such as store organization (Hart & Davies, 1996), product display and presentation (Bryan & Gershman, 1999), and overall design and

DOI: 10.4018/978-1-61520-611-7.ch061

maintenance of the entire retailing environment (Kotler, 1974). It is well established that success in merchandising results in increased sales and enhanced customer satisfaction (Berman & Evans, 1998; Levy & Weitz, 1998).

## BACKGROUND

Study has shown that customer satisfaction in online shopping is based upon the customer's assessment of various critical factors including **site design**, convenience (Szymanski & Hise, 2000), and perceptions of usefulness and ease of use (Chen, et al., 2002; Qiu & Li, 2008). One challenge an online store faces is organizing and presenting their products in a way that the customer will find enticing. One potential advantage an online retailer has is its ability to offer customers more products than would be possible in a physical environment, however for this benefit to be fully realized the products must be presented in a manner that enhances the retailer's overall site design and shopper convenience. There is a direct relationship between a customer's assessment of the aesthetic quality of an online store, and their assessment of the quality and organization of the product information provided on the site (S. Y. Kim & Lim, 2001; Park & Stoel, 2002).

While Kotler coined the term "**atmospherics**" to describe use of the physical shopping environment to influence customer shopping (Kotler, 1974), Childers originated the term "**webmospherics**" to describe the same concept in online stores (Childers, et al., 2001) and others have built on that work (Hausman & Siekpe, 2009; Richard, 2005). Presenting large numbers of products tends to create confusion and a feeling of being overwhelmed (Huffman & Kahn, 1998). Forcing customers to scroll through long product lists or pages of information is tedious and reflects poor store design (Tilson, Dong, Martin, & Kieke, 1998). The grouping of products into smaller collections and the use of **product selection cues** such as recommendation systems can reduce confusion and motivate additional product sales (Lee, Kim, & Moon, 2000; Senecal, Kalczynski, & Nantel, 2005). Removing potential confusion and enhancing the enjoyment of shopping is a key element in online retail success (Cai & Xu, 2006; A. D. Cox, Cox, & Anderson, 2005).

The key in this process is to recognize that although online retailers do not face the same physical constraints as store-based retailers, they do face practical constraints in managing a shopper's attention and motivation. For this reason visual merchandising in the online environment is an important concern. How can products best be presented to facilitate a shopper's navigation among the products and positively influence his purchase decision?

## VISUAL MERCHANDISING ONLINE

Research was conducted by the author to test the viability of extracting merchandising principles from physical retailing for use as the foundation of design guidelines for online retailing. A set of candidate merchandising principles was selected, an online store guideline based on each principle was formulated, a prototype store was constructed for each guideline, and the stores were usability tested by users.

### Store Variation One: Unsought Products

In physical stores shoppers are immersed in an environment where they see many products not specifically related to a conscious shopping goal. Frequently these **unsought products** will attract the shopper's attention and will be purchased. In many online stores only products within a selected category or matching a product search term are displayed. This provides little opportunity for the shopper to be influenced by something outside of their explicit focus.

The following design guideline was applied in a test store: As customers navigate through the online store, other randomly selected products are placed in their view. These interjected products are not the focal point of product presentation, but rather they are displayed as small pictures along the bottom of the screen. These unsought products are swapped out every 30 seconds, independent of other screen content.

## Store Variation Two: Affinity Positioning

In physical stores products are often arranged using affinity positioning: placing products that are likely to be purchased together in close physical proximity to one another (Blischok, 1995), often on the same display rack (Buchanan, Simmons, & Bickart, 1999). **Affinity positioning** recognizes that products frequently are bought in groups, and their joint display permits the customer to view related products at the same time, often with one eye fixation. This grouping suggests items that can (and should) be purchased together, thus enhancing the retailer's revenue.

The following design guideline was applied in a test store: Every product category is displayed in conjunction with a related product category to facilitate joint product selection. When a customer chooses a product category for viewing, selected products from a complementary product category are displayed at the bottom of the screen. Complementary products can attract customer attention while the overall focus is the selected product category.

## Store Variation Three: Visual Dominated Shopping

In physical stores shoppers do not receive detailed product information as they begin **browsing**. Initial product selection is done visually. Although a customer may be able to take in several hundred products in one eye fixation, it is easy and natural for a customer to be able to quickly find and focus on a single product of interest. Once a shopper focuses on a particular item of interest, they then receive detailed information by further examination of the merchandise, related tags, and/or signage. Customers never seek, nor are given, this information for products in which they are not interested.

The following design guideline was applied in a test store: products are initially displayed to customers in picture form only. More products can be presented to the shopper at one time, since text and other elements which might cause distraction have been removed. Once a customer selects an item of interest additional information is displayed. The store is purposely designed to use minimal text until product information is requested by the shopper.

## Store Variation Four: Visual Shopping Cart

In physical stores shoppers accumulate products in shopping carts or similar devices to which they have ready, continuous visual access. Ongoing shopping activities are often related to items already selected for purchase. Customers desiring to make product comparisons can easily glance at merchandise in their shopping cart for assistance. As they travel through the store, their cart provides a frequent visual reminder of their shopping task.

The following design guideline was applied in a test store: Rather than hide the contents of a shopper's cart on another display screen, the customer is presented with an always-visible shopping cart. The shopping cart displays small pictures of the cart contents on the right side of every page. These product pictures make it easier for a customer to keep track of exactly what he has selected for purchase and may influence a customer's later product selection.

## Testing Protocol

Undergraduate college students were selected as the target audience for this study, partially because of convenience, but primarily because of their level of experience with both physical and online shopping. The current generation of undergraduate college students represents the first generation to achieve buying power during an era when both physical and online shopping alternatives existed.

The testing framework was based upon **usability** testing practices and guidelines suggested by Barnum, Rubin, and Nielsen (Barnum, 2002; Nielsen, 1999; Nielsen & Mack, 1994; Rubin, 1994). A baseline store was created similar in appearance to store design templates used in Yahoo Shopping's online mall. A variation store was created for each of the previously stated guidelines. These variations were the same as the baseline store except they featured a different store name and color scheme, and employed one of the previously stated guidelines. Each store featured the same selection of fashion products. Fashion items were chosen as the product line to be featured because of the interesting inter-product relationships fashion items possess. A set of shopping tasks was created, giving test participants an overall goal to accomplish while evaluating the stores.

Each test participant interacted with two online stores, typically the baseline store and a variation store (although other testing combinations were recorded as well). A Store Evaluation Worksheet was developed asking test participants a variety of questions about their shopping session. The primary focus of the instrument was the participant's perceptions and preferences for each of the stores they interacted with during testing. Each participant was asked which of the two stores they liked better. They were then presented with seven categories for rating their experience with each store on a 10 point scale—attractive/unattractive, easy to use/hard to use, well organized/poorly organized, easy to find things/hard to find things, exciting/boring, easy to understand/hard to understand, and efficient/inefficient. These categories were drawn from characteristics of successful stores as suggested by the literature (Jarvenpaa & Ouellete, 1994; Lohse & Spiller, 1998; Nielsen & Norman, 2000; Smith & Whitlark, 2001; Wexelblat & Maes, 1999). This set of questions was followed by additional closed and open-ended questions.

184 undergraduate students participated in the testing, generating 368 store visitation sessions. Several alternative store designs other than those presented here were also considered. In addition to the data collected from above described worksheet, log files maintained by the web server were available for analysis. The evaluation worksheet recorded information allowing each shopper's responses to be paired with their entries in the log.

## Testing Results

When examining the store preference question and the seven subjective rating factors for store quality, the results were mixed. No clear indication of preference was present. Several stores scored higher in various categories, but overall the baseline store and the revised stores were very similar in their effect. None of the proposed guidelines outlined here demonstrated *statistically significant* superiority in testing overall.

The variation stores did exhibit clear differences in factors such as time spent in accomplishing tasks and the number of products viewed when completing a task. Both of these measures are significant, as over time they should contribute to additional product sales for a retailer (J. Kim, Fiore, & Lee, 2007). However, given the overall test results, this raises an obvious question about the study goal of extracting online design guidelines from the merchandising literature and practices of physical retailers.

Reflecting on the testing protocol and process, although care was taken in determining an appropriate evaluation protocol, several unavoidable test characteristics eroded the quality of the results. The number of test participants, although large overall, was reduced in statistical power by having their testing spread out over eight variation stores. Focusing the testing on a smaller number of stores may have improved the statistical power of the results.

Perhaps most significantly, participants in the testing process realized that they were not patronizing actual online stores and they were not really choosing products that they would be purchasing. The tasks they were given to complete, although typical and appropriate, were not tasks of their own choosing which they were really interested in accomplishing. Perhaps most importantly, they were not spending real money in the expectation of acquiring real merchandise. Given all of these factors, test participants were not really interacting with the test stores in the same manner as if they were actually shopping for their own benefit.

## FUTURE RESEARCH DIRECTIONS

Given that the outcomes of this research were mixed, additional research in this area seems warranted. While partnering with an actual online retailer was not possible for the sake of this research, the possibility of doing that in future research does exist. A more complete picture of the viability of the design variation can be determined by comparing the current practices of a retailer with other design variations under consideration for that retailer. Such a partnering with an actual online retailer would provide extremely valuable data to the researcher, but it would also require extensive trust, cooperation, and, in all likelihood, confidentiality between the online retailer and the researcher.

Although four design guidelines have been proposed here, and a total of eight were tested overall, many more principles can certainly be extracted from store-based retailing literature and practice. The author continues to believe that by mining the literature of physical retailing store design and merchandising, online retailers may gain valuable insights for future design guidelines.

## CONCLUSION

To ignore store-based merchandising principles and practices when creating online stores is believed by this author to be a mistake. This practice robs online store designers of a valuable input to the store creation process. By creating stores that reflect the design principles and practices of physical stores, online retailers can create stores that seem familiar to shoppers and increase sales revenue. By focusing on established best practices in retail merchandising, new insights for online merchandise display may results. Although the research work presented here does not establish statistically significant outcomes, the overall goal of continuing to explore this path seems valid. A wide array of literature exists in store-based merchandising. Online store designers may find great benefit in mining that literature for new design techniques and guidelines.

## REFERENCES

Barnum, C. (2002). *Usability Testing and Research*. New York: Longman.

Berman, B., & Evans, J. R. (1998). *Retail Management: A Strategic Approach* (7th ed.). Upper Saddle River, NJ: Prentice Hall.

Blischok, T. J. (1995). Every Transaction Tells a Story. *Chain Store Age Executive*, *71*(3), 50–57.

Bryan, D., & Gershman, A. (1999). *Opportunistic Exploration of Large Consumer Product Spaces.* Paper presented at the First ACM Conference on Electronic Commerce, Denver, Colorado.

Buchanan, C., Simmons, C. J., & Bickart, B. A. (1999). Brand Equity Dilution: Retailer Display and Context Brand Effects. *JMR, Journal of Marketing Research*, *36*(3), 345. doi:10.2307/3152081

Cai, S., & Xu, Y. (2006). Effects of outcome, process and shopping enjoyment on online consumer behaviour. *Electronic Commerce Research and Applications*, *5*(4), 272–281. doi:10.1016/j.elerap.2006.04.004

Chen, L.-d., Gillenson, M. L., & Sherrell, D. L. (2002). Enticing online consumers: an extended technology acceptance perspective. *Information & Management*, *39*(8), 705–719. doi:10.1016/S0378-7206(01)00127-6

Childers, T. L., Carr, C. L., Peck, J., & Carseon, S. (2001). Hedonic and Utilitarian Motivations for Online Retail Shopping Behavior. *Journal of Retailing*, *77*(4), 511–535. doi:10.1016/S0022-4359(01)00056-2

Cox, A. D., Cox, D., & Anderson, R. D. (2005). Reassessing the pleasures of store shopping. *Journal of Business Research*, *58*(3), 250–259. doi:10.1016/S0148-2963(03)00160-7

Cox, K. (1964). The Responsiveness of Food Sales to Shelf Space Changes in Supermarkets. *JMR, Journal of Marketing Research*, *1*, 63–67. doi:10.2307/3149924

Cox, K. (1970). The Effect of Shelf Space Upon Sales of Branded Products. *JMR, Journal of Marketing Research*, *7*, 55–58. doi:10.2307/3149507

Hart, C., & Davies, M. (1996). The Location and Merchandising of Non-food in Supermarkets. *International Journal of Retail & Distribution Management*, *24*(3), 17. doi:10.1108/09590559610147892

Hausman, A. V., & Siekpe, J. S. (2009). The effect of web interface features on consumer online purchase intentions. *Journal of Business Research*, *62*(1), 5–13. doi:10.1016/j.jbusres.2008.01.018

Hübscher, R., Pittarese, T., & Lanford, P. (2002). Navigation in e-Business Web Sites. In S. Nansi (Ed.), *Architectural Issues of Web-Enabled Electronic Business*: Idea Group.

Huffman, C., & Kahn, B. E. (1998). Variety for Sale: Mass Customization or Mass Confusion? *Journal of Retailing*, *74*(4), 492–514. doi:10.1016/S0022-4359(99)80105-5

Jarvenpaa, S. L., & Ouellete, S. J. (1994). Consumers' Perception of Risk and the Purchase of Apparel from Catalogs. *Journal of Direct Marketing*, *8*, 23–36. doi:10.1002/dir.4000080205

Kim, J., Fiore, A. M., & Lee, H.-H. (2007). Influences of online store perception, shopping enjoyment, and shopping involvement on consumer patronage behavior towards an online retailer. *Journal of Retailing and Consumer Services*, *14*(2), 95–107. doi:10.1016/j.jretconser.2006.05.001

Kim, S. Y., & Lim, Y. J. (2001). Consumers' Perceived Importance of and Satisfaction with Internet Shopping. *Electronic Markets*, *11*(3), 148–154. doi:10.1080/101967801681007988

Kotler, P. (1974). Atmospherics as a Marketing Tool. *Journal of Retailing*, (3): 48–64.

Kotzan, J. A., & Evanson, R. V. (1969). Responsiveness of Drug Store Sales to Shelf Space Allocations. *JMR, Journal of Marketing Research*, *1*(6), 465–469. doi:10.2307/3150084

Lee, J., Kim, J., & Moon, J. Y. (2000, April 2000). *What Makes Internet Users Visit Cyber Stores Again? Key Design Factors for Customer Loyalty.* Paper presented at the Conference on Human Factors and Computing Systems, The Hague, The Netherlands.

Levy, M., & Weitz, B. (1998). *Retailing Management* (3rd ed.). New York: Irwin/McGraw-Hill.

Lohse, G. L., & Spiller, P. (1998). Electronic Shopping: Designing Online Stores with Effective Customer Interfaces. *Communications of the ACM*, *41*(7), 81–87. doi:10.1145/278476.278491

Netscape Communications Corporation. (1997). *Internet Shopping Network Uses KIVA Server Software from Netscape for Online Retailing Service*. Retrieved July 2, 2003, 2003, from http://wp.netscape.com/newsref/pr/newsrelease550.html

Nielsen, J. (1999). *Designing Web Usability*. Indianapolis, IN: New Riders Publishing.

Nielsen, J., & Mack, R. L. (1994). *Usability Inspection Methods*. New York: Wiley.

Nielsen, J., & Norman, D. (2000). Usability on the Web Isn't a Luxury. *Information Week*, *773*, 65–73.

Park, J. H., & Stoel, L. (2002). Apparel Shopping on the Internet: Information Availability on U.S. Apparel Merchant Web Sites. *Journal of Fashion Marketing and Management*, *6*(2), 158–176. doi:10.1108/13612020210429908

Petrak, L. (2000). Staking Claim in Cyberspace. *National Provisioner*, *214*(9), 47–54.

Pittarese, T. (2003). *Creating Effective Online Fashion Stores: Merchandising in an Online Retail Environment Based on Design Principles from Physical Stores.* Unpublished Doctoral Dissertation, Auburn University.

Qiu, L., & Li, D. (2008). Applying TAM in B2C E-Commerce Research: An Extended Model. *Tsinghua Science and Technology*, *13*(3), 265–272. doi:10.1016/S1007-0214(08)70043-9

Richard, M.-O. (2005). Modeling the impact of internet atmospherics on surfer behavior. *Journal of Business Research*, *58*(12), 1632–1642. doi:10.1016/j.jbusres.2004.07.009

Rosenberg, J. M. (1995). *Dictionary of Retailing and Merchandising*. New York: Wiley.

Rubin, J. (1994). *Handbook of Usability Testing*. New York: Wiley.

Senecal, S., Kalczynski, P. J., & Nantel, J. (2005). Consumers' decision-making process and their online shopping behavior: a clickstream analysis. *Journal of Business Research*, *58*(11), 1599–1608. doi:10.1016/j.jbusres.2004.06.003

Smith, S. M., & Whitlark, D. B. (2001). Men and Women Online: What Makes Them Click? *Marketing Research*, *13*(2), 20–26.

Szymanski, D. M., & Hise, R. T. (2000). e-Satisfaction: An Initial Examination. *Journal of Retailing*, *76*(3), 309–323. doi:10.1016/S0022-4359(00)00035-X

Tilson, R., Dong, J., Martin, S., & Kieke, E. (1998). *Factors and Principles Affecting the Usability of Four e-Commerce Sites.* Paper presented at the Fourth Conference on Human Factors and the Web, AT&T Labs USA.

Wexelblat, A., & Maes, P. (1999). *Footprints: History-Rich Tools for Information Foraging*. Paper presented at the Conference on Human Factors and Computing Systems.

Zakon, R. H. (2002, November 1, 2006). *Hobbes' Internet Timeline 8.2*. Retrieved March 27, 2009, from http://www.zakon.org/robert/internet/timeline/

## KEY TERMS AND DEFINITIONS

**Affinity Positioning:** physical placement and combined visual merchandising of products frequently purchased together

**Atmospherics:** recognition that the entire physical retail experience influences the purchase process; an attempt to positively control the entire retail environment to motivate purchasing

**Browsing:** a shopper's opportunistic exploration of a retail environment; unfocused navigation and viewing of products

**Merchandising:** activities employed by a retailer to entice consumers to make a purchase

**Shopping:** a shopper's focused exploration of a retail environment in search of a particular product or type of product; distinct from browsing based on the shopper's thought process and intent

**Unsought Products:** products selected by consumers on the spur of the moment without prior intent and often without full evaluation of the purchase decision; often referred to as impulse purchases

**Visual Merchandising:** merchandising activities that particularly focus on the presentation and display of merchandise in a retail setting

**Webmospherics:** application of the concept of atmospherics to web-based shopping; an attempt to control the entire web-shopping experience to motivate online purchasing

# Section 7
# Online Consumer Behavior

# Chapter 62
# Internet Consumer Behavior:
## Flow and Emotions

**Marie-Odile Richard**
*University of Montreal, Canada*

**Michel Laroche**
*Concordia University, Canada*

## INTRODUCTION

As the internet is a new medium and a new distribution channel, it is important to understand the behavior of site visitors. This requires the development of a new model of Internet consumer behavior. The model in Figure 1-1 is an original model based on Mehrabian and Russell's (1974) *SOR* paradigm (i.e., *s*timulus, *o*rganism, *r*esponse) which is explicated in this chapter and the next three ones. In this chapter we will explain the shaded areas of Figure 1

## BACKGROUND

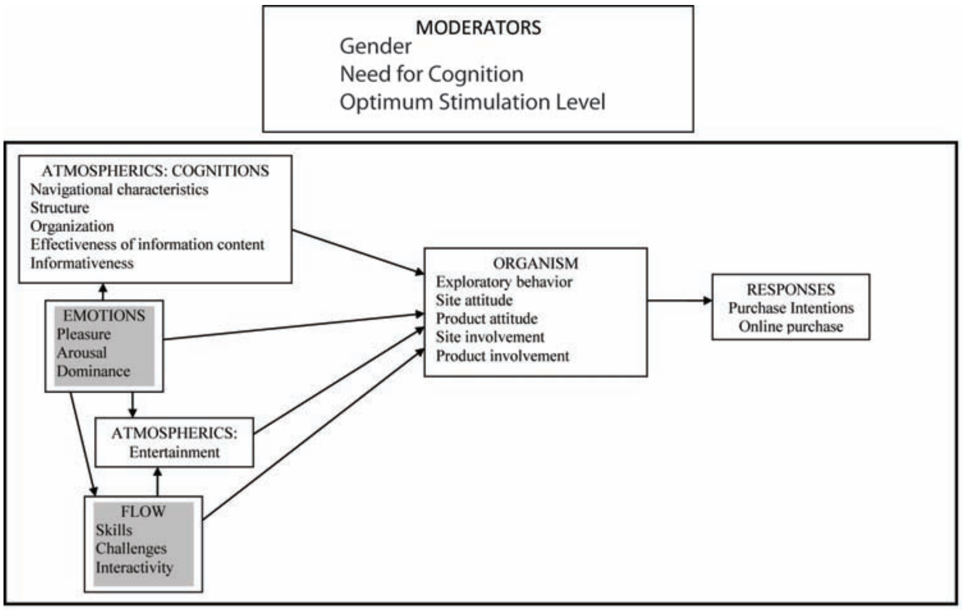
The key concepts which are part of the stimulus dimension of *SOR*, i.e., inputs to the organism and response variables are flow, emotions and web atmospherics. This chapter develops the flow construct, composed of skills, challenge and interactivity, and the emotions construct, composed of pleasure, arousal and dominance. The next chapter will develop the web atmospherics variables.

### Flow

Flow is defined as a state occurring during internet navigation which: *1)* is characterized by a seamless sequence of responses facilitated by machine interactivity; *2)* is intrinsically enjoyable; *3)* is accompanied by a loss of self-consciousness; and *4)* is self-reinforcing and *5)* leads to a sense of playfulness (Hoffman & Novak, 1996). Flow is related to skills, challenges and interactivity.

DOI: 10.4018/978-1-61520-611-7.ch062

*Figure 1. Model of consumer navigation behavior: flow and emotions* (*Source: Adapted from Richard, M.O. (2009). Modeling the internet behavior of visitors by the study of cognitive variables and moderators, unpublished doctoral dissertation, HEC-Montreal Business School.)*




## Skills

Novak, Hoffman and Yung (2000) define *skills* as the consumer's capacity for action during the online navigation process. Ghani and Deshpande (1994) report that skills directly affect the flow: they show that the level of perceived skills, as well as perceived challenges, is positively associated with the achievement of flow which, in turn, predicts exploratory behavior. Ghani (1991) discovers that flow is related to exploratory use behavior (considered as the consequences of flow; Hoffman & Novak, 1996). Ghani and Deshpande (1994) state that flow is present when skills and challenges are both high, since they independently contribute to the flow (Novak, Hoffman, & Yung, 2000). Although they operate independently, studies demonstrate that high skill and high challenge levels lead to satisfying consumer experiences on the Internet (Csikszentmihalyi, 2000; Richard & Chandra, 2005). Although marginally significant, skills are a predictor of perceived interactivity and people with high skills levels perceive the website as having greater interactivity (Jee & Lee, 2002; Wu, 2000).

## Challenge

Another predictor of flow is challenge in internet activities. Novak, Hoffman, and Yung (2000) define challenges as the opportunities for action on the internet. Skills at navigating the web do not affect the surfing experiences and behavior of site visitors, since those planning to make online purchases have already developed basic navigational skills. But, positive challenges have an important influence on web experiences, since visitors must use their skills and abilities in navigating the site, learning how to interact with it, process information and make decisions on the purchase of needed products. On the other hand, negative challenges lead to slow downloading times, frustration and aborted buying processes. Positive challenges lead to positive site and product attitudes, as well as purchase intentions and behavior (Koufaris, Kambil, & LaBarbera, 2001).

The level of challenges may have an impact on attitudes toward the website. Websites that are not challenging are considered boring sites (Anand & Sternthal, 1990). If a website offers enough challenges, a positive attitude is attainable by surfers (Luna, Peracchio, & de Juan, 2002). Challenges are positively related to attitudes towards the site only if the level is not excessive. Flow can occur if surfers are challenged enough, that is neither are they bored nor do they reach the point of anxiety (Csikszentmihalyi, 2000).

### Balance Between Skills and Challenge

To obtain an autotelic experience, flow arises from a balance between challenges (i.e., action opportunities) and skills (i.e., action capabilities; Csikszentmihalyi, 2000). For Massimini and Carli (1988), flow begins when skills and challenges are balanced and are above individual means. However, there are limitations on creation of flow as it does not depend entirely on either the objective nature of the challenges or the objective skills level (Csikszentmihalyi, 2000). The presence of flow depends on perceptions of skills and challenge. With the same level of challenge, people can feel anxious, then bored, and in flow immediately afterward and thus, it is impossible to predict in which state people will be (Csikszentmihalyi, 2000).

People skilled at using the web and finding it challenging more likely search for and purchase online a wide range of products; hence, skills and challenges predict online consumers search and purchase behavior (Novak, Hoffman, & Yung, 2000). There is a positive relationship between the difference between skills and challenges and online search and purchase of computer-related products, but a negative one with search and purchase of non-computers related products in traditional media (Novak, Hoffman, & Yung, 2000). If skills are greater than challenge, search for entertainment online and purchase in retail stores will ensue. If challenges are greater than skills, search and purchase in traditional media will occur (Novak, Hoffman, & Yung, 2000). Challenges positively affect information search and perceived interactivity**.** They may create arousal and lead to more site activities (Jee & Lee, 2002).

## Interactivity

The Internet incorporates higher vividness and *interactivity* than traditional media (Coyle & Thorson, 2001). It is characterized by the following: interactivity, irrelevance of distance and time, low set-up costs, wide coverage, and ease of entry (Berthon, Pitt, & Watson, 1996). Among these, interactivity is a key advantage (Rafaeli & Sudweeks, 1997).

Classified as interactivity on the Internet are: clicking, providing feedback, or information search (Gallagher, Foster, & Parsons, 2001). Interactive sites give opportunities to engage customers in exchanges with the website or its sponsor. There are several interactive functions: online problem diagnostics, games, virtual reality displays, and user groups. Other interactive functions used in other media are: coupons, dealer locators, surveys, and contact information (Gallagher, Foster, & Parsons, 2001).

## Conceptualization of Interactivity

There is little agreement on how interactivity should be conceptualized (Heeter, 2000).

Initially, interactivity was considered as communication through a medium, and later defined as a property of the medium (Ha & James, 1998). Interactivity has been operationalized as a part of the communication process (Kirsch, 1997), a medium characteristic (Hoffman and Novak 1996), an individual trait (Chen, 1984), a psychological state (Newhagen, Corders, & Levy, 1995), and a variable characteristic of communication settings (Rafaeli, 1988).

## Definitions of Interactivity

Several definitions of interactivity are:

- The extent of sequencing of messages, especially whether later messages relate to earlier messages (Rafaeli & Sudweeks. 1997);
- The ability of users to modify in real time the form and the content of a mediated environment (Steuer, 1992);
- The ability of two or more communication parties to act on each other, on the communication medium, and on the messages and their degree of synchronization (Liu & Shrum, 2002).
- The surfers' perceptions that the site provides effective and personalized methods to search and retrieve information, and permits surfers to build the information to which they would be exposed (Luna, Peracchio, & de Juan, 2002).

## Dimensions of Interactivity

- Liu and Shrum (2002) propose *three* dimensions: (1) active control, as users' ability to voluntarily participate in and instrumentally influence a communication; (2) two-way communication, as the bi-directional flow of information; and (3) synchronicity, as the speed of the interaction. Active control is a voluntary and instrumental action that directly influences the surfer's experience; two-way communication is the ability for reciprocal communication between companies and users; and synchronicity is the degree to which users' input and the response they receive from the communication are simultaneous.
- Ha and James (1998) use interpersonal and mechanical perspectives. Their *five* dimensions of interactivity are: playfulness, choice, connectedness, information collection, and reciprocal communication. Applied to websites, an interactive site has good mapping, quick transitions between input and resulting actions, and several ways to manipulate its contents.

## Influences of Interactivity

Interactivity impacts *loyalty* for multiple reasons. For Alba et al. (1997), interactivity enables search to quickly locate a desired product, thereby replacing dependence on memory. Another is that interactivity increases the amount of information presented to consumers to help them choose desired products. Finally, the navigational process facilitated by interactivity increases freedom of choice and the level of surfer control (Hoffman & Novak, 1996).

Interactivity reflects the perception that the *information is relevant* to consumer needs (Fortin & Dholakia, 2000), leading to positive attitude formation (MacInnis & Jaworski, 1989). For Bucy (2003) interactivity gives sites their "stickiness," or continuing appeal beyond expected content. Sundar, Kalyanaraman and Brown (2003) show that interactivity helps in customization, i.e., surfers receive unique combinations of messages. They find strong correlations between perceived interactivity and perceived relevance of, and involvement with, information content, which predicts website attitudes.

Although interactivity and vividness are attributes of computer-mediated environments and not similar to involvement, site involvement hides effects due to increasing levels of vividness and interactivity. The more site attitudes are positive, the more interactive and vivid they are (Richard & Chandra, 2005). Others show that increased interactivity contributes to higher *site involvement* (Bucy, 2003) and more positive attitudes toward the portal (Sundar, Kalyanaraman, & Brown, 2003). Also, interactivity relates to *exploratory behavior*, and greater interactions between surfers and the web when their search for information leads to greater exploratory behavior.

There are *disagreements* regarding the influence of interactivity on purchase intentions and other behavioral changes. Some find it has a direct influence on purchase intention (Wu, 2000; Yoo & Stout, 2001), whereas for others interactivity influences decision making through perceived website quality (Ghose & Dou, 1998). Perceived interactivity has a direct impact on intentions to revisit a website and on consumer purchases from it (Luna, Peracchio, & de Juan, 2002).

## Emotions

Studies using emotions focus on emotional responses to ads, and the mediating role of emotions on satisfaction (Phillips & Baumgartner, 2002).

### Basic PAD Model

The basic model used in marketing is Mehrabian and Russell's (1974)*PAD* model, consisting of three dimensions: *arousal* relates to feelings of being stimulated, excited and aroused; *pleasure* relates to feelings of happiness, satisfaction or contentment; *dominance* relates to feelings of being in control, important and autonomous. It is useful for studying emotions in retail environments (Sherman, Mathur, & Smith, 1997) and capturing emotional components of consumption experiences (Havlena & Holbrook, 1986). By extension, it is useful for web navigation behavior. The role of dominance in approach-avoidance behavior remains unclear and has received little research attention. Foxall and Greenley (1999) find that *PAD* explains approach-avoidance behavior over several situations. Biggers and Rankis (1983) find more approach behavior toward situations with high dominance and more avoidance behavior toward situation with low dominance. This approach is capable of characterizing emotional responses in internet navigation (Mehrabian & Russell, 1974).

### Hierarchy of Emotions and Cognitions

In the past, researchers used "liking an advertisement" ($A_{ad}$) to measure affect and claimed a direct link between affect and cognition, that cognition precedes affect, or that affective reactions are mediated by cognition (Greenwald & Leavitt, 1984). Others suggest that cognition and affect are separate and distinct in persuasion (Petty et al., 1993).

### Two Schools of Thought Contribute to Understanding These Relationships

- The *emotion-cognition model* (Zajonc & Markus, 1982). In the servicescapes model, the emotional process begins when some message, object, or event triggers a cognitive appraisal resulting in evaluations mediated by beliefs and shaped by personal values (Bitner, 1992). Izard, Kagan, & Zajonc (1984) and Zajonc and Markus (1982) posit that emotions take place without antecedent cognitive processes, and can be generated by biological, sensory or cognitive events. Arousal and motor activities are hard representations of emotions. The cognitive experience is not part of the emotional process, and the experience of emotion is uniquely the cognition of having one. Izard, Kagan, & Zajonc (1984) do not deny that cognition is a sufficient condition to produce emotions, the question is whether it is a necessary cause.
- The *cognition-emotion model* (Lazarus, 1991) posits the role of cognition as a necessary but not sufficient condition to elicit emotions. External and internal cues are appraised in terms of one's own experience and goals. Appraisal of the significance of

the person-environment relationship is necessary and sufficient; without personal appraisal there is no emotion; with an appraisal an emotion is generated. Chebat and Michon (2003) find support for this hierarchy in studying the effects of ambient scent on emotions and cognitions.

### Empirical Evidence

In studies of website quality, few combine emotions and cognitions. There is a need to further understand the interplay and the hierarchy of cognitions and emotions in website navigation. Studies of emotions as mediator of responses to advertising show that cognition can drive affect (Edell & Burke, 1987), while others posit that affect can directly influence attitudes (Brown & Stayman, 1992) and that cognitive-based models fail to measure emotions associated with information sources (Edell & Burke, 1987). Support for the influence of affect has been found in studies of mood (Petty et al. 1993), judgment (Pham et al., 2001), susceptibility (Fabrigar & Petty, 1999), and those linking affect and behavioral prediction (Smith, Haugtvedt, & Petty, 1994). Advertising researchers struggle with two questions: what is more predictive of consumer response-thoughts or feelings? In the paradigm of cognitive, affective and conative attitudes do cognitions dominate and do they mediate the relationship between affect and conation? These issues have yet to be resolved (Morris et al., 2002) and the question of whether evaluation is preceded by low-level affective processes, low-level cognitive processes, or both represents a fertile area for research (Ajzen, 2001).

### Relationship between Arousal and Pleasure

Only two studies look at the relationship between arousal and pleasure. Kaltcheva and Weitz (2006) find that arousal mediates the relationship between retail physical environment and pleasure. Wang et al. (2007) also find a direct positive relationship between arousal and pleasure.

### Emotions and Site Attitudes

When consumers feel pleasure, it influences attitudes, and affective responses play an important role in perceptions (Isen, 1984). Affective conditioning theory predicts that a pleasant experience transfers to attitudes (Madden, Allen, & Twible, 1988). The applicability of classical conditioning to websites seems likely, as consumers transfer positive (or negative) feelings from interaction with the website to their attitudes toward it. In addition, because control is desirable, if consumers perceive the website as enhancing their control, their site attitude is more favorable (Peterman, Rohem, & Haugtvedt, 1999). Thus, when users experience high levels of pleasure and dominance, they have a more favorable site attitude.

## FUTURE RESEARCH DIRECTIONS

- Clarify the structure and operationalization of the flow experience.
- Clarify the structure and operationalization of site interactivity.
- Determine whether site evaluation is preceded by low-level affective processes, low-level cognitive processes, or both.

## CONCLUSION

Flow and emotions are two major inputs to the evaluations of websites. Their important role in the model has been explicated. The next chapter covers the other major input, i.e., web atmospherics.

## REFERENCES

Ajzen, I. (2001). Nature and operation of attitudes. *Annual Review of Psychology*, *52*(1), 27–58. doi:10.1146/annurev.psych.52.1.27

Alba, J., Lynch, J., Weitz, B., Janiszevski, C., Lutz, R., Sawyer, A., & Wood, S. (1997). Interactive home shopping: Consumer, retailer and manufacturer incentives to participate in electronic marketplaces. *Journal of Marketing*, *61*(July), 38–53. doi:10.2307/1251788

Anand, P., & Sternthal, B. (1990). Ease of message processing as a moderator of repetition effects in advertising. *JMR, Journal of Marketing Research*, *27*(August), 345–353. doi:10.2307/3172591

Berthon, P., Pitt, L., & Watson, R. T. (1996). The world wide web as an advertising medium: Toward an understanding of conversion efficiency. *Journal of Advertising Research*, *36*(Jan-Feb), 43–54.

Biggers, T., & Rankis, O. E. (1983). Dominance-submissiveness as an affective response to situations and as a predictor of approach-avoidance. *Social Behavior and Personality*, *11*(2), 61–69. doi:10.2224/sbp.1983.11.2.61

Bitner, M. J. (1992). Servicescapes: The impact of physical surroundings on customers and employees. *Journal of Marketing*, *56*(2), 57–71. doi:10.2307/1252042

Brown, S. P., & Stayman, D. M. (1992). Antecedents and consequences of attitudes toward the ad: A meta analysis. *The Journal of Consumer Research*, *19*(June), 4–51.

Bucy, E. P. (2003). The interactivity paradox: Closer to the news but confused. In E.P. Bucy & J.E. Newhagen (eds.), *Media access: Social and psychological dimensions of new technology use* (pp. 47-72). Mahwah, NJ: Erlbaum.

Chebat, J. C., & Michon, R. (2003). Impact of ambient odors on mall shoppers' emotions, cognition, and spending: A test of competitive causal theories. *Journal of Business Research*, *56*, 529–539. doi:10.1016/S0148-2963(01)00247-8

Chen, M. (1984). Computers in the lives of our children: Looking back on a generation of television research. In R. Rice, et al, (eds.), *The New Media: Communication, Research and Technology,* (pp. 269-286). Beverly Hills, CA: Sage.

Coyle, J. R., & Thorson, E. (2001). The effects of progressive levels of interactivity and vividness in web marketing sites. *Journal of Advertising*, *30*(3), 65–77.

Csikszentmihalyi, M. (2000). *Beyond boredom and anxiety: Experiencing flow in work and play*. San Francisco, CA: Jossey-Bass.

Edell, J. A., & Burke, M. C. (1984). The moderating effects of attitude toward an ad on ad effectiveness under different processing conditions. In T.C. Kinnear (ed.), *Advances in Consumer Research,* (pp. 644-649). Ann Arbor, MI: Association for Consumer Research.

Fabrigar, L. R., & Petty, R. E. (1999). The role of the affective and cognitive bases of attitudes in susceptibility to affective and cognitively based persuasion. *Personality and Social Psychology Bulletin*, *25*(3), 363–381. doi:10.1177/0146167299025003008

Fortin, D. R., & Dholakia, R. R. (2000). The impact of interactivity and vividness on involvement: An empirical test of the Hoffman-Novak model. *INFORMS Conference on Understanding consumer behavior on the Internet*.

Foxall, G. R., & Greenley, G. E. (1999). Consumers' emotional responses to service environments. *Journal of Business Research*, *46*, 149–158. doi:10.1016/S0148-2963(98)00018-6

Gallagher, K., Foster, K. D., & Parsons, J. (2001). The medium is not the message: Advertising effectiveness and content evaluation in print and on the web. *Journal of Advertising Research*, *41*(4), 57–70.

Ghani, J. A. (1991). Flow in human-computer interactions: Test of a model. In J. Carey (ed.), *Human factors in management information systems: An organizational perspective* 3. Norwood, NJ: Ablex.

Ghani, J. A., & Deshpande, S. P. (1994). Task characteristics and the experience of optimal flow in human-computer interaction. *The Journal of Psychology*, *128*(4), 381–391.

Ghose, S., & Dou, W. (1998). Interactive functions and their impacts on the appeal of Internet presence sites. *Journal of Advertising Research*, *38*(2), 29–43.

Greenwald, A. G., & Leavitt, C. (1984). Audience involvement in advertising: Four levels. *The Journal of Consumer Research*, *11*(June), 581–592. doi:10.1086/208994

Ha, L., & James, E. L. (1998). Interactivity reexamined: A baseline analysis of early business web sites. *Journal of Broadcasting & Electronic Media*, *42*(4), 457–469.

Havlena, W. J., & Holbrook, M. B. (1986). The varieties of consumption experience: Comparing two typologies of emotions in consumer behavior. *The Journal of Consumer Research*, *13*, 394–404. doi:10.1086/209078

Heeter, C. (2000). Interactivity in the context of designed experience. *Journal of Interactive Advertising, 1*(1). Retrieved from www.jiad.org/vo1/no1/heeter/index.html

Hoffman, D. L., & Novak, T. P. (1996). Marketing in hypermedia computer-mediated environments: Conceptual foundations. *Journal of Marketing*, *60*(3), 50–68. doi:10.2307/1251841

Isen, A. M. (1984). Toward understanding the role of affect in cognition. In R.S. Wyer & T.K. Srull (eds). *Handbook of Social Cognition*, 3 (pp. 179-236). Mahwah, NJ: Erlbaum

Izard, C. E., Kagan, J., & Zajonc, R. B. (1984). *Emotions, cognitions, and behaviour*. Cambridge, MA: Cambridge Press.

Jee, J., & Lee, W. N. (2002). Antecedents and consequences of perceived interactivity: An exploratory study. *Journal of Interactive Advertising*, *3*(1), 1–16.

Kaltcheva, V. D., & Weitz, B. A. (2006). When should a retailer create an exciting store environment? *Journal of Marketing*, *70*(January), 107–118. doi:10.1509/jmkg.2006.70.1.107

Kirsch, D. (1997). Interactivity and multimedia interfaces. *Instructional Science*, *25*, 79–96. doi:10.1023/A:1002915430871

Koufaris, M., Kambil, A., & Labarbera, P. A. (2001). Consumer behavior in Web-based commerce: An empirical study. *International Journal of Electronic Commerce*, *6*(2), 115–138.

Lazarus, R. S. (1991). *Emotion and adaptation*. New York: Oxford Press.

Liu, Y., & Shrum, L. J. (2002). What is interactivity and is it always such a good thing? Implications of definition, person, and situation for the influence of interactivity on advertising effectiveness. *Journal of Advertising*, *31*(4), 53–64.

Luna, D., Peracchio, L. A., & de Juan, M. D. (2002). Cross-cultural and cognitive aspects of website navigation. *Journal of the Academy of Marketing Science*, *30*(4), 397–410. doi:10.1177/009207002236913

MacInnis, D. J., & Jaworski, B. J. (1989). Information processing from advertisements: Toward an integrative framework. *Journal of Marketing*, *53*(Oct), 1–23. doi:10.2307/1251376

Madden, T. J., Allen, C. T., & Twible, J. L. (1988). Attitude toward the ad: An assessment of diverse measurement indices under different processing sets. *JMR, Journal of Marketing Research*, *25*(Aug), 242–252. doi:10.2307/3172527

Massimini, F., & Carli, M. (1988). The systematic assessment of flow in daily experience. In M. Csikszentmihalyi & I. Csikszentmihalyi, (eds.), *Optimal experience: Psychological studies of flow in consciousness* (pp. 288-306). New York: Cambridge.

Mehrabian, A., & Russell, J. A. (1974). The basic emotional impact of environments. *Perceptual and Motor Skills*, *38*, 283–301.

Morris, J. D., Woo, C., Geason, J., & Kim, J. (2002). The power of affect: Predicting intention. *Journal of Advertising Research*, *42*(3), 7–17.

Newhagen, J. E., Corders, J. W., & Levy, M. R. (1995). Audience scope and the perception of interactivity in viewer mail on the internet. *The Journal of Communication*, *45*(3), 164–175. doi:10.1111/j.1460-2466.1995.tb00748.x

Novak, T. P., Hoffman, D. L., & Yung, Y. F. (2000). Modeling the flow construct in online environments: A structural modeling approach. *Marketing Science*, *19*(1), 22–42. doi:10.1287/mksc.19.1.22.15184

Peterman, M. L., Rohem, H. A. J., & Haugtvedt, C. P. (1999). An exploratory attribution analysis of attitudes toward the WWW as a product information source. *Advances in Consumer Research. Association for Consumer Research (U. S.)*, *26*, 75–79.

Petty, R. E., Schumann, D. W., Richman, S. A., & Strathman, A. J. (1993). Positive mood and persuasion: Different roles for affect under high- and low-elaboration conditions. *Journal of Personality and Social Psychology*, *64*, 5–20. doi:10.1037/0022-3514.64.1.5

Pham, M., Cohen, J. B., Pracejus, J., & Hughes, G. (2001). Affect Monitoring and the Primacy of Feelings in Judgment. *The Journal of Consumer Research*, *28*(September), 167–188. doi:10.1086/322896

Phillips, D. M., & Baumgartner, H. (2002). The role of consumption emotions in the satisfaction response. *Journal of Consumer Psychology*, *12*(3), 243–252. doi:10.1207/S15327663JCP1203_06

Rafaeli, S. (1988). Interactivity from new media to communication. In R.P. Hawkins, J.M. Wiermann, & S. Pingree, (eds.), *Advancing communication science: Merging mass and interpersonal processes,* (pp. 110-134). Beverly Hills, CA: Sage.

Rafaeli, S., & Sudweeks, F. (1997). Networked interactivity. *Journal of Computer Mediated Communication*. Retrieved from www.207.201.161.120/jcmc/vol2/issue4/rafaeli.sudweeks.html

Richard, M. O. (2009). *Modeling the internet behavior of visitors by the study of cognitive variables and moderators*. Unpublished doctoral dissertation, HEC-Montreal, Canada.

Richard, M. O., & Chandra, R. (2005). A model of consumer web navigational behavior: Conceptual development and application. *Journal of Business Research*, *58*(8), 1019–1029. doi:10.1016/j.jbusres.2004.04.001

Sherman, E., Mathur, A., & Smith, R. B. (1997). Store environment and consumer purchase behavior: Mediating role of cognitions. *Psychology and Marketing*, *14*, 361–378. doi:10.1002/(SICI)1520-6793(199707)14:4<361::AID-MAR4>3.0.CO;2-7

Smith, S. M., Haugtvedt, C. P., & Petty, R. E. (1994). Attitudes and recycling: Does the measurement of affect enhance behavioral prediction? *Psychology and Marketing*, *11*(4), 359–374. doi:10.1002/mar.4220110405

Steuer, J. (1992). Defining virtual reality: Dimensions determining telepresence. *The Journal of Communication*, *42*(4), 73–93. doi:10.1111/j.1460-2466.1992.tb00812.x

Sundar, S. S., Kalyanaraman, S., & Brown, J. (2003). Explicating Web site interactivity: Impression formation effects in political campaign sites. *Communication Research*, *30*(1), 30–59. doi:10.1177/0093650202239025

Wang, L. C., Baker, J., Wagner, J. A., & Wakefield, K. (2007). Can a retail web site be social? *Journal of Marketing*, *71*(July), 143–157. doi:10.1509/jmkg.71.3.143

Wu, G. (2000). *The role of perceived interactivity in interactive ad processing*. Unpublished dissertation, Texas at Austin.

Yoo, C. Y., & Stout, P. A. (2001). Factors affecting users' interactivity with the web site and the consequences of users' interactivity. In C.R. Taylor (ed.), *Proceedings,* (pp. 53-61). Villanova, PA: American Academy of Advertising.

Zajonc, R. B., & Markus, H. (1982). Affective and Cognitive Factors in Preferences. *The Journal of Consumer Research*, *9*, 123–131. doi:10.1086/208905

## ADDITIONAL READING

Richard, M. O. (2005). Modeling the Impact of Internet Atmospherics on Surfer Behavior. *Journal of Business Research*, *58*(12), 1632–1642. doi:10.1016/j.jbusres.2004.07.009

## KEY TERMS AND DEFINITIONS

**Active Control:** ability to voluntarily participate in and instrumentally influence a communication.

**Arousal:** feelings of being stimulated, excited and aroused.

**Challenge:** opportunities for action on the Internet.

**Dominance:** feelings of being in control, important and autonomous.

**Flow:** state occurring during internet navigation which is intrinsically enjoyable, accompanied by loss of self-consciousness, self-reinforcing and leads to a sense of playfulness.

**Interactivity:** degree several communication parties act on each other, the communication medium, and the messages and their synchronization.

**Pleasure:** feelings of happiness, satisfaction or contentment.

**Skills:** capacity for action during the online navigation process.

**Synchronicity:** degree to which users' input and the response they receive from the communication are simultaneous.

**Two-Way Communication:** ability for reciprocal communication between companies and users.

# Chapter 63
# Internet Consumer Behavior: Web Atmospherics

**Marie-Odile Richard**
*University of Montreal, Canada*

**Michel Laroche**
*Concordia University, Canada*

## INTRODUCTION

This chapter develops the major components of web atmospherics (Richard, 2005). In retailing research, retail atmospherics (e.g., scents, color, design) are very important to the success of retailers. Similarly, Richard (2005) demonstrates that web atmospherics are important to the development of positive attitudes toward the website and the products it describes. In Figure 1, these are the shaded areas.

## BACKGROUND

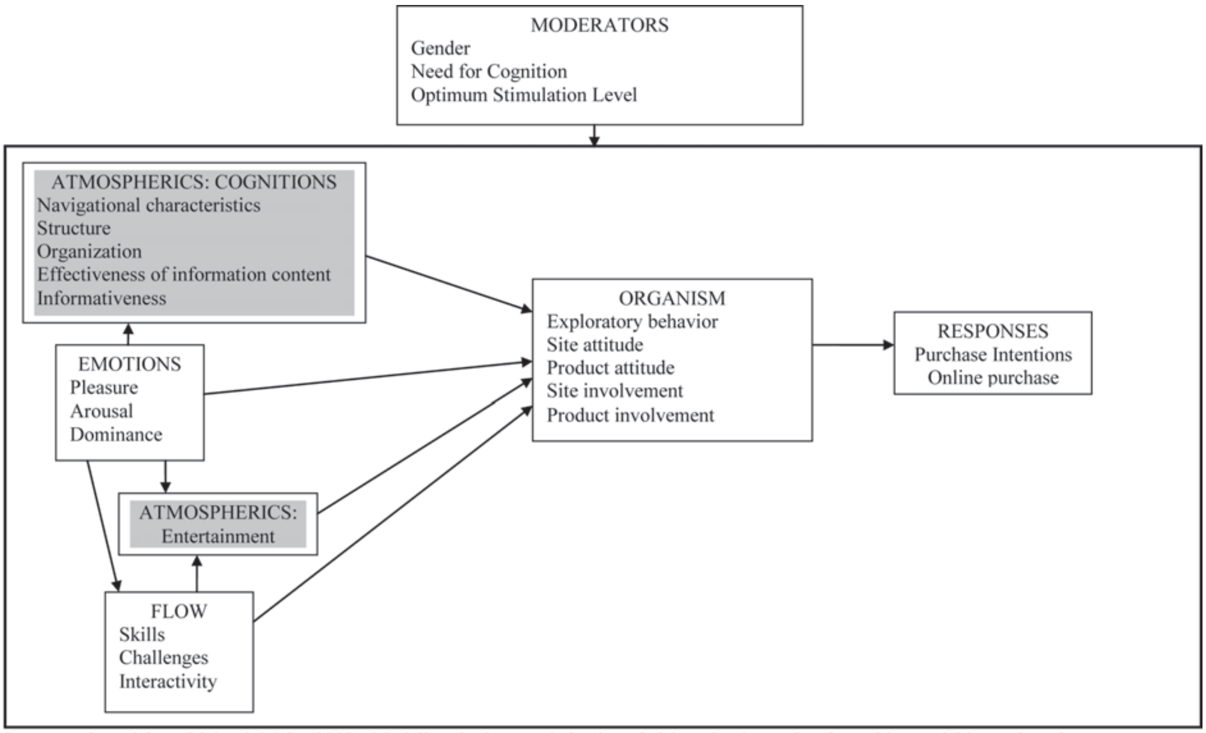
Web atmospherics are the conscious development of website environment to induce a positive response by visitors. These are critical to the effectiveness of a site since they determine consumer online browsing and purchase behavior. Six variables are part of web atmospherics: navigational characteristics, website structure, website organization, effectiveness of its content, website informativeness, and website entertainment.

### Navigational Characteristics

Characteristics of the products and websites encountered early in online browsing can influence the level of arousal and pleasure (emotions) that consumers experience, and thus can influence their shopping behavior. Two manipulations by Menon and Kahn (2002) show that if the starting experiences encountered by consumers in a simulated internet shopping trip are high in pleasure, then there is a positive influence on approach behavior (attitudes) and shoppers engage in more arousing activities such as more exploration and tendencies

DOI: 10.4018/978-1-61520-611-7.ch063

*Figure 1. Model of consumer navigation behavior: web atmospherics(Source: Adapted from Richard, M.O. (2009). Modeling the internet behavior of visitors by the study of cognitive variables and moderators, unpublished doctoral dissertation, HEC-Montreal Business School.)*




Source: Adapted from Richard, M.O. (2009). Modeling the internet behavior of visitors by the study of cognitive variables and moderators, unpublished doctoral dissertation, HEC-Montreal Business School.

to examine new products and stores (Menon & Kahn, 2002).

Lynch, Kent and Srinivasan (2001) identify three characteristics of a website (i.e., site quality, affect and trust) that affect purchase behavior. *Site quality* is represented by ease of use, provision of helpful graphics, usefulness of search engines, and completeness of information (Lynch, Kent, & Srinivasan, 2001). Online sellers believe that site quality influences surfers' probability of buying during the visit and returning to visit the website (Lynch, Kent, & Srinivasan, 2001). The impact of site quality on purchase intentions depends on the selected product category and the world region examined (Lynch, Kent, & Srinivasan, 2001).

## Wayfinding

In brick-and-mortar shops, physical maneuvering of a store's environment (i.e., social, visual and design factors) by consumers is called *wayfinding* (Passini, 1984). It is also possible to apply the wayfinding concept to the Internet, but the physical maneuvering process is replaced with maneuvering through scrolling and linking on the Web. Wayfinding on the web is labeled *navigation*. Hoffman and Novak (1996) define navigation as the process of self-directed movement through a computer-mediated environment. Navigational cues are important in brick-and-mortar stores as well as on the web. Text and icon links are cues that help consumers in navigation (Hoffman & Novak, 1996).

## High- and Low-Task Relevant Cues

There are two categories of cues: *high-task* relevant cues and *low-task*-relevant or design cues (Eroglu, Machleit, & Davis 2001). Among navigational cues, there are 'next', 'previous links', navigation bars, and site indexes with navigation bars. If surfers' navigational control is hindered by navigational cues, they may indirectly develop avoidance behavior (i.e., negative attitudes) toward the site, such as stopping exploratory site navigation, leaving the site, locating and browsing similar websites. The attitude-behavior literature suggests that attitudes lead to behavioral intentions and behavior (Eagly & Chaiken, 1993). If surfers experience negative attitudes toward a website, they likely develop negative behavior toward it.

Intentions to *revisit* websites, one of the variables explaining attitudes toward a website, are stimulated by good information on the website, frequent change and newness in its content, personalized services, and contests (Ellsworth & Ellsworth 1997). According to Chaffey et al. (2000), other determinants of customers' intentions to return to the website are high-quality content, ease of use, fast downloading, and frequent updating.

In the same vein, Ducoffe (1996) states that both informative elements (via the central route) and creative and entertaining elements (via the peripheral route) in Internet ads have positive effects on perceptions of the value of these ads. Both creative or entertaining and informative elements of a site affect attitudes towards the site, which affects behavioral intentions to revisit (Supphellen & Nysveen 2001).

## Evaluation of Websites

Sandvig and Bajwa (2004) analyze the qualitative evaluation of websites. Among most liked attributes are simple layouts, useful and well organized information, simple and comprehensive menus, ease in following menu options, ease in transitions between pages, ease in navigating (browse), good use of graphics and color, visually appealing, and user friendly. Among least liked attributes are outdated links, incomplete and outdated information, information overload on pages, inability to find needed information, cluttered and disorganized information, difficult search options, confusing menus, slow download-times, and small fonts.

## **Structure of the Website**

Store layouts, which improve consumer's wayfinding, are important to the success of retailers. This is also true with the Internet, as it is easy to leave a site in order to surf other competitive sites. Among all design elements of a store layout, signage is an important one. In an online retailing context, layout refers to the *structure* of a site.

The structure of websites influences online information search. Huizingh (2000) reports four navigational types of structure: a tree, a tree with a return-to-home page button, a tree with some horizontal links and an extensive network. Most websites have a simple structure: over 60% had a tree structure or a tree structure with a back to home page button. For Poruban (2002), a tree structure helps consumers to move and access information easily. Consumers must learn the navigational cues of the site. The easier it is to use, the more cognitive capacities are available to process information in this site, and goal achievement results in a higher product-brand recall, attitude toward the retailer, site attitude and/or product purchase intentions.

An efficient online site structure increases the motivation and ability of consumers to search for information (Celsi & Olson, 1988). Similarly, the more efficient and effective is the structure, the better is the ability to process product information, diminishing the cost of search, permitting a faster search, increasing the probability of success, and enhancing attitudes toward the website (Elliott & Speck, 2005). Thus, the consumer surfing the site more likely acquires the information needed to develop not only purchase intentions but also positive attitudes toward the retailers and the websites they developed (Griffith, 2005).

## Organization of the Website

Early in the adoption of the Internet by marketing researchers, the organization of the information in websites was not a major concern of website designers. Over time, they developed good website designs. Early on, they found that a great deal of information on a site may be interesting to visitors if they find the presentation of information logical and easy to understand.

*Organization* is defined as the ability of a website to arrange content, information, images, and graphics in order to increase the clarity of the information provided and to make it easier for visitors to find the information they need (Chen & Wells, 1999). Thus, a well-organized website is less complex, more user friendly, and increases the quality of a visitor's experience at the site, improving the effectiveness of the website.

Organization of a website is evaluated by elements such as effective arrangement of content, hyperlinks, and graphics, its e-comprehension, its readability, the chunking of its information and its complexity (Bauer, Grether, & Leach, 2002; Leong, Ewing, & Pitt, 2002). According to the Elaboration Likelihood Model (ELM), organization of a website is a high relevant cue inducing surfers to follow the central route, and for marketers to evaluate how well a website presents itself and for designers how it tour-guides its surfers. Poor organization is caused by too many links, layers or animations, leading surfers to develop lower site attitudes and involvement (Chen & Wells, 1999).

## Effectiveness of the Information Content of the Website

*Effectiveness of information content* is defined as the currency of the information content of a website and to the degree that the information on a website is convenient, accurate, up-to-date, complete and relevant to visitors (Richard 2005). Even though most studies show that perception of site content can be measured by its level of information and detailed and specific information levels on its products or other relevant topics, Dolakia and Rego (1998) find the information content of Web pages, per se, does not attract visitors. It may be that sometimes the information is not easy to find on a website. Online purchasers frequently complain that sites they would like to patronize have inadequate navigation and search engine capabilities. Thus, it is important to reduce irrelevant information, improve information organization and offer better information processing aids (Wolfinbarger & Gilly, 2001).

Information is important to consumers who use websites in a *goal-directed* fashion; the availability of information is one reason that many surfers view search and purchase on the Internet as a utilitarian activity (Wolfinbarger & Gilly, 2001). Product information includes the amount, accuracy, and form of information about products (i.e., goods and/or services) offered on a website. Since e-consumers cannot physically examine a product, they depend on information to identify, compare, and select products. Online information includes text, tables, graphs, photos, audio, and video. Better product information helps online shoppers make better decisions, feel more confident about their decisions, increase their satisfaction with the shopping experience, and improve their attitudes toward the site.

Several studies report a positive association between product information and attitude toward a website (Donthu, 2001; Kwon, Kim, & Lee, 2002). Product information increases attitude toward online shopping (Vijayasarathy & Jones, 2000), the amount of online shopping (Kwak, Fox, & Zinkhan, 2002), online spending (Korgaonkar & Wolin, 1999), and satisfaction with online purchases (Szymanski & Hise, 2000).

Johnson and Misic (1999) report that both the content and the site are evaluated for currency and presentation. Currency is important as it implies that all the information on a site is updated (Yang, Peterson, & Huang, 2001). Currency is more than updated data as it includes news, special promotions, and announcements of upcoming events, anything that refreshes the content or appearance of the website, with new page designs, photos and headlines (Elliott & Speck, 2005).

## Informativeness of the Website

Hoffman and Novak (1996) define *informativeness* as the ability of a website to make information available. It is viewed as static information available on a website. A site may be high on informativeness irrespective of manner of presentation. Concerns about information overload or formatting are not related to the ability of the website to provide useful information. Thus, informativeness is a perceptual construct, and it is not the same as the actual amount of information available on a website, even though it may be correlated with it.

Informativeness focuses on the site as an interactive provider. Intelligent, resourceful, and knowledgeable are adjectives often used (Maddox, 1999). Information often available in a website is product information and the perception of the site content may be measured by the degree it is considered to be informative (Huizingh, 2000). An informative site provides detailed specific information on products, the company or other relevant topics. It includes texts, tables, graphs, photos, audio and video. A website concentrates on functions such as information, transactions or entertainment. With better search engines/browsers, faster downloading, sites are becoming more advanced, with elements such as information on the company, products, non-commercial information; transactions; and entertainment (Huizingh, 2000).

Eighmey (1997) finds that effective websites have productive combinations of information and entertainment. Chen and Wells (1999) find that informativeness of a website is the second most important factor in explaining variance in attitudes toward the website. Lohse, Bellman and Johnson (2000) find that search for product information is the most important predictor of online purchases. Finally, for Chen, Clifford, and Wells (2002), informativeness is closely related to attitudes toward a website.

## Entertainment of the Website

Even though *entertainment* is viewed as a peripheral cue and may be an attractive source (Cho, 1999), it is important for visitors to determine whether or not the site is worth revisiting and it develops purchase intentions for the products it describes. For Katerattanakul (2002), many surf online just for information search or pure enjoyment. The effectiveness of a website depends on whether visitors feel that it is capable of attracting their attention by being fun, exciting, pleasurable, enjoyable, or entertaining (Bruner & Kumar, 2000; Chen & Wells, 1999). Uses of interesting themes, good graphics, or appealing designs contribute to a website being perceived as entertaining (Chakraborty, Lala, & Warren, 2002). Entertainment involves sensory and hedonic stimuli (e.g., color, music, action, and interactivity) that promote enjoyment while using a site.

Like brick-and mortar shoppers, e-shoppers prefer experiences that create positive feelings. Past research suggests that vividness, aesthetically pleasing elements, and engaging material are positively related to website attitudes (Coyle & Thorson, 2001; Kwon, Kim, & Lee, 2002; McMillan, Hwang, & Lee, 2003). Entertainment increases attitude toward online shopping (Vijayasarathy and Jones, 2000), intention to shop online (Lynch, Kent, & Srinivasan, 2001), and frequency of online purchases (Korgaonkar & Wolin 1999).

For McQuail (1983), the value of entertainment is in its ability to fulfill needs for escapism, diversion, aesthetic enjoyment or emotional release. People scoring web ads high in entertainment value develop favorable attitudes and high involvement with the information content of the site (De Pelsmacker, Dedock, & Gueuns, 1998).

For Ducoffe (1996), both 'informativeness' and 'entertainment' are important for evaluating an ad, and by extension a website. Surfers rating web ads high develop favorable site attitudes and involvement with information content. Entertainment developed during site visits is due to sensory and hedonic stimuli (e.g., color, music, action, pictures, graphs, videos, and interactivity). Chen and Wells (1999) find that those with greater perceptions of a site's entertainment value have more positive attitudes toward websites (McMillan, Hwang, & Lee 2003), and develop more positive attitudes toward the brand and stronger purchase intentions.

## FUTURE RESEARCH DIRECTIONS

The study of other forms of web atmospherics is needed such as the use of colors, different fonts, music, movement, illustrations, etc. Findings will help web designers provide more effective websites

## CONCLUSION

Understanding web atmospherics is important for firms who need effective websites to generate traffic and sales. The more important variables identified by research are effectiveness of information content, informativeness and entertainment.

## REFERENCES


Bauer, H. H., Grether, M., & Leach, M. (2002). Building customer relations over the Internet. *Industrial Marketing Management*, *31*(2), 155–163. doi:10.1016/S0019-8501(01)00186-9

Bruner, G. C. II, & Kumar, A. (2000). Web commercials and advertising hierarchy-of-effects. *Journal of Advertising Research*, *40*(1-2), 35–42.

Celsi, R. L., & Olson, J. C. (1988). The role of involvement in attention and in comprehension processes. *The Journal of Consumer Research*, *15*(2), 210–224. doi:10.1086/209158

Chaffey, D., & Mayer, R. Johnstone, K., & Ellis-Chadwick, F. (2000). *Internet marketing*. Harlow, UK: Pearson.

Chakraborty, G., Lala, V., & Warren, D. (2003). What do customers consider important in B2B websites? *Journal of Advertising Research*, *43*, 50–61.

Chen, Q., Clifford, S. J., & Wells, W. D. (2002). Attitude toward the site II: New information. *Journal of Advertising Research*, *42*(2), 33–45.

Chen, Q., & Wells, W. D. (1999). Attitude toward the site. *Journal of Advertising Research*, *39*(5), 27–37.

Cho, C. H. (1999). How advertising works on the world wide web: Modified elaboration likelihood model. *Journal of Current Issues and Research in Advertising*, *21*(1), 33–49.

Coyle, J. R., & Thorson, E. (2001). The effects of progressive levels of interactivity and vividness in web marketing sites. *Journal of Advertising*, *30*(3), 65–77.

De Pelsmacker, P., Dedock, B., & Geuens, M. (1998). A study of 100 likeable TV commercials: Advertising characteristics and the attitude towards the ad. *Marketing Research Today*, *27*(4), 166–179.

Dholakia, U. M., & Rego, L. L. (1998). What makes commercial web pages popular? *European Journal of Marketing*, *32*(7/8), 724–736. doi:10.1108/03090569810224119

Donthu, N. (2001). Does your website measure up? *Marketing Management*, *10*(4), 29–32.

Ducoffe, R. H. (1996). Advertising value and advertising on the web. *Journal of Advertising Research*, *36*(5), 21–35.

Eagly, A. H., & Chaiken, S. (1993). *The psychology of attitudes*. Fort Worth, TX: Harcourt Brace Jovanovich.

Eighmey, J. (1997). Profiling user responses to commercial web sites. *Journal of Advertising Research*, *37*(3), 59–66.

Elliott, M. T., & Speck, P. S. (2005). Factors that affect attitude toward a retail website. *Journal of Marketing Theory and Practice*, *13*(1), 40–51.

Ellsworth, J. H., & Ellsworth, M. V. (1997). *Marketing on the Internet.* New York: Wiley.

Eroglu, S. A., Machleit, K. A., & Davis, L. M. (2001). Atmospherics qualities of online retailing: A conceptual model and implications. *Journal of Business Research*, *54*(2), 177–184. doi:10.1016/S0148-2963(99)00087-9

Griffith, D. A. (2005). An examination of the influences of store layout in online retailing. *Journal of Business Research*, *58*(10), 1391–1396. doi:10.1016/j.jbusres.2002.08.001

Hoffman, D. L., & Novak, T. P. (1996). Marketing in hypermedia computer-mediated environments: Conceptual foundations. *Journal of Marketing*, *60*(3), 50–68. doi:10.2307/1251841

Huizingh, E. (2000). The content and design of websites: An empirical study. *Information & Management*, *7*, 123–134. doi:10.1016/S0378-7206(99)00044-0

Johnson, K. L., & Misic, M. M. (1999). Benchmarking: A tool for website evaluation and improvement. *Internet Research*, *9*(5), 383–392. doi:10.1108/10662249910297787

Katerattanakul, P. (2002). Framework of effective website design for business-to-consumer internet commerce. *INFOR*, *40*(1), 57–70.

Korgaonkar, P. K., & Wolin, L. D. (1999). A multivariate analysis of web usage. *Journal of Advertising Research*, *39*(2), 53–68.

Kwak, H., Fox, R. J., & Zinkhan, G. M. (2001). Factors influencing consumers' internet purchases: attitudes, internet experiences, demographics, and personality traits. In *Proceedings,* (pp. 106-107), Chicago, IL: American Marketing Association.

Kwon, O. B., Kim, C. R., & Lee, E. J. (2002). Impact of website information design factors on consumer ratings of web-based auction sites. *Behaviour & Information Technology*, *21*(6), 387–402. doi:10.1080/0144929021000050256

Leong, E. K. F., Ewing, M. T., & Pitt, L. F. (2002). E-comprehension: Evaluating B2B websites using readability formulae. *Industrial Marketing Management*, *31*(2), 125–131. doi:10.1016/S0019-8501(01)00184-5

Lohse, G. L., Bellman, S., & Johnson, E. J. (2000). Consumer buying behavior on the Internet: Findings from panel data. *Journal of Interactive Marketing*, *14*(1), 15–29. doi:10.1002/(SICI)1520-6653(200024)14:1<15::AID-DIR2>3.0.CO;2-C

Lynch, P. D., Kent, R. J., & Srinivasan, S. S. (2001). The global internet shopper: Evidence from shopping tasks in twelve countries. *Journal of Advertising Research*, *41*(3), 15–23.

Maddox, L. M. (1999). The use of pharmaceutical website for prescription drug information and product requests. *Journal of Product and Brand Management*, *8*(6), 488–496. doi:10.1108/10610429910299728

McMillan, S. J., Hwang, J. S., & Lee, G. (2003). Effects of structural and perceptual factors on attitude toward the website. *Journal of Advertising Research*, *43*(4), 400–409.

McQuail, D. (1993). *Mass communication theory: An introduction*. London: Sage.

Menon, S., & Kahn, B. (2002). Cross-category effects of induced arousal and pleasure on the internet shopping experience. *Journal of Retailing*, *78*(1), 31–40. doi:10.1016/S0022-4359(01)00064-1

Passini, R. E. (1984). Spatial representations: A way-finding perspective . *Journal of Environmental Psychology*, *4*(2), 153–164. doi:10.1016/S0272-4944(84)80031-6

Poruban, S. (2002). Effective use of the web. *Oil & Gas Journal*, *100*(12), 19.

Richard, M. O. (2005). Modeling the Impact of Internet Atmospherics on Surfer Behavior. *Journal of Business Research*, *58*(12), 1632–1642. doi:10.1016/j.jbusres.2004.07.009

Richard, M. O. (2009). *Modeling the internet behavior of visitors by the study of cognitive variables and moderators*. Unpublished doctoral dissertation, HEC-Montreal Business School.

Sandvig, J. C., & Bajwa, D. (2004). Information seeking on university web sites: An exploratory study. *Journal of Computer Information Systems*, *45*(1), 13–22.

Supphellen, J. S., & Nysveen, H. (2001). Drivers of intention to revisit the websites of well-known companies. *International Journal of Market Research*, *43*(3), 341–352.

Szymanski, D. M., & Hise, R. T. (2000). E-satisfaction: An initial examination. *Journal of Retailing*, *76*(3), 309–322. doi:10.1016/S0022-4359(00)00035-X

Vijayasarathy, L. R., & Jones, J. M. (2000). Print and internet catalog shopping: Assessing attitudes and intentions. *Internet Research*, *10*(3), 191–202. doi:10.1108/10662240010331948

Wolfinbarger, M., & Gilly, M. C. (2001). Shopping online for freedom, control and fun. *California Management Review*, *43*(2), 34–55.

Yang, Z., Peterson, R. T., & Huang, L. (2001). Taking the pulse of internet pharmacies. *Marketing Health Services*, *21*(2), 4–10.

## ADDITIONAL READING

Richard, M. O., & Chandra, R. (2005). A model of consumer web navigational behavior: conceptual development and application. *Journal of Business Research*, *58*(8), 1019–1029. doi:10.1016/j.jbusres.2004.04.001

## KEY TERMS AND DEFINITIONS

**Effectiveness of Information Content:** currency of the information content of a website and degree that the information is convenient, accurate, up-to-date, complete and relevant.

**Entertainment:** ability to attract attention by being fun, exciting, pleasurable, enjoyable, or entertaining

**Informativeness:** amount and richness of the information contained in a website.

**Navigation:** the process of self-directed movement through a computer-mediated environment.

**Organization:** ability of a website to arrange content, information, images, and graphics to increase the clarity of provided information and make it easier to find need information.

**Site Quality:** represented by ease of use, provision of helpful graphics, usefulness of search engines, and completeness of information.

**Structure:** the layout of a site such as a tree, a tree with a return-to-home page button, a tree with some horizontal links and an extensive network.

**Wayfinding:** physical maneuvering of a store's environment (i.e., social, visual and design factors)

**Web Atmospherics:** conscious development of website environment to induce a positive response.

# Chapter 64
# Internet Consumer Behavior:
## Behavioral Variables

**Marie-Odile Richard**
*University of Montreal, Canada*

**Michel Laroche**
*Concordia University, Canada*

## INTRODUCTION

In the previously, the authors covered the major stimulus variables, i.e., flow, emotions and web atmospherics, which impact the organism and response variables of the model. This chapter now covers some behavioral variables as indicated in the shaded areas of Figure 1.

## BACKGROUND

The key behavioral variables identified by the literature are: exploratory behavior, site attitude, product attitude, site involvement and product involvement. This chapter will define them and explain their roles in the model.

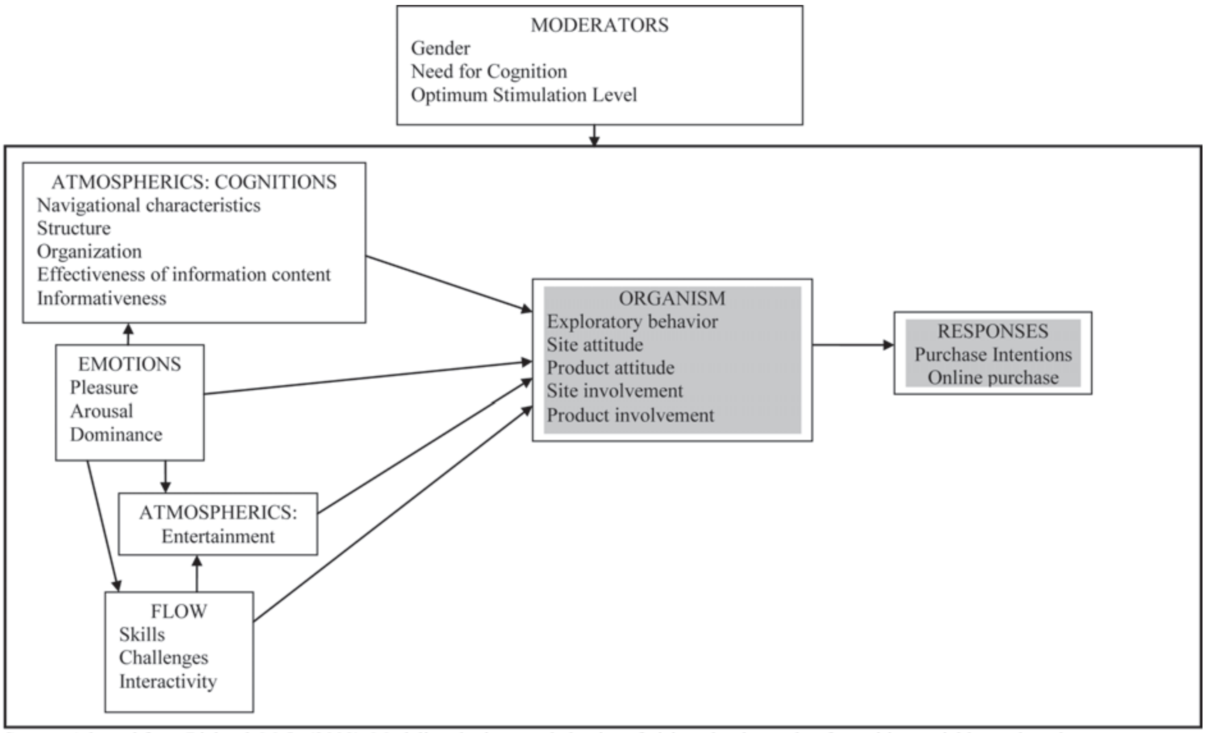
DOI: 10.4018/978-1-61520-611-7.ch064

### Exploratory Behavior

*Exploratory behavior* is defined as a behavior with the unique function of changing the stimulus field (Berlyne, 1963). Raju (1980) lists risk taking, innovativeness, brand switching, repetitive behavior proneness, information seeking, exploration through shopping and interpersonal communication as aspects of exploratory consumer behavior. There are several specific types of exploratory behavior: innovative behavior (Foxall, 1986), cognitive responses to ads (Faison, 1977), and curiosity-motivated search for product information (Hirschman, 1980).

Studies suggest a two-factor conceptualization of exploratory consumer buying behavior: exploratory acquisition of products and exploratory information seeking (Baumgartner & Steenkamp, 1996). Browsing, one form of exploratory behavior, is performed when surfers do not have knowledge of

*Figure 1. Model of consumer navigation behavior: behavioral variables (Source: Adapted from Richard, M.O. (2009). Modeling the internet behavior of visitors by the study of cognitive variables and moderators. Unpublished doctoral dissertation, HEC-Montreal Business School.)*




*Source*: Adapted from Richard, M.O. (2009). Modeling the internet behavior of visitors by the study of cognitive variables and moderators. Unpublished doctoral dissertation, HEC-Montreal Business School.

available information, are not sure whether their requirements can be met or how these requirements may be achieved. Browsing is either general or purposeful. *Purposive* browsing occurs when surfers have specific requirements, whereas general browsing is an opportunity for surfers to fine-tune the perceptions of their requirements or simply keep themselves up-to-date on the latest changes in a field or product type (Rowley, 2000).

Exploratory behavior by site visitors influences their site attitudes. The more they explore the possibilities offered by the site, the more they fine-tune their requirements and have a positive idea of the site they visit, triggering approach behavior.

## Site Attitudes and Product Attitudes

As there are few studies on site attitudes, the literature on ad attitudes can be used for websites. Ad attitude consists of feelings of favorability/unfavorability toward the ad and mediates the influence of brand attitudes on purchase intentions (Shimp, 1981). Laczniak and Muehling (1990) define ad attitude as the predisposition of individuals to answer favorably or not to an ad exposure; product/brand attitudes as the predisposition of individuals to answer favorably or not to a product or a brand.

### Findings from Ad Attitude Research

Ad attitude is unidimensional, purely affective without any cognitive or behavioral components

(MacKenzie & Lutz, 1989). For Gardner (1983), it is predominantly affective. Most authors perceive it as a situationally-bound construct. However, Shimp (1981) describes it as multidimensional, composed of a cognitive dimension (i.e., conscious responses to executional elements) and an affective (i.e., emotional responses without any conscious processing) dimension. He hypothesizes that these dimensions likely have an unequal impact on consumers. Zinkhan and Zinkhan (1985) position the cognitive dimension as high involvement (i.e., central processing), and the affective dimension as low involvement (i.e., peripheral processing).

Lutz (1975) defines five antecedents of attitudes toward the ad: *1)* ad credibility, *2)* ad perceptions, *3)* attitude toward the advertiser, *4)* attitudes toward advertising in general, and *5)* mood. According to the *Elaboration Likelihood Model* (ELM), attitude toward an object is based on central and peripheral processes (Petty et al., 1993). *Peripheral* processes use simple decision rules, conditioning processes, mere-exposure processes, and others not involving scrutiny of central merits of the object (Petty & Cacioppo, 1986). Many peripheral cues have a greater impact when motivation and/or ability to investigate the central merits of the products are low (Maheswaran, 1994). Motivation moderates the effect of peripheral cues by focusing on the central merits of the products, then decreasing the impact of peripheral cues (Haugtvedt & Petty, 1992). Even though ELM theory explains attitude change, neither the central nor the peripheral approaches alone account for the results (Petty, Cacioppo, & Schumann, 1983). According to dual process models of attitude change, when the motivation or the ability to investigate relevant information is lacking, one or more peripheral processes likely determine persuasion results.

### Application to Site Attitudes

Stevenson, Bruner, and Kumar (2000) show that site attitude is worth including in research on websites, their content, and the ads they include. Luna, Peracchio, and de Juan (2002) consider site attitudes as an antecedent of flow mediating three effects: two site characteristics (interactivity and challenges) and focused attention. Brown and Stayman (1992) find that attitudes toward the ad influence brand attitudes and purchase intentions. By analogy, attitudes toward the website is an indicator of site value. A website can be estimated according to three dimensions (entertainment, informativeness and organization) which relate to site attitudes (Chen, Clifford, & Wells, 2002). For Kwak, Fox, and Zinkhan (2002) online ad attitudes are not related to Internet purchase process and is weaker Internet involvement in explaining web buying in specific categories, whereas researchers measure attitude toward Internet ads in general.

### Effects on Product Attitudes

If websites reflect the characteristics of traditional ads, site attitudes lead to consequences identical to those found in attitude research (Jee & Lee, 2002). Flow mediates the effects of site attitudes on intentions to revisit and to purchase the product, but it is not needed to predict purchase intentions (Luna, Peracchio, & de Juan, 2002). Also, site attitudes have a positive and strong impact on ad attitudes, product/brand attitudes and purchase intentions (Bruner & Kumar 2000). Finally, it is important to evaluate attitudes toward the company behind the site, which may be related to site attitudes (Supphellen & Nysveen 2001).

## Product Involvement and Website Involvement

*Involvement* is important in audience processing of both traditional advertising (Petty & Cacioppo, 1986) and web advertising (Cho, 1999). Involvement is a motivational state influenced by perceptions of the object's relevance based on inherent needs, values and interests (Zaichkowsky, 1985). Its main antecedents are the characteristics of the person, the stimulus/object, and the situation. For Zaichkowsky (1985) involvement is unidimensional. Her PII scale consists of two groups of adjectives: the first one contains items as indicators of involvement (states), whereas the second is associated with the measure of attitudes. Both represent conceptually different constructs, but there is a caution that the involvement scale suffers from attitudinal contamination. On the other hand, for Laurent and Kapferer (1985) involvement is multifaceted: importance of the product and consequences of making a wrong choice, probability of making a wrong purchase, and symbolic and emotional values of the product.

## Two Types of Involvement

There are two types of involvement: enduring and situational involvement. *Enduring* involvement predicts behavior such as information search (Higie & Feick, 1989). There is enduring involvement for a product category when there are intrinsic rewards (Schmidt & Spreng, 1996). Enduring involvement directly predicts skills and challenges, two antecedents of flow (Novak, Hoffman, & Yung, 1998). *Situational* involvement links a product or a situation and outcomes or consequences of that situation (Schmidt & Spreng, 1996). It leads to an increase in attention and information processing because of the belief that these efforts produce favorable outcomes (Schmidt & Spreng, 1996). However, its role had not been explored as well as goal-directed and experiential navigation behaviors (Novak, Hoffman, & Yung, 1998). Based on involvement and search behavior, researchers differentiate flow states from these behaviors. Among the opposite characteristics are: extrinsic vs. intrinsic motivation, situational vs. enduring involvement, directed vs. non-directed research, goal-directed vs. navigational choice (Hoffman & Novak, 1996). In internet contexts, a distinction is made between product (enduring) involvement and website (situational) involvement.

## Goal-Directed and Experiential Search

There are motivations that are both *goal-directed* (i.e., to obtain information) and *experiential* (i.e., to be entertained). Goal-directed Internet use suggests an intentional selective manner, reflecting a deliberate exposure to specific content (Rubin & Perse, 1987). When users log on, they have a specific objective in mind. For example, an online session spent searching for information about a specific product suggests goal-directed motivation. In contrast, when people use the Internet for diversion, escape, and/or relaxation (i.e., experiential use), there is no specific outcome-oriented goal. The Internet is used primarily for the experience. The focus is more directed on the medium than on special content and focuses on the satisfactions offered by the medium itself (Perse & Greenberg-Dunn, 1998). However, as online surfers are active and involved, researchers look for factors influencing motivation. Eighmey (1997) studies perceptions of the use of commercial websites and finds that visitors liked information placed in an enjoyable milieu. Thus, both goal-directed and experiential gratifications can be obtained from the Internet.

MacInnis and Jaworski (1989) studies processing and evaluation of the information by the consumers' motivation, their ability and opportunity to process information. Information relevance (i.e., involvement) impacts both motivation to process information (MacInnis & Jaworski, 1989) and the way it is processed (Johnson & Eagly, 1990). Ability to process (i.e., skills and challenges) is related to the amount and type of knowledge acquired through experience. Opportunity to process depends on the facets of the immediate environment such as situational distractions (e.g., noise, crowding), information overload, information board (i.e., organized by brand or by attribute), and modality (i.e., print or broadcasting) (Celsi & Olson, 1988). However, with the Internet, there is some restriction on information processing ability due to inexperience, but not knowledge.

## Elaboration Likelihood Model (ELM)

For *ELM* involvement affects motivation to process information (Petty & Cacioppo, 1986). Does involvement affect motivation to process the content of a website and, if so, could it moderate the relationship between website factors and site attitude? According to ELM, high involvement individuals more likely access a product-specific site, explore product-specific information, and generate thoughts about products. If these product-related arguments are strong, involved shoppers more likely form positive attitudes toward these products. On the other hand, low involvement visitors less likely look for product-related information and likely attend to peripheral content. Entertainment elements are more peripheral than central, and entertainment should be more important for low involved visitors. Two studies find that involvement has a positive effect on site attitude (Coyle & Thorson, 2001; McMillan, Hwang, & Lee, 2003). Two others consider whether it has a moderating effect: one finds evidence that it does (Cho, 1999); the other that it does not (McMillan, Hwang, & Lee, 2003). Entertainment is also significant in explaining site attitude, especially for low involved surfers (Elliott & Speck, 2005). The differences between low and high involved visitors reflects a difference between peripheral and central processing. Peripheral processors (low involved surfers) are less purposeful, more easily attracted to extraneous design elements, and more satisfied by them. Currency is a determinant of site attitude, especially for high involved visitors. Those more interested in and familiar with a product category more likely appreciate new information about the category. Fogg et al. (2002) find that frequency of updates is strongly related to website credibility. This suggests that e-tailers must not merely update website information; they must signal it. Every time customers visit the site, they should find something new; otherwise they would have fewer reasons to return.

Highly-involved individuals search for information before purchase, process relevant information in depth, and use more criteria in their decisions than others (Leong, 1993). Internet-involved customers more likely purchase online than low-involved ones (Kwak, Fox, & Zinkhan, 2002). In general, visitors acquire high involvement levels related to overall Internet purchases and for most personal products (except for entertainment and music) (Kwak, Fox & Zinkhan, 2002). Balabanis and Reynolds (2001) posit that aspects related to the product attract the interest of highly-involved consumers, whereas low-involved ones focus more on the peripheral stimuli of the site or its design characteristics. The relationship between involvement and website attitudes is partially dependent on the characteristics of the site (Balabanis & Reynolds, 2001). Harvin (2000) indicates that consumers are more comfortable with strong off-line brands they already know and trust. For Yoo and Stout (2001), consumers with a high level of product involvement have more intentions to interact with a website, leading to more extensive search and more trials of interactive functions.

Involvement varies according to the optimum stimulation level of site visitors (covered in Chapter 4). Involved surfers are more prone to search for information when surfing the websites and in doing that, explore new stimuli and situations because of a higher need for environmental stimulation.

## Purchase Behavior

Online purchasing is the most rapidly growing form of shopping, with sales growth rates that surpass buying through traditional retailing. Forrester Research (2007) reports that in 2007 Internet sales to consumers amounted to $259 billion, an annual growth rate of 18% over 2006. This is increasingly recognized in the literature.

Among reasons cited for abortion of information search processes and shopping trials, researchers include: lack of enthusiasm to supply personal and credit card information, technical problems with websites, and problems in locating products. Consumer search experiences at retailers' websites are determinants of their online purchasing behaviors (Shim et al., 2001). More precisely, information search is the most important element leading to online purchases. If search intentions play a central role in predicting future purchasing intentions, search attitudes are a valuable tool for purchasing on the Web. Consequently, no-purchase decisions on the Web are consequence of unfavorable reactions to a site rather than a broader lack of interest in this channel (Shim et al., 2001). Search intentions mediate the relationships between purchase intentions and key antecedents of purchase intentions, chiefly when shopping online. Visitors' perceptions that the Internet's role in consumer information search is one of its most pronounced features indicates that information search online continues to progress as a major vehicle for comparison shopping (Dickson, 2000).

Intentions consist of motivational components of behavior and are characterized by the degree of efforts a person exerts to perform this behavior (Shim et al., 2001). Donovan and Rossiter (1982) demonstrate that store-induced pleasure and arousal are positively linked to willingness to buy. Arousal is due to the level of challenges. Pleasure in atmospherics is similar playfulness in the theory of the flow. Playfulness is an important indicator of flow and is predicted by the antecedents of skills (through control), challenges (through arousal), and focused attention during the interaction. It leads to consequences of flow such as positive effect, more exploratory behavior, and greater web use. Also, a short intense flow state can move consumers to buy in an expedient manner by providing feelings of pleasure of control that result from flow, while reducing deliberation time necessary before buying (Smith & Sivakumar, 2002).

Shim et al. (2001) show that intention to use the Internet to search for information for search goods is not only the strongest predictor of Internet purchase intentions but also mediates the relationships between purchase intentions and predictors such as attitudes toward online shopping, perceived control and online purchase experience. Sansgiry, Cady, and Sansgiry (2001) evaluate simulated over-the-counter (OTC) product labels for two product categories in random order and find that when consumers are involved in their purchases, they significantly more likely understand information from the label and evaluate it appropriately. However, involvement neither affects attitudes toward the product label nor enhances purchase intentions.

## FUTURE RESEARCH DIRECTIONS

- Identify additional behavioral variables.
- Further explore the nature and structure of site attitude and site involvement.
- Clarify the distinction between site attitudes, product attitudes, and brand attitudes in the same website.
- Develop new measures of website effectiveness.

## CONCLUSION

This chapter showed the important role of the key variables of site attitude and site involvement within the overall model of internet consumer behavior, and their relationship to product involvement, product attitudes and online purchase intentions.

## REFERENCES

Balabanis, G., & Reynolds, N. L. (2001). Consumer attitudes towards multi-channel retailers' web sites: The role of involvement, brand attitude, internet knowledge and visit duration. *The Journal of Business Strategy*, *18*(2), 105–131.

Baumgartner, H., & Steenkamp, J. B. E. M. (1996). Exploratory consumer behavior: Conceptualization and measurement. *International Journal of Research in Marketing*, *13*(2), 121–137. doi:10.1016/0167-8116(95)00037-2

Berlyne, D. E. (1963). Motivational problems raised by exploratory and epistemic behavior. In S. Koch (ed). *Psychology: A study of science,* (p. 284-364). New York: McGraw-Hill.

Brown, S. P., & Stayman, D. M. (1992). Antecedents and consequences of attitudes toward the ad: A meta analysis. *The Journal of Consumer Research*, *19*(June), 4–51.

Bruner, G. C. II, & Kumar, A. (2000). Web commercials and advertising hierarchy-of-effects. *Journal of Advertising Research*, *40*(1-2), 35–42.

Celsi, R. L., & Olson, J. C. (1988). The role of involvement in attention and in comprehension processes. *The Journal of Consumer Research*, *15*(2), 210–224. doi:10.1086/209158

Chen, Q., Clifford, S. J., & Wells, W. D. (2002). Attitude toward the site II: New information. *Journal of Advertising Research*, *42*(2), 33–45.

Cho, C. H. (1999). How advertising works on the world wide web: Modified elaboration likelihood model. *Journal of Current Issues and Research in Advertising*, *21*(1), 33–49.

Coyle, J. R., & Thorson, E. (2001). The effects of progressive levels of interactivity and vividness in web marketing sites. *Journal of Advertising*, *30*(3), 65–77.

Dickson, P. R. (2000). Understanding the trade winds: The global evolution of production, consumption and the internet. *The Journal of Consumer Research*, *27*(June), 115–122. doi:10.1086/314313

Donovan, R. J., & Rossiter, J. R. (1982). Store atmosphere: an environmental psychology approach. *Journal of Retailing*, *58*(1), 34–57.

Eighmey, J. (1997). Profiling user responses to commercial web sites. *Journal of Advertising Research*, *37*(3), 59–66.

Elliott, M. T., & Speck, P. S. (2005). Factors that affect attitude toward a retail website. *Journal of Marketing Theory and Practice*, *13*(1), 40–51.

Faison, E. W. J. (1977). The neglected variety drive: A useful concept for consumer behavior. *The Journal of Consumer Research*, *4*, 172–175. doi:10.1086/208693

Fogg, B. J., Soohoo, C., Danielsen, D., Marable, L., Stanford, J., & Tauber, E. (2002). How do people evaluate a web site's credibility? Results from a large study. *Consumer WebWatch*. Available at http://credibility.stanford.edu/mostcredible.html

Forrester Research. (2007). Retrieved from www.forrester.com/ER/Press/Release/0,1769,1145,00.html.

Foxall, G. R. (1986). Consumer innovativeness: Novelty seeking, creativity and cognitive style. In E.C. Hirschman & J.N. Sheth (eds). *Research in Consumer Behavior* 3 (pp. 79-113). Greenwich, CT: JAI.

Gardner, M. P. (1983). Advertising effects on attributes recalled and criteria used for brand evaluations. *The Journal of Consumer Research*, *10*(Dec), 310–318. doi:10.1086/208970

Harvin, R. (2000). In internet branding the offlines have it. *Brandweek*, *41*(4), 30–31.

Haugtvedt, C. P., & Petty, R. E. (1992). Personality and persuasion: Need for cognition moderates the persistence and resistance of attitude changes. *Journal of Personality and Social Psychology*, *63*, 308–319. doi:10.1037/0022-3514.63.2.308

Higie, R. A., & Feick, L. F. (1989). Enduring involvement: Conceptual and measurement issues. [Ann Arbor, MI: Association for Consumer Research.]. *Advances in Consumer Research. Association for Consumer Research (U. S.)*, *16*, 690–696.

Hirschman, E. C. (1980). Innovativeness, novelty seeking, and consumer creativity. *The Journal of Consumer Research*, *7*(Dec), 283–295. doi:10.1086/208816

Hoffman, D. L., & Novak, T. P. (1996). Marketing in hypermedia computer-mediated environments: Conceptual foundations. *Journal of Marketing*, *60*(3), 50. doi:10.2307/1251841

Jee, J., & Lee, W. N. (2002). Antecedents and consequences of perceived interactivity: An exploratory study. *Journal of Interactive Advertising*, *3*(1), 1–16.

Johnson, B. T., & Eagly, A. H. (1990). Involvement and persuasion: Types, traditions and the evidence. *Psychological Bulletin*, *107*, 375–384. doi:10.1037/0033-2909.107.3.375

Kwak, H., Fox, R. J., & Zinkhan, G. M. (2001). Factors influencing consumers' internet purchases: attitudes, internet experiences, demographics, and personality traits. In *Proceedings, 12* (pp. 106-107). Chicago: American Marketing Association.

Laczniak, R. N., & Muehling, D. D. (1990). Delay effects of advertising moderated by involvement. *Journal of Business Research*, *20*, 263–277. doi:10.1016/0148-2963(90)90017-8

Laurent, G., & Kapferer, J. N. (1985). Measuring consumer involvement profiles. *JMR, Journal of Marketing Research*, *22*(Feb), 41–53. doi:10.2307/3151549

Leong, S. M. (1993). Consumer decision making for common, repeat-purchase products: a dual replication. *Journal of Consumer Psychology*, *2*(2), 193–208. doi:10.1016/S1057-7408(08)80024-1

Luna, D., Peracchio, L. A., & de Juan, M. D. (2002). Cross-cultural and cognitive aspects of website navigation. *Journal of the Academy of Marketing Science*, *30*(4), 397–410. doi:10.1177/009207002236913

Lutz, R. J. (1975). Changing brand attitudes through modification of cognitive structure. *The Journal of Consumer Research*, *1*(4), 49–59. doi:10.1086/208607

MacInnis, D. J., & Jaworski, B. J. (1989). Information processing from advertisements: Toward an integrative framework. *Journal of Marketing*, *53*(Oct), 1–23. doi:10.2307/1251376

MacKenzie, S. B., & Lutz, R. J. (1989). An empirical examination of the structural antecedents of attitude toward the ad in an advertising pretesting context. *Journal of Marketing*, *53*(Apr), 48–65. doi:10.2307/1251413

Maheswaran, D. (1994). Country of origin as a stereotype: Consumer expertise and attribute strength on product evaluations. *The Journal of Consumer Research*, *21*, 354–365. doi:10.1086/209403

McMillan, S. J., Hwang, J. S., & Lee, G. (2003). Effects of structural and perceptual factors on attitude toward the website. *Journal of Advertising Research*, *43*(4), 400–409.

Novak, T. P., Hoffman, D. L., & Yung, Y. F. (2000). Modeling the flow construct in online environments: a structural modeling approach. *Marketing Science*, *19*(1), 22–42. doi:10.1287/mksc.19.1.22.15184

Perse, E., & Greenberg-Dunn, D. (1998). The utility of home computers and media use: Implications of multimedia and connectivity. *Journal of Broadcasting & Electronic Media*, *42*(4), 435.

Petty, R. E., & Cacioppo, J. T. (1986). *Communication and Persuasion: Central and Peripheral Routes to Attitudes Change*. New York: Springer-Verlag.

Petty, R. E., Cacioppo, J. T., & Schumann, D. (1983). Central and peripheral routes to advertising effectiveness: The moderating role of involvement. *The Journal of Consumer Research*, *10*(2), 135–146. doi:10.1086/208954

Petty, R. E., Schumann, D. W., Richman, S. A., & Strathman, A. J. (1993). Positive mood and persuasion: Different roles for affect under high- and low-elaboration conditions. *Journal of Personality and Social Psychology*, *64*, 5–20. doi:10.1037/0022-3514.64.1.5

Raju, P. S. (1980). Optimum stimulation level: It's relationship to personality, demographics and exploratory behavior. *The Journal of Consumer Research*, *7*(Dec), 272–282. doi:10.1086/208815

Richard, M. O. (2009). *Modeling the Internet Behavior of Visitors by the Study of Cognitive Variables and Moderators, unpublished doctoral dissertation*, HEC-Montreal Business School.

Rowley, J. (2000). Product search in e-shopping: A review and research propositions. *Journal of Consumer Marketing*, *17*(1), 20–35. doi:10.1108/07363760010309528

Rubin, A. M., & Perse, E. M. (1987). Audience activity and television news gratifications. *Communication Research*, *14*(1), 58–84. doi:10.1177/009365087014001004

Sansgiry, S. S., Cady, P. S., & Sansgiry, S. (2001). Consumer involvement: Effects on information processing from over-the-counter medication labels. *Health Marketing Quarterly*, *19*(1), 61–78. doi:10.1300/J026v19n01_05

Schmidt, J. B., & Spreng, R. A. (1996). A proposed model of external consumer information search. *Journal of the Academy of Marketing Science*, *24*(3), 246–256. doi:10.1177/0092070396243005

Shim, S., Eastlick, M. A., Lotz, S. L., & Warrington, P. (2001). An online prepurchase intentions model: The role of intention to search. *Journal of Retailing*, *77*(3), 397–416. doi:10.1016/S0022-4359(01)00051-3

Shimp, T. A. (1981). Attitude toward the ad as a mediator of consumer brand choice. *Journal of Advertising*, *10*(2), 9–15.

Smith, D. N., & Sivakumar, K. (2004). Flow and internet shopping behavior: A conceptual model and research propositions. *Journal of Business Research*, *57*(10), 1199–1208. doi:10.1016/S0148-2963(02)00330-2

Stevenson, J. S., Bruner, G. C. II, & Kumar, A. (2000). Web page background and viewer attitudes. *Journal of Advertising Research*, *40*(1/2), 29–34.

Supphellen, J. S., & Nysveen, H. (2001). Drivers of intention to revisit the websites of well-known companies. *International Journal of Market Research*, *43*(3), 341–352.

Yoo, C. Y., & Stout, P. A. (2001). Factors affecting users' interactivity with the web site and the consequences of users' interactivity. In C.R. Taylor (ed.), *Proceedings* (pp. 53-61). Villanova, PA: American Academy of Advertising.

Zaichkowsky, J. L. (1985). Measuring the involvement construct. *The Journal of Consumer Research*, *12*(4), 341–352. doi:10.1086/208520

Zinkhan, G. M., & Zinkhan, F. C. (1985). Response profile and choice behavior: An application to financial services advertising. *Journal of Advertising*, *14*(3), 39–66.

## ADDITIONAL READING

Richard, M. O. (2005). Modeling the Impact of Internet Atmospherics on Surfer Behavior. *Journal of Business Research*, *58*(12), 1632–1642. doi:10.1016/j.jbusres.2004.07.009

## KEY TERMS AND DEFINITIONS

**Enduring Involvement:** degree of interest in a product on an ongoing basis.

**Exploratory Behavior:** behavior with the sole function of changing the stimulus field.

**Involvement:** a motivational state influenced by perceptions of the object's relevance based on inherent needs, values and interests.

**Peripheral Cues:** Peripheral processes use simple decision rules, conditioning processes, mere-exposure processes, and others not involving scrutiny of central merits of the object.

**Product Attitude:** predisposition to answer favorably or not to a product in a consistent manner.

**Product Involvement:** degree of interest in a product on an ongoing basis.

**Site Attitude:** predisposition to answer favorably or not to a particular website in a consistent manner.

**Site Involvement:** degree of interest in a specific website.

**Situational Involvement:** degree of interest in a specific situation or occasion.

# Chapter 65
# Internet Consumer Behavior:
## Major Moderating Variables

**Marie-Odile Richard**
*University of Montreal, Canada*

**Michel Laroche**
*Concordia University, Canada*

## INTRODUCTION

This chapter concludes the model of internet consumer behavior by describing some key moderating variables such as gender, need for cognition (NFC) and optimum stimulation level (OSL)(Figure 1).

## BACKGROUND

The selection of each moderating variable (i.e., gender, NFC and OSL) is justified with appropriate background and its moderating effects on the model of Internet consumer behavior are explained.

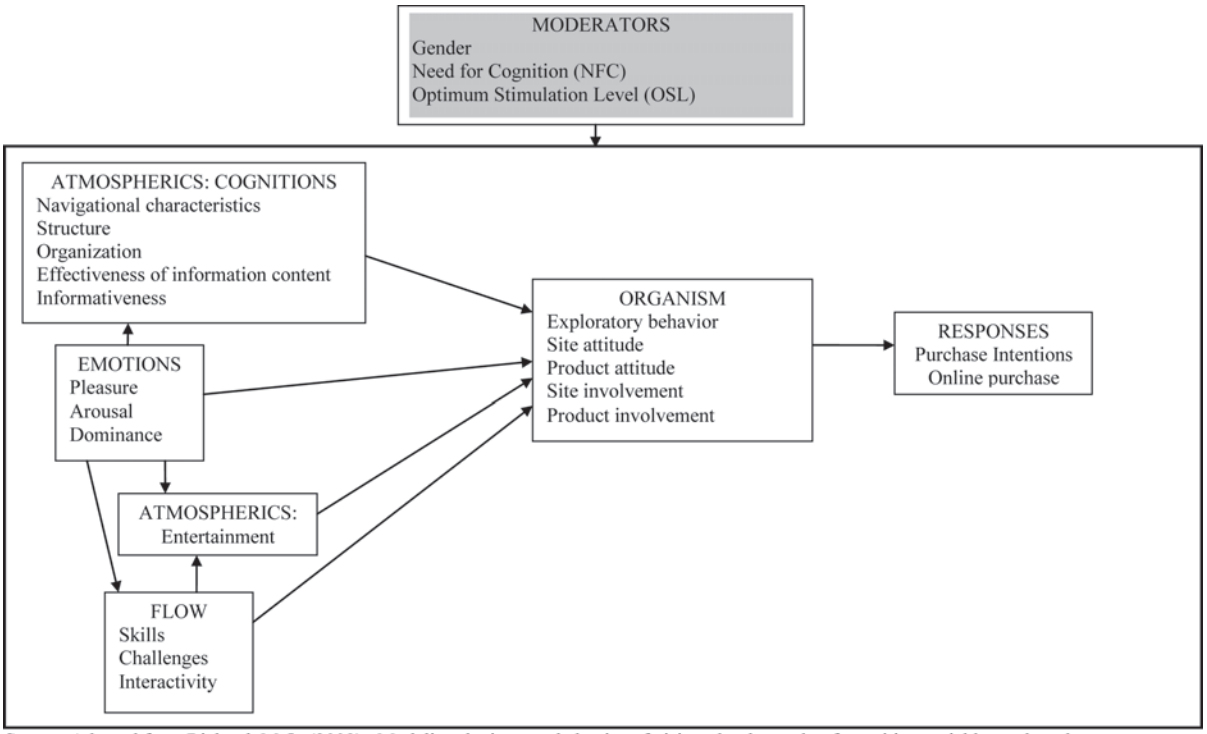
### Gender

As shopping online becomes more common, the number of women shopping online shows a corresponding increase although male consumers are considered to be early adopters of Internet shopping (Asch, 2001). By 2005, men and women are equally likely to be online, including 68% of men and 66% of women (Pew, 2005). There has been an increase of 3% for men versus 12% of women (2000-2005) for information search on products and services, and by 2005, 82% of men vs. 75% of women conducted searches on products.

Despite the growing importance of the Internet, little research has investigated web browsing behavior. Some investigated differences between males and females in their perceptions of web advertising (Schlosser, Shavitt, & Kanfer, 1999), use patterns (Weiser, 2000), and online privacy concerns (Sheehan, 1999). However, little is known about how Internet experience and web atmospherics impact navigational behavior and about the moderating effects of gender on the relationship between Internet experience and web atmospherics, on one hand, and browsing behavior, on the other.

DOI: 10.4018/978-1-61520-611-7.ch065

*Figure 1. Model of consumer navigation behavior: selected moderators (Source: Adapted from Richard, M.O. (2009). Modeling the internet behavior of visitors by the study of cognitive variables and moderators. Unpublished doctoral dissertation, HEC-Montreal Business School.)*




*Source*: Adapted from Richard, M.O. (2009). Modeling the internet behavior of visitors by the study of cognitive variables and moderators. Unpublished doctoral dissertation, HEC-Montreal Business School.

Males have more internet experience and higher skills than females, except with emailing; but over time, this gender gap in experience and skills has narrowed (Schumacher & Morahan-Martin, 2001). Since males engage in less detailed elaboration of commercial messages than females and less likely to engage in detailed and thorough examinations of messages which involve extended decisions based on product attributes (Putrevu, 2004), the effects of *both* skills and challenge on exploratory behavior are stronger for females compared to males. In addition, no gender differences are expected on the effect of challenge on attitude toward the website (Luna, Peracchio, & de Juan, 2002). Finally, since males buy more online than females (Rodgers & Harris, 2002), and are less likely to fully explore the website, their challenge is more focused on developing pre-purchase evaluations (Putrevu, 2004).

## Explanations from Psychology

According to the *selectivity hypothesis*, females are comprehensive processors, i.e., they give equal weight to self- and other-generated information; males are heuristic processors, i.e., they do not process all the information, but rather a subset of it, and are driven by overall message themes or schemas (Meyers-Levy & Maheswaran, 1991). An alternative explanation comes from Putrevu (2004): females are *relational* processors, i.e., they value category-based messages that focus on common themes; males are *item-specific* processors, i.e., they value attributes-based messages that bring out distinctive or unique features of the site. The difference between these theories is that the first one looks at the *depth* of processing, while the second at the *style* of processing. Thus, both predict that the more structured a site is, the more males find it easy to navigate, acquire specific information, find the experience enjoyable, and like the website more. Conversely, females are not affected by site structure and gather needed information pieces and decipher the interrelationships among them.

For Smith and Whitlark (2001) men and women have different needs and motivations in using the Internet: men use it for computer interest and hobbies, for personal productivity, and to connect with the world; women use it to make friends, nurture children, role play and for job productivity. For Wolin and Korgaonkar (2003), functional sites are designed for users to review, extract, and reference information, but are not designed for shopping. Moreover, in traditional markets, females spend more time shopping than men, enjoy it more, make more comparison shopping and bargain hunt (Wood, 1998). Since females more likely use websites for enjoyment and information gathering, effectiveness of information content has a stronger influence on both exploratory behavior and site involvement for females compared to males. Further, since women are more interested in information-rich sites processed in a relational way, while men consider only nonverbal reinforcements such as pictures, women react in a stronger exploratory fashion to increased site informativeness (Putrevu 2004).

Based on the *elaboration likelihood model* (Petty & Cacioppo, 1986), males use the peripheral route rather than the central route to persuasion, i.e., they focus more attention on peripheral cues, such as color, and behavior flows from entertainment. Women follow the central route by thoroughly analyzing site contents to find out what they want and search for, generate enjoyment in the 'online shopping experience', which stimulates *more* exploratory behavior (Putrevu, 2004). For Wolin and Korgaonkar (2003) males prefer functional sites, while women prefer shopping sites; but both groups like entertaining sites; thus, there is no gender difference on how entertainment affects both site involvement and site attitude.

Females have higher exploratory behavior when they visit a website compared to males, as they more likely engage in detailed elaboration of information content (Meyers-Levy & Maheswaran, 1991), browsing more to get all the information required, and understanding the interrelationships among them (Putrevu, 2004). Thus, women develop stronger site attitudes relative to their exploratory behavior. Since males do not process all information, but a selected subset of it, their relationship between exploratory behavior and site attitude is weaker than for females (Putrevu, 2004).

## Explanations from Neurology

Neuro-anatomical studies with technologies such as MRI (Magnetic Resonance Imaging) point to gender differences concerning verbal and visual-spatial abilities. Men perform better than women on visuo-spatial tasks, i.e., those requiring mental rotation of 3-D images (Weiss, Kemmler, & Deisenhammer, 2004). Mental rotation is a complex cognitive ability. As both genders show very high and similar levels of activation, differences in activation patterns are attributed to gender-specific strategies in solving the mental rotation task (Weiss, Kemmler, & Deisenhammer 2003). Men use a gestalt strategy (object rotation-recognition), whereas women use a more analytic-serial strategy. The former is reflected by activation in parietal areas, whereas the latter activates right frontal areas (Cabeza & Nyberg, 2000). Results suggest gender differences in the right temporal gyrus in mental rotation. Gender differences arise at different processing levels (including perception, encoding, and rotation-matching). Strong neural connections between the posterior parietal cortex and the hippocampus as well as the parahippocampal region suggest functional interactions during spatial-cognition tasks such as orienting, navigating and forming visuo-spatial memory traces (Seltzer & Pandya, 1994). Also, right prefrontal areas are activated by visuo-spatial working memory tasks and play a role in complex navigation (Salmon et al., 1996).

There is a link between these neurological findings and the browsing of consumers when they visit a site with few or many specific landmarks. During navigation, there is an activation of parahippocampal and an activity of right hippocampal areas related to the allocentric (i.e., world-centered representation of the environment) aspects of route finding (Grön et al., 2000). The hippocampus is activated for processing spatial arrangements to serve navigation per se, meanwhile the parahippocampus is involved in processing specific places and routes (Epstein et al., 1999). Concerning navigational performance between genders, for spatial cognition, women engage right parietal and right prefrontal areas whereas men activate the left hippocampal region (Grön et al., 2000). They process spatial information differently. These explanations suggest interesting avenues for research with the use of new mapping techniques.

## Need for Cognition (NFC)

NFC is conceptualized by Cohen, Stotland, and Wolfe (1955) as a need to understand and make reasonable the experiential world. NFC is defined as a stable individual difference in people's tendency to engage in and enjoy effortful cognitive activity. Low NFC is the relative absence of motivation for effortful cognitive activities that defines high NFC.

### Findings from Advertising Research

From findings in *advertising*, high NFC individuals process and evaluate information more thoroughly than low NFC individuals. High-NFC people are intrinsically motivated intellectually, tend to exhibit curiosity, and are tolerant of different ideas (Sadowski & Cogburn, 1997). High-NFC individuals enjoy thinking and doing complex tasks, less likely diminish their efforts on cognitive tasks in situations where reduction of efforts occurs (Cacioppo & Petty, 1989) and derive their attitudes based on the merits of the arguments presented (Haugtvedt & Petty, 1992). NFC operationalizes the motivational component of the ELM (Petty & Cacioppo, 1986): people high in NFC more likely think about and elaborate cognitive processes on relevant information when they are forming attitudes than people low in NFC. For, Haugtvedt and Petty (1992), even though attitudes and beliefs of high and low NFC people may seem identical after a persuasive communication, they differ in their persistence over time and resistance to counter-persuasion attempts. According to ELM, persuasion uses one of two routes, central or peripheral, to change attitudes. Individuals develop both the motivation and the ability to evaluate message arguments thoughtfully via the central route. However, by the peripheral route, customers lack the motivation or ability to "scrutinize" message arguments and use some heuristics or cues for their judgment (Petty & Cacioppo, 1986). Situational factors such as personal relevance influence the extent of message processing and the type of routes to persuasion (Petty & Cacioppo, 1986).

### NFC and the Internet Medium

NFC has an impact in the internet medium. High-NFC visitors engage in more search activities that lead to greater perceived interactivity. For Jee and Lee (2002), NFC is a predictor of perceived interactivity. Mantel and Kardes (1999) find that high-NFC people more likely search for a website before making a purchase decision compared to low-NFC ones. To find information, high-NFC visitors favor information-orientated media, with a verbal instead of a visual processing style (Heckler, Childers, & Houston, 1993). High-NFC individuals are more interested in the quality of verbal information, than in executional characteristics such as graphics (Cacioppo et al., 1986). Low-NFC individuals are more prone to the influence of symbolic cues, as they avoid elaborative processing. Thus, low-NFC individuals base their attitudes not on the actual informational content of the website, but on the attractiveness of the executional characteristics.

Compared to low-NFC visitors, high-NFC ones are more favorable toward a website that combines complex verbal with simple visual elements. Low-NFC visitors do not evaluate a website with high visual and low verbal complexity more favorably than high-NFC ones, suggesting that high-NFC visitors find this condition equally persuasive. From a resource-matching perspective, less relevant peripheral visual cues influence high NFC evaluations. Specifically, cognitive resources available to high-NFC visitors for website processing are greater than those needed to process the verbal information (Peracchio & Meyers-Levy, 1997). Although they are predisposed toward verbal information (Cacioppo & Petty, 1989), high NFC people utilize visual stimuli as central cues to help in their evaluations, instead of disregarding them in favor of verbal information (Meyers-Levy & Peracchio 1995). However, in low complexity sites, low NFC visitors express more positive attitudes than high NFC ones.

The extent to which visitors are motivated to think about information when they are exposed to persuasive situations, including advertisements or websites, influences the formation of attitudes (Haugtvedt & Petty, 1992), is important to understand the information provided on the internet (Macias, 2003; Shon, Chen, & Chang, 2003) and it influences how advertising information is evaluated (Mantel and Kardes, 1999; Zhang & Buda, 1999).

### Dual Mediation versus Affect Transfer Models

Sicilia, Ruiz, and Manuera (2005) study how levels of NFC affect the relationship between site attitudes and brand attitudes. They find that greater cognitive demands allow high-NFC visitors to make an informed decision, and the higher the NFC, the greater the access to product information and the motivation to think about it (Putrevu & Lord, 2003). Thus, thinking about the brand motivated visitors to spend time and effort for processing information, and that thinking is influenced by their evaluation of the website. This suggests the *dual mediation model*. However, low-NFC visitors, less motivated to think, adopt a simple approach in their evaluations (Tuten & Bosnjak, 2001). They find it less necessary to think about product information provided on the website, and more likely use the characteristics of the website to form their product attitudes (Chatterjee, Heath, & Mishra, 2002). Their opinion towards the website is directly transferred to the product. With visitors motivated to think about the information and who interact with the website (i.e., high NFC), the model that best explains the relationship is the dual mediation model. This suggests attitude formation via the central route, with firmly held opinions. In contrast, with low NFC surfers, site attitude directly influences brand attitudes through the peripheral route. This process of attitude formation is the *affect transfer model*. The difference in how the two groups form attitudes means that those in the low NFC group hold their opinions less firmly than those in the high NFC group.

## Optimum Stimulation Level (OSL)

OSL refers to the amount of stimulation people prefer in life (McReynolds, 1971). For Mehrabian and Russell (1974), preference for an environment is linked to preferred arousal level: some prefer quiet settings, whereas others actively search to increase arousal levels by selecting novel, complex, or unpredictable settings.

### Findings from Psychology

High OSL people explore more new stimuli and situations, while low OSL people are more comfortable with familiar situations and stimuli and avoid new or unusual situations or stimuli (Raju, 1980). OSL determines the degree of exploratory tendencies across many situations (Raju, 1980). Researchers suggest a link between OSL and exploratory tendencies (Steenkamp & Baumgartner, 1992). For Mittelstaedt et al. (1976) OSL is correlated with various exploratory tendencies, such as seeking information out of curiosity. Exploratory tendencies are categorized as curiosity-motivated behaviors, variety seeking, and risk taking (Raju, 1980). Even if there are studies done on that subject, some gaps remain in understanding the relationship between OSL and exploratory consumer behavior (Steenkamp & Baumgartner, 1992).

As Raju (1980) suggests, exploratory behavior (EXPB) and OSL are useful in studying individual differences. Links exist between personality traits, OSL and consumer exploratory behavior. Specifically, relationships exist between OSL and personality traits and between OSL and EXPB (Raju, 1980). Unfortunately, there is scant research on the relationship between OSL and personality traits, as the only personality traits studied are intolerance for ambiguity, rigidity, and dogmatism. Thus, it is difficult to generalize this relationship. OSL mediates the relationship between personality traits and EXPB. However, no data are collected on personality, OSL and EXPB simultaneously. Apparent links may be present between personality traits including OSL and consumer EXPB.

### OSL and the Internet Medium

High OSL people more likely possess autotelic personality traits and develop flow; low OSL ones more likely experience anxiety in their interactions with computer-mediated environments: there is no link between OSL and playfulness, but OSL leads to a greater exploratory behavior on the web (Hoffman & Novak, 1996).

OSL is related to curiosity-motivated behavior, variety seeking, and risk taking. Study of curiosity-motivated behavior has not looked at consumer reactions to specific stimuli (specific curiosity). Acquisition of information to purchase a product and information seeking out of curiosity (exploratory behavior) are two motives that lead to information seeking behavior (Steenkamp & Baumgartner, 1992). High OSL people search for more information than low OSL ones when information acquisition is motivated by curiosity. There is no reason to assume that OSL has an effect on purposeful information search behavior, but is only weakly related to information seeking (Raju, 1980; Steenkamp & Baumgartner, 1992). High OSL people generate more cognitive responses while they are visiting a site than low OSL ones. However, it is difficult to separate true exploratory information seeking from a goal-directed one.

OSL is related to exploratory purchase behavior. Precisely, OSL is an antecedent of exploratory purchasing behavior tendencies (Baumgartner & Steenkamp 1996). High levels of OSL decrease the persistence of the same purchase response over time. OSL is positively related to tendency to buy new products and brands (Venkatraman & Price 1990).

## FUTURE RESEARCH DIRECTIONS

- Use of medical imaging technology to study gender differences in website navigation.
- Conduct more research on the role of OSL in website navigation

- Identify other important moderators, such as culture or the nature of websites.
- Develop a typology of website visitors based on individual variables.

## CONCLUSION

This chapter explains the role of important moderators such as gender, NFC and OSL and their impacts on the model of internet consumer behavior. Better understanding of the effects of these moderators will lead to more effective use of websites by online companies.

## REFERENCES

Asch, D. (2001). Competing in the new economy. *European Business Journal*, *13*(3), 119–126.

Baumgartner, H., & Steenkamp, J. B. E. M. (1996). Exploratory consumer behavior: Conceptualization and measurement. *International Journal of Research in Marketing*, *13*(2), 121–137. doi:10.1016/0167-8116(95)00037-2

Cabeza, R., & Nyberg, L. (2000). Imaging cognition II: An empirical review of 275 PET and f-MRI studies. *Journal of Cognitive Neuroscience*, *12*, 1–47. doi:10.1162/08989290051137585

Cacioppo, J. T., & Petty, R. E. (1989). Effects of message repetition on argument processing, recall, and persuasion. *Basic and Applied Social Psychology*, *10*, 3–12. doi:10.1207/s15324834basp1001_2

Cacioppo, J. T., Petty, R. E., Kao, C. F., & Rodriguez, R. (1986). Central and peripheral routes to persuasion: An individual difference perspective. *Journal of Personality and Social Psychology*, *51*, 1032–1043. doi:10.1037/0022-3514.51.5.1032

Chatterjee, S., Heath, T. B., & Mishra, D. B. (2002). Communicating quality through signals and substantive messages: The effects of supporting information and need for cognition. In S.M. Broniarczyk & K. Nakamoto (eds.), *Advances in Consumer Research,* (Vol. 29, pp. 228-229). Valdosta, GA: Association for Consumer Research.

Cohen, A., Stotland, E., & Wolfe, D. (1955). An experimental investigation of need for cognition. *Journal of Abnormal and Social Psychology*, *51*, 291–294. doi:10.1037/h0042761

Epstein, R., Harris, A., Stanley, D., & Kanwisher, N. (1999). The parahippocampal place area: Recognition, navigation or encoding? *Neuron*, *23*, 115–125. doi:10.1016/S0896-6273(00)80758-8

Grön, G., Wunderlich, A. P., Spitzer, M., Tomczak, R., & Riepe, M. W. (2000). Brain activation during human navigation: Gender-different neural networks as substrate of performance. *Nature Neuroscience*, *3*, 404–408. doi:10.1038/73980

Haugtvedt, C. P., & Petty, R. E. (1992). Personality and persuasion: Need for cognition moderates the persistence and resistance of attitude changes. *Journal of Personality and Social Psychology*, *63*, 308–319. doi:10.1037/0022-3514.63.2.308

Heckler, S. E., Childers, T. L., & Houston, M. J. (1993). On the construct validity of the SOP scale. *Journal of Mental Imagery*, *17*(3&4), 119–132.

Hoffman, D. L., & Novak, T. P. (1996). Marketing in hypermedia computer-mediated environments: Conceptual foundations. *Journal of Marketing*, *60*(3), 50. doi:10.2307/1251841

Jee, J., & Lee, W. N. (2002). Antecedents and consequences of perceived interactivity: An exploratory study. *Journal of Interactive Advertising*, *3*(1), 1–16.

Luna, D., Peracchio, L. A., & de Juan, M. D. (2002). Cross-cultural and cognitive aspects of web site navigation. *Journal of the Academy of Marketing Science*, *30*(4), 397–410. doi:10.1177/009207002236913

Macias, W. (2003). A preliminary structural equation model of comprehension and persuasion of interactive advertising brand web sites. *Journal of Interactive Advertising*, *3*(2).

Mantel, S. P., & Kardes, F. R. (1999). The role of direction of comparison, attribute-based processing, and attitude-based processing in consumer preference. *The Journal of Consumer Research*, *25*(4), 335–352. doi:10.1086/209543

McReynolds, P. (1971). The nature and assessment of intrinsic motivation. In P. McReynolds (ed). *Advances in Psychological Assessment,* (Vol. 2, pp. 157-177). Palo Alto, CA: Science and Behavior.

Mehrabian, A., & Russell, J. A. (1974). The basic emotional impact of environments. *Perceptual and Motor Skills*, *38*, 283–301.

Meyers-Levy, J., & Maheswaran, D. (1991). Exploring differences in males' and females' processing strategies. *The Journal of Consumer Research*, *18*(1), 63–70. doi:10.1086/209241

Meyers-Levy, J., & Peracchio, L. A. (1995). Understanding the effects of color: How the correspondence between available and required resources affects attitudes. *The Journal of Consumer Research*, *22*(2), 121–138. doi:10.1086/209440

Mittelstaedt, R. A., Grossbart, S. L., Curtis, W. W., & Deverre, S. P. (1976). Optimum stimulation level and the adoption decision process. *The Journal of Consumer Research*, *3*(3), 84–94. doi:10.1086/208655

Peracchio, L. A., & Meyers-Levy, J. (1997). Evaluating persuasion-enhancing techniques from a resource-matching perspective. *The Journal of Consumer Research*, *24*(3), 178–191. doi:10.1086/209503

Petty, R. E., & Cacioppo, J. T. (1986). *Communication and persuasion: Central and peripheral routes to attitudes change*. New York: Springer-Verlag.

Pew. (2005, December 28). *Internet and American Life Project Survey: How women and men use the internet.*

Putrevu, S. (2004). Communicating with the sexes: Male and female responses to print advertising. *Journal of Advertising*, *33*(3), 51–62.

Putrevu, S., & Lord, K. R. (2003). Processing internet communications: A motivation, opportunity and ability framework. *Journal of Current Issues and Research in Advertising*, *25*, 45–59.

Raju, P. S. (1980). Optimum stimulation level: It's relationship to personality, demographics and exploratory behavior. *The Journal of Consumer Research*, *7*(4), 272–282. doi:10.1086/208815

Richard, M. O. (2009). *Modeling the internet behavior of visitors by the study of cognitive variables and moderators*. Unpublished doctoral dissertation, HEC-Montreal Business School.

Rodgers, S., & Harris, M. A. (2003). Gender and e-commerce: An exploratory study. *Journal of Advertising Research*, *43*(3), 322–329.

Sadowski, C. J., & Cogburn, H. E. (1997). Need for cognition in the big five factor structure. *The Journal of Psychology*, *131*(3), 307–312. doi:10.1080/00223989709603517

Salmon, E., Van der Linden, M., Collette, F., & Delfiore, G. (1996). Regional brain activity during working memory tasks. *Brain*, *119*, 1617–1625. doi:10.1093/brain/119.5.1617

Schlosser, A. E., Shavitt, S., & Kanfer, A. (1999). Survey of internet users' attitudes toward internet advertising. *Journal of Interactive Marketing*, *13*(3), 34–54. doi:10.1002/(SICI)1520-6653(199922)13:3<34::AID-DIR3>3.0.CO;2-R

Schumacher, P., & Morahan-Martin, J. (2001). Gender, internet and computer attitudes and experiences. *Computers in Human Behavior*, *17*(January), 95–110. doi:10.1016/S0747-5632(00)00032-7

Seltzer, B., & Pandya, D. N. (1994). Further observations on parieto-temporal connections in the rhesus monkey. *Experimental Brain Research*, *55*, 301–312.

Sheehan, K. B. (1999). An investigation of gender differences in online privacy concerns and resultant behaviors. *Journal of Interactive Marketing*, *13*(4), 24–38. doi:10.1002/(SICI)1520-6653(199923)13:4<24::AID-DIR3>3.0.CO;2-O

Shon, Z. Y., Chen, F. Y., & Chang, Y. H. (2003). Airline e-commerce: The revolution in ticketing channels. *Journal of Air Transport Management*, *9*(5), 325–331. doi:10.1016/S0969-6997(03)00040-1

Sicilia, M., Ruiz, S., & Munuera, J. L. (2005). Effects of interactivity in a web site. *Journal of Advertising*, *34*(3), 31–45.

Smith, S. M., & Whitlark, D. B. (2001). Men and women online: What makes them click? *Marketing Research*, *13*(2), 20–25.

Steenkamp, J. B. E. M., & Baumgartner, H. (1992). The role of optimum stimulation level in exploratory consumer behavior. *The Journal of Consumer Research*, *19*(3), 434–448. doi:10.1086/209313

Tuten, T. L., & Bisnjak, M. (2001). Understanding differences in web usage: The role of need for cognition and the five factor model of personality. *Social Behavior and Personality*, *29*(4), 391–398. doi:10.2224/sbp.2001.29.4.391

Venkatraman, M. P., & Price, L. (1990). Differentiating between cognitive and sensory innovativeness. *Journal of Business Research*, *20*(4), 293–315. doi:10.1016/0148-2963(90)90008-2

Weiser, E. B. (2000). Gender differences in internet use patterns and internet application preferences: A two-sample comparison. *Cyberpsychology & Behavior*, *3*(2), 167–178. doi:10.1089/109493100316012

Weiss, E., Kemmler, G., & Deisenhammer, E. A. (2004). Sex differences in cognitive functions. *Personality and Individual Differences*, *35*(4), 863–875. doi:10.1016/S0191-8869(02)00288-X

Wolin, L. D., & Korgaonkar, P. (2003). Web advertising: Gender, differences in beliefs, attitudes and behavior. *Internet Research*, *13*(5), 375–385. doi:10.1108/10662240310501658

Wood, M. (1998). Socio-economic status, delay of gratification, and impulse buying. *Journal of Economic Psychology*, *19*(3), 295–320. doi:10.1016/S0167-4870(98)00009-9

Zhang, Y., & Buda, R. (1999). Moderating effects of need for cognition on responses to positively versus negatively framed advertising messages. *Journal of Advertising*, *28*(2), 1–15.

## ADDITIONAL READING

Richard, M.O., Chebat, J.C., Yang, Z., & Putrevu, S. (in press, 2010). A proposed model of online consumer behavior: assessing the role of gender. *Journal of Business Research.*

## KEY TERMS AND DEFINITIONS

**Affect Transfer Model:** process of attitude formation where site attitude directly influences brand attitudes through the peripheral route.

**Dual Mediation Model:** process of process of attitude formation via the central route; thinking about the brand motivates efforts for processing information, and is influenced by evaluation of the website.

**Need for Cognition (NFC):** stable individual difference in people's tendency to engage in and enjoy effortful cognitive activity.

**Optimum Stimulation Level (OSL):** amount of stimulation people prefer in life.

**Relational Hypothesis:** a theory whereby females are described as relational processors and males as males are item-specific processors. It relates to the style of processing.

**Selectivity Hypothesis:** a theory whereby females are described as comprehensive processors and males as heuristic processors. It relates to the depth of processing.

# Chapter 66
# Consumer Information Sharing

**Jonathan Foster**
*University of Sheffield, UK*

**Angela Lin**
*University of Sheffield, UK*

## INTRODUCTION

One area of e-business that has visibly changed in the last few years is the capacity of the Internet for supporting consumer-to-consumer *information sharing*. By using a variety of *social media* software applications such as online reviews, blogs, social tagging, and wikis, consumers are increasingly able to generate and share content about the products and services that are available in the marketplace. Collectively the labor expended by consumers in generating such content is considerable, influencing other consumers' perceptions of these products and services and informing their purchasing decisions. It has been estimated for example that more than 5 million customers have reviewed products on the *Amazon.com* site, with many more making purchasing decisions informed by reading such reviews (Amazon, 2008). According to the findings of a recent *Pew Internet & American Life Project* survey, consumer generated information sources such as product reviews and blogs are also considered equally as important as commercial information, e.g. manufacturers' specifications, when making a purchasing decision (Horrigan, 2008). This article aims to provide an up-to-date review of the practice of consumer information sharing. First the different kinds of information sought by consumers are identified; second the social media software applications that consumers use to create, organize and share information with other consumers are discussed; and finally consideration is given to the marketing implications of consumer information sharing and how e-businesses can utilize social media for developing and managing relations with their customers.

DOI: 10.4018/978-1-61520-611-7.ch066

## CONSUMER INFORMATION

Consumers seek information in order to reduce any uncertainties or risks associated with an intended purchase (Conchar, Zinkhan, Peters, and Olavarrieta, 2004). Consumers also seek information in order to make sense of a product or group of products. The kinds of information sought by consumers typically relate to product attributes (e.g. specification, price, quality standards), expert and consumer opinions, and vendor reputation. Identifying relevant information sources involves the consumer either in an internal search of their prior knowledge of the same or similar products, and/or an external search of new information sources. An internal search is said to occur when consumers rely on their personal knowledge and experience of a product, while an external search occurs when consumers look for information beyond their own personal knowledge and experience. The range of external consumer information sources includes: store representatives, salespersons, and company websites; commercial media (e.g. magazines, advertisements), expert reviews; social sources (e.g. word of mouth, family and friends) and recommendations; and an increasing range of social media (e.g. blogs, social bookmarking tools, social shopping sites, and wikis) that consumers use to generate, organize, and communicate information about products and services. In sum, consumers seek a range of different kinds of information in order to reduce the uncertainties and risks associated with making a purchasing decision and to make sense of the products. Information sources can be both internal and external to the consumer and span a spectrum that includes ratings, reviews and recommendations on the one hand, more interactive resources e.g. blogs, and opportunities for fuller participation in consumer wikis and customer communities.

## CONSUMER INFORMATION AND SOCIAL MEDIA

Socially-owned media applications such as blogs, social tagging, and opinion sites have been enthusiastically adopted by consumers; with the resulting consumer generated content being widely used by consumers in the course of their purchasing activities. Reasons for this adoption include the relatively low costs associated with their implementation, and the dynamic and recent nature of the content. In contrast to traditional commercially-produced sources the use of social media enables consumers to access, produce, and share content generated by their peers. Rather than describe the different types of social media applications that have been developed, the review is organized in terms of the uses that such media have for consumers and for generating consumer content. Consumer uses of social media include reviewing and rating products and services, organizing content for subsequent access by other consumers, communicating with other consumers through weblogs, and collaborating and participating in the development of more substantive resources such as consumer wikis and customer communities. A description of each of these uses is provided here, along with illustrative examples. The review concludes with a short summary of some of the problems that can arise from consumers' use of social media.

Perhaps the most evident use of social media in the consumer domain is in enabling the publishing and reading of consumer reviews. Reviews written by consumers are perceived to be less biased than the information provided by advertisers and can provide additional information that enhances the credibility of what is already available from retailers and manufacturers. Different types of consumer review exist, depending on the purpose for which they are intended. These include product reviews, content reviews, and seller reviews. Product reviews normally focus on the functionalities of a product e.g. its usability, efficiency, quality, design, reliability, and so on e.g. *Epinions* (http://www.epinions.com/); content reviews focus and share opinions on the content of a product e.g. a book, music, or movie e.g. *Music Emissions* (http://www.musicemissions.com); seller reviews are often used as a mechanism to establish trust between buyers and sellers and to convey a sense of product and service quality e.g. *Froogle* (http://www.froogle.com), and *Ebay* (http://www.ebay.com). Consumer reviews have become a valued consumer information source and their use increases consumers' confidence when making a purchasing decision (Harrell, 2008). Therefore, a growing number of retailers incorporate customer reviews on their site in order to enrich their consumers' shopping experience. An interactive dimension can be added to these reviews by providing a facility for other consumers to rate the usefulness of particular reviews e.g. *Amazon* (http://www.amazon.com). Ratings are also used as a simple way of evaluating goods and services. These include dedicated ratings and reviews sites e.g. *Bizrate* (http://www.bizrate.com) as well as the embedding of ratings scales into reputation systems. Reputation systems enable a consumer to rate a vendor on a given scale. Displays of reputation information often include an aggregated statistical score for positive, negative and neutral ratings; along with the facility to read related limited free-text comments. Enhancements of reputation systems include an interactive facility enabling vendors to respond to consumers' comments, often in the interests of equity when the vendor perceives a comment to be unfair or partial. A further mechanism for aggregating consumer opinions are voting systems. *ILikeTotallyLoveIt.com* for example carries a facility enabling consumers to vote on their agreement with consumers product stories. Consumers' preferences can also aggregated and displayed via recommender systems. Recommender systems in e-commerce identify a similarity in the preferences or tastes of one consumer and others (e.g. goods purchased, products viewed); and make recommendations for new purchases drawn from the set of other goods bought or viewed by each of the like-minded consumers (Foster, 2006).

Social media also provide an opportunity for users to describe and organize content though the use of descriptors called tags e.g. *Flickr* (http://www.flickr.com). In contrast to the hierarchical category systems developed by organizations and designers on the basis of a standardized vocabulary, social tagging systems enable users to generate and navigate meta-data that describe and organize content flexibly on the basis of users' rather than experts' terminology. If a critical mass of users use the social tagging system, a folksonomy (a blending of the words 'folk' and 'taxonomy') of terms is generated that displays the terms used and chosen by users to assign meaning to the site's content. Although dedicated social tagging sites exist that carry consumer generated content e.g. *Digg* (http://www.digg.com), the more popular use of social tags in a consumer context is for them to become embedded in other media and act as metadata for describing and organizing consumer-generated content. For example *Amazon* (http://www.amazon.com) provides facilities for customer to tag their products. Other consumers then have the opportunity to search for and retrieve relevant products by clicking on these tags. Emerging tags can also be displayed as an ordered alphabetical list, while it has also become popular for groups of user-generated tags to be displayed in the form of a tag cloud that utilizes typographic devices to visualize the frequency and recency with which the tags have been used. Further interactivity is provided by enabling other customers to vote on whether they agree or not that the selected tag is related to the product.

A further highly trusted source for influencing the customer decision process are consumer weblogs or blogs. These are a form of online journal with entries that record consumers' personal experiences and opinions of products and companies, as well comments on issues relevant to the consumer marketplace and consumer culture more generally. An important element of consumer blogs is the ability of other consumers to comment on the entries. Third party hosted and personal consumer blogs exist. *Gizmodo* (http://www.gizmodo.com) for example is currently a popular third party site hosting consumer-to-consumer communication around gadgets; while *Festival of Frugality* (http://www.festivaloffrugality.com) enables consumers to share cost saving tips. Consumers also use blogs to record their personal experience with a product and make comment on the product after its use. *Things I Bought That I Love* (http://thingsiboughtthatilove.com) is a personal consumer blog dedicated to describing and recommending products that a consumer has purchased to other consumers; while *A Suitable Wardrobe* (http://asuitablewardrobe.dynend.com) is a blog written by a men's clothing enthusiast to share his knowledge of men's dressing style. Video sharing websites e.g. *Youtube* (http://www.youtube.com) and *Expo* (http://www.expotv.com) also carry consumer video reviews; thus combining the benefits of trusted consumer reviews with an element of storefront demonstration. Finally, social media such as wikis allow consumers to edit and modify content and collaborate on the generation of consumer information resources (Foster, in press). *Wikitravel* (http://wikitravel.org) is a consumer-generated travel guide that aims to be a free, complete, up-to-date, and reliable guide to worldwide travel; while *Shopwiki* (http://www.shopwiki.com/wiki) carries consumer authored buying and gift guides.

Consumers' use of social media gives rise to a number of business and design challenges. Preeminent among these challenges is the quality and usefulness of the content generated. At its best, consumer information shares similar properties with those attributed to crowd wisdom that contributions are voluntary, diversified, independent, decentralized, and aggregated (Surowiecki, 2004). There is no guarantee however that opinions shared by consumers are free from bias and are those of individuals who are acting independently; and a number of mechanisms have been put in place to safeguard against this e.g. ranking and voting mechanisms that judge review and reviewer helpfulness, more detailed breakdowns and explanations of ratings and reputation scores, and vendor feedback facilities that enable right of reply. In addition, while the quality of some amateur reviews and customer ratings can be questioned, if there is sufficient critical mass, statistical answers from groups of sufficiently large sizes tend to be accurate (Sunstein, 2006). Hence, aggregation in itself is often a sufficient safeguard against idiosyncratic or commercially-motivated contributions; while more collaboratively developed resources such as consumer wikis rely on the distributed knowledge of individuals as a guide to the accuracy and reliability of the content.

## E-BUSINESS, CONSUMERS, AND SOCIAL MEDIA

The advent of consumer information sharing and their take up of social media is both an opportunity and a threat for conducting e-business. On the one hand, consumers willing participation in what is from an e-business perspective marketing and brand building is a boon to businesses and brings marketing benefits and increased exposure to branding and an enhanced reputation. On the other hand in a networked environment reputation is often fragile; and therefore one of the key lessons of this trend is for e-businesses to develop and manage relations with their customers in these same social media environments (Lin and Foster, forthcoming). Some of the strategies that businesses can use to engage with this new breed of active and participatory consumer include listening, talking, energizing, supporting, and embracing customers and their ideas (Li and Bernoff, 2008). One way to combine these strategies is to develop *customer communities*. *Starbucks* for example has developed *My Starbucks Idea* (http://mystarbucksidea.force.com/ideaHome) which combines crowdsourcing and relationship management in one application; while *Amazon* hosts a range of customer communities from Harry Potter to martial arts (http://amazon.com/communities) that aim to develop customer loyalty and that utilize all the social media applications described here. In sum, media convergence and the increasingly ubiquitous nature of networked communication have provided marketing opportunities for businesses that go beyond information access and exchange to meaning making and identity formation (Deighton and Kornfeld, 2007).

## FUTURE RESEARCH DIRECTIONS

Although consumer information has increased in availability and accessibility, there remain many factors that can influence effective consumer information sharing and where further research is needed to understand more of the conditions that affect the take-up of consumer-generated content and its impact on purchasing decisions. These include individual differences among consumers, the quality of the information shared and perceptions of the value of such content. Consumers vary for example in their prior knowledge of a product or brand, their knowledge of appropriate information sources and channels, search skills, as well as external factors such as the time available to them within which to make a decision. The depth of an *information search*, i.e. the extent to which a consumer will search, will also depend on balancing the costs and benefits of doing the information search. That is, when the benefits of an information search are perceived to outweigh the costs, consumers are likely to continue searching; if not consumers are likely to stop searching and to engage in satisficing. Increasing the quality and authority of consumer-generated content will continue to present technical and business challenges; while knowing more about when during the purchasing process and why such content is valued would be valuable for consumer information systems designers and marketing personnel.

## CONCLUSION

The topic of consumer information sharing can be considered to incorporate study not only of the mechanisms available for the search, aggregation and sharing of information and opinions, but also of the facilities available for discussing these information and opinions once shared – an advance that may also have helped to counter bias in consumer judgments. Of the range of information sources available, non-commercial information sources are regarded by consumers as normally being more accurate, i.e. free from commercial interest and related to objective facts. Access to traditional social sources such as word of mouth and face-to-face communication can sometimes be limited by shared preconceptions of a product or brand; and recent developments in social media have created the reality of making purchasing decisions that are informed, even possibly optimally informed, not only by information and judgments that come from immediate social networks and strong ties but also from extended virtual networks and weak ties (Frenzen and Nakamoto, 1993). In sum, it is clear that engaging with and sharing social media has proven to be popular among consumers and that with certain safeguards as to the quality, authority, and usefulness of the contributions, also beneficial to businesses' marketing and branding operations.

## REFERENCES

Amazon.com. Inc. (2008, November 24). *Investors relations: Press release*. Retrieved December 10, 2008 from http://phx.corporate-ir.net/phoenix.zhtml?c=97664&p=irol-newsArticle&ID=1229410&highlight=

Conchar, M. P., Zinkhan, G. M., Peters, C., & Olavarrieta, S. (2004). An integrated framework for the conceptualization of consumers' perceived-risk processing. *Journal of the Academy of Marketing Science*, *32*(4), 418–436. doi:10.1177/0092070304267551

Deighton, J., & Kornfeld, L. (1997). *Digital interactivity*: *Unanticipated consequences for markets, marketing, and consumers*. [Working Paper 08-017]. Retrieved from http://www.hbs.edu/research/pdf/08-017.pdf

Foster, J. (2006). Collaborative information seeking and retrieval. *Annual Review of Information Science & Technology*, *40*, 329–356. doi:10.1002/aris.1440400115

Foster, J. (Ed.). (in press). *Collaborative information behavior: User engagement and communication sharing*. Hershey, PA: IGI Global.

Frenzen, J., & Nakamoto, K. (1993). Structure, cooperation, and the flow of market information. *The Journal of Consumer Research*, *20*(3), 360–375. doi:10.1086/209355

Harrell, D. (2008). The influence of consumer generated content on customer experiences and consumer behavior. In P.C. Deans, (Ed.), *Social software and Web 2.0 technology trends*. Hershey, PA: IGI Global.

Horrigan, J. B. (2008). *The Internet and Consumer Choice: Online Americans Use Different Search and Purchase Strategies for Different Goods*. Pew Internet and American Life Project [Report]. Retrieved from http://www.pewinternet.org

Li, C., & Bernoff, J. (2008). *Groundswell: Winning in a world transformed by social technologies*. Boston: Harvard University Press.

Lin, A. & Foster, J. (forthcoming). *Consumer information systems and relationship management*: *Design, implementation, and use*. Hershey, PA: IGI Global.

Sunstein, C. R. (2006). *Infotopia*: *How many minds produce knowledge*. Oxford, UK: Oxford University Press.

Surowiecki, J. (2004). *The Wisdom of crowds*: *Why the many are smarter than the few.* London: Abacus.

## KEY TERMS AND DEFINITIONS

**Consumer Generated Content:** content generated by consumers' use of social media. Examples include reviews, ratings, tags, and weblog or wiki entries.

**Consumer Information:** the information needed by consumers when researching, purchasing, and completing a purchase. Examples of consumer information needs include: product attributes (e.g. specification, price, quality standards), expert and consumer opinions, and vendor reputation.

**Customer Decision Process:** The set of stages that consumers pass through when deciding to purchase products or services. When purchasing products, consumers typically pass through a prepurchase stage that involves recognition of need, information gathering, and the evaluation of different product alternatives; a purchase stage in which a decision to purchase is taken; and a post-purchase stage during which customers evaluation the purchase, consider becoming a loyal customer; and finally, dispose of the product.

**Information Sharing:** an umbrella term for the processes involved in the creation, exchange and use of information. Information sharing includes the sharing of pre-defined information, and discussion of the information once shared.

**Recommender System:** Recommender systems in e-commerce identify a similarity in the preferences or tastes of one consumer and others (e.g. goods purchased, products viewed); and make recommendations for new purchases drawn from the set of other goods bought or viewed by each of the like-minded consumers.

**Social Media:** socially rather than commercially-owned media enabling its users to rapidly publish and distribute ideas and opinions, primarily although not exclusively, to a peer audience. Examples of social media include: weblogs, social tagging systems, and wikis.

**Social Tagging:** in contrast to the pre-defined categories and terms of a classification scheme, social tagging systems enable users to create and assign tags that meaningfully organize the content of a website. Aggregation of tags leads to the generation of a folksonomy, a socially-owned socially owned vocabulary, whose terms define and organize the content of a website from the perspective of members of the user community rather than that of experts.

# Chapter 67

# B2C E-Commerce Acceptance Models Based on Consumers' Attitudes and Beliefs:

## Integrating Alternative Frameworks

**Ángel Herrero-Crespo**
*Universidad de Cantabria, Spain*

**Ignacio Rodríguez-del-Bosque**
*Universidad de Cantabria, Spain*

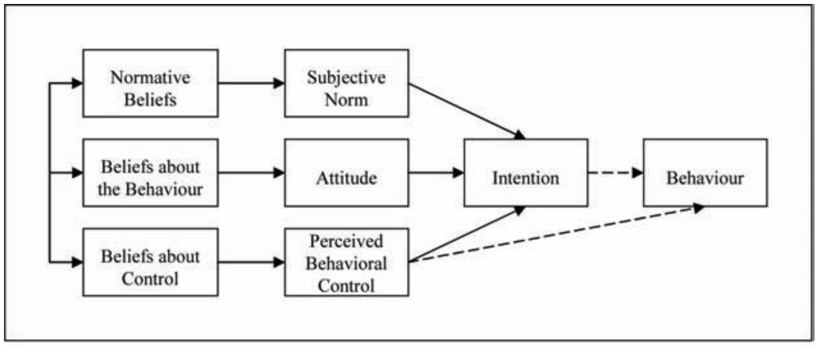
## INTRODUCTION

The novelty and dynamism of Internet and e-commerce have lead to the revision of the classic paradigm of consumer behaviour and to the continuous study of individuals' conduct in virtual environments. In this context, the literature on Internet has placed special attention on the development and testing of theoretical models aimed to describe and explain e-commerce acceptance by final consumers. In this sense, two theoretical frameworks stand out as the most relevant and widely used approaches in e-commerce adoption literature: the Theory of Planned Behaviour (Schifter & Ajzen, 1985; Ajzen, 1991) and the Technology Acceptance Model (Davis, 1989; Davis et al., 1989). Both models are based on traditional theory of consumer behaviour and focus on individuals' attitudes and beliefs about e-commerce and virtual transactions. However, TPB and TAM differ in the variety of explanatory variables they include and in the identification of beliefs considered as determinants of individuals' attitudes towards a behaviour or technology.

Taking into account the theoretical basement shared by both models, Taylor & Todd (1995) propose the Decomposed Theory of Planned Behaviour which integrates the TAM and TPB, enjoying the strengths of both frameworks. Thus, the DTPB provides greater insight into the factors that influence behaviour or technology acceptance (Tayor & Todd, 1995; Rodríguez-del-Bosque & Herrero, 2005). Nevertheless, the relative trade off of the deeper understanding of IT usage provided by the Decomposed Theory of Planned Behaviour is the

DOI: 10.4018/978-1-61520-611-7.ch067

*Figure 1. Theory of planned behavior*




increased complexity and decreased parsimony of the model.

Given the widespread use of the TPB, the TAM and the DTPB in literature about IS and e-commerce adoption, this paper intends to describe their main principles and to examine their weaknesses and strengths for the research of e-commerce acceptance. Additionally, discussion about the integration and development of these models to study Internet shopping behaviour are presented. Finally, future research directions on this topic are proposed.

## BACKGROUND: B2C E-COMMERCE ACCEPTANCE MODELS BASED ON CONSUMERS' ATTITUDES AND BELIEFS

The Theory of Planned Behaviour, the Technology Acceptance Model and the Decomposed Theory of Planned Behaviour are described next. In addition, the most important studies carried out in the field of e-commerce which are based on these theoretical frameworks are analysed.

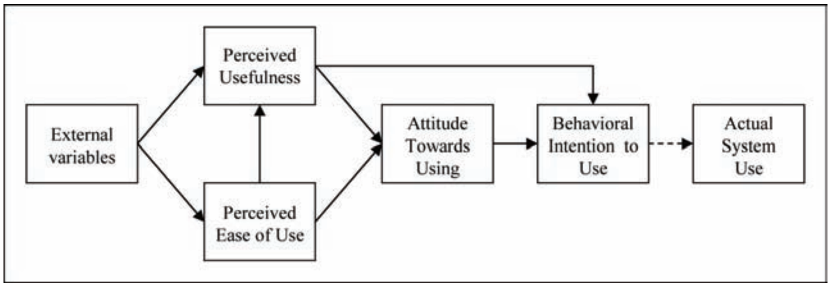
### Theory of Planned Behavior (TPB)

The Theory of Planned Behaviour (Schifter & Ajzen, 1985) focuses on those conducts in which the individual is influenced to a certain extent by the availability of certain requirements and resources. The TPB considers intention as the best predictor of behaviour, as it expresses the effort that individuals are willing to make to develop a particular action (Ajzen, 1991). Likewise, the model identifies three types of determinants and explanatory variables of the intention of behaviour: attitude towards behaviour, subjective norm and perceived behavioural control (Figure 1).

The *attitude* towards behaviour refers to the overall disposition, favourable or unfavourable, towards the development of this conduct and it is the result of the individuals' beliefs with respect to the behaviour and its consequences. On the other hand, the *subjective norm* reflects the effect that other people's opinion –family or friends, among others– has on the consumer's behaviour. Finally, *perceived behavioural control* represents the individual's perceptions with regard to the presence or the absence of the necessary resources and opportunities to develop the conduct.

The Theory of Planned Behaviour has been extensively used and supported in research on the Internet and e-commerce (see Rodríguez-del-Bosque & Herrero, 2005). Particularly, this theoretical model has been taken as a reference to examine the acceptance of the Internet as a shopping channel (Limayem et al., 2000; Keen et al., 2002; Bosnjak et al., 2006; Herrero & Rodríguez-del-Bosque, 2008), the adoption of shopping through mobile telephone systems

*Figure 2. Technology acceptance model (TAM)*




(Khalifa & Cheng, 2002) and the use of a shopping robot (Gentry & Calantone, 2002). On the whole, the empirical evidence obtained by these studies has supported the validity of the TPB to explain e-commerce acceptance.

## Technology Acceptance Model (TAM)

Davis' (1989) Technology Acceptance Model focuses on the behaviour of new technologies' usage. Thus, the TAM identifies two specific beliefs that fundamentally affect the acceptance of computer innovations: perceived usefulness (PU) and perceived ease of use (PEOU). The first one is defined as "the user's subjective probability that using a specific system will increase his or her performance in a particular activity", while perceived ease of use refers to the "degree to which the user expects the target system to be free of effort".

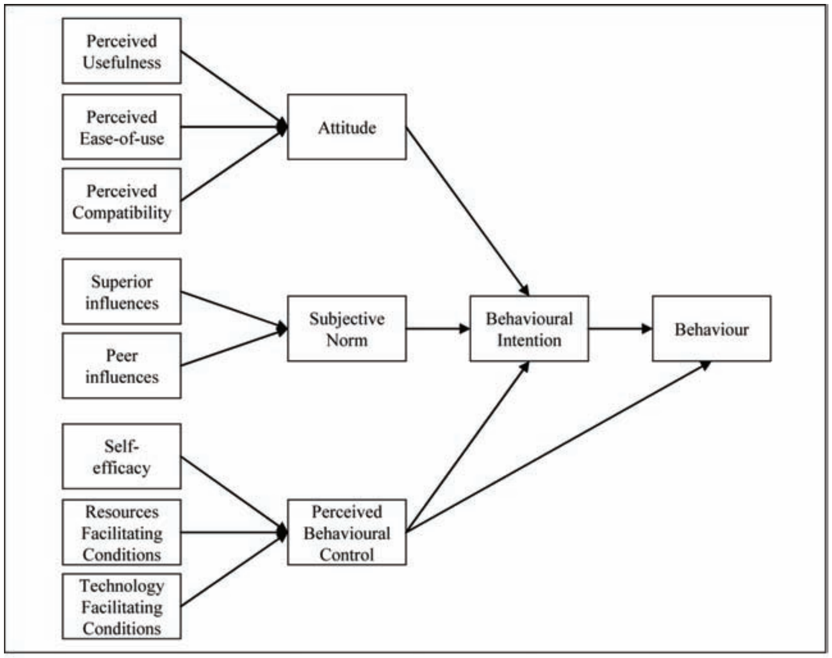
The Technology Acceptance Model postulates that the use of a computer innovation is determined by behavioural intention. However, the TAM considers two direct determinants of intention: attitude towards technology and its perceived usefulness (Davis, 1989; Davis et al., 1989). Likewise, perceived usefulness also affects attitude. On the other hand, according to this model, the perceived ease of use in technology determines both attitude towards it and perceived usefulness in it. Figure 2 shows the basic structure of the Technology Acceptance Model.

The TAM represents the most significantly applied theoretical framework in research on information systems in general, and on the Internet in particular –see Lee et al. (2003)–. Regarding this subject, it is worth mentioning the studies supported by the TAM to analyze electronic shopping acceptance, whether considering this behaviour from a general perspective (Teo et al., 1999; Childers et al., 2001; Fenech & O'Cass, 2001; Salisbury et al., 2001; O'Cass & Fenech, 2003; Park et al., 2004; Shih, 2004; Bosnjak et al., 2006; Herrero & Rodríguez-del-Bosque, 2008; Rodríguez-del-Bosque & Herrero, 2008; Herrero et al., 2009) or studying the usage of a specific virtual store or service (Gefen & Straub, 2000; Chen et al., 2002; Gefen, 2003; Pavlou, 2003; Van-der-Heijden et al., 2003). On the whole, the different studies that have analyzed Internet behaviour based on the Technology Acceptance Model support the main relationships postulated in it.

## Decomposed Theory of Planned Behavior (DTPB)

The Decomposed Theory of Planned Behaviour (Taylor & Todd, 1995) represents an effort to integrate the contributions of the TPB and the TAM in order to provide a more thoughtful explanation of the adoption of technology innovations. Hence, based on literature on innovation characteristics, the model develops the dimensions of attitude,

*Figure 3. Decomposed theory of planned behavior*




subjective norm and perceived behavioural control, decomposing them into specific beliefs groups (Figure 3).

Based on literature regarding innovation characteristics (Rogers, 1983; Moore & Benbasat, 1991), the model proposes three determinants of attitude towards a new technology: relative advantage, complexity and compatibility. Relative advantage refers to the degree to which an innovation is superior to other alternatives and it can incorporate aspects such as economic profits, image improvement, convenience and satisfaction (Rogers, 1983), making it comparable to the concept of "perceived usefulness" (Davis, 1989). On the other hand, complexity represents the degree to which an innovation is perceived as difficult to understand, learn or operate (Rogers, 1983), and it is an analogous dimension to "perceived ease of use". Finally, compatibility refers to the degree to which a new technology meets the habits, values and needs of the potential adopter (Rogers, 1983).

With reference to the subjective norm, different research supports its decomposition in diverse structures that represent the influence of different groups of reference (Oliver & Bearden, 1985; Burnkrant & Page, 1988). In particular, Taylor & Todd (1995) propound the inclusion of three groups in a business context: superiors, equals and subordinates. Finally, perceived behavioural control is decomposed into the dimensions of self–efficacy (Bandura, 1982) and facilitating conditions (Triandis, 1977).

Some authors have applied the Decomposed Theory of Planned Behaviour to the study of Internet use and e-commerce acceptance (Bhattacherjee, 2000; Lau et al., 2001; Lu et al., 2001; Hsu and Chiu, 2004a; Hsu and Chiu, 2004b; Pavlou and Fygenson, 2006). Overall, the results obtained in these papers have supported the causal structure proposed by the DTPB and their authors have pointed out the usefulness of this theoretical framework to provide a global explanation of the adoption of e-commerce and e-services.

## STRENGHTS AND WEAKNESSES OF TPB, TAM AND DTPB TO EXPLAIN E-COMMERCE ACCEPTANCE: AN OPEN ISSUE

Although the theories examined have been extensively used in literature about IS and e-commerce adoption, none of these alternative models have achieved universal acceptance, as there are strong points and weak points in each one (see Ajzen, 1991; Mathieson, 1991; Gentry & Calantone, 2002; Venkatesh et al., 2003; Bosnjak et al., 2006). In this sense, the investigations focused on the comparison of the Theory of Planned Behaviour and the Technology Acceptance Model have found that the TAM may be more appropriate to analyse IS adoption, since it has been developed specifically to study this behaviour while the TPB is a general model (Davis et al., 1989; Gentry & Calantone, 2002). However, Mathieson (1991), Taylor & Todd (1995) and Herrero et al. (2006) point out the excessive simplicity of the TAM to explain IS adoption, as it only considers attitudes, perceived usefulness and ease of use as predictive variables. In contrast, these authors acknowledge that the TPB provides a deeper understanding of the factors that determine IS adoption, including social pressures and facilitating conditions. Taking into account the particular strengths of both theoretical models, Mathieson (1991) proposes the combined use of the TAM and the TPB, using the first model to identify dissatisfied IS users and discover the general nature of their complaints, and the TPB to obtain more specific information about the problem.

Following this approach, the Decomposed Theory of Planned Behaviour integrates both the TAM and TPB approaches, enjoying the strengths of both theoretical frameworks. Thus, this model is specifically designed to explain IS acceptance and also includes detailed attitudinal, social and control influences, by decomposing the beliefs structures. As a result, the DTPB provides greater insight into the factors that influence behaviour or technology acceptance (Taylor & Todd, 1995; Rodríguez-del-Bosque & Herrero, 2005). Nevertheless, the relative trade off of the deeper understanding of IT usage provided by this theory is its higher complexity and lower parsimony. In this sense, Bagozzi (1992) points out that explanatory power being equivalent, the "best" model is the one which is the most parsimonious. Moreover, Mulaik et al. (1989) state that a model that leads to good prediction while using only a few predictors is preferable. Other researchers, however, have argued that parsimony is desirable only to the extent that it facilitates understanding (Browne & Cudeck, 1993). According to this approach, the DTPB seems to be especially appropriate for research aimed at providing a deeper understanding of IT usage (in this case, e-commerce acceptance).

## FUTURE RESEARCH DIRECTIONS

Although different studies have supported the usefulness of the three models examined to explain e-commerce acceptance, the empirical evidence available regarding this issue is still limited, and somehow contradictory (Gentry & Calantone, 2002; Bosnjak et al., 2006; Herrero et al., 2006), and additional research is needed.

Firstly, the relationship between beliefs, attitude, intention and behaviour propounded in the TPB, the TAM and the DTPB should be re-examined. Regarding this subject, the TAM includes a direct influence of perceived usefulness on the intention to accept/use IS, an effect that has been supported by various studies in the scope of e-commerce (Gefen & Straub, 2000; Gentry & Calantone, 2002; Featherman & Pavlou, 2003). However, the DTPB does not incorporate this effect, and only consider the indirect influence of perceived usefulness on intention through its effect on attitudes towards the system. On the contrary, some authors have even propounded to eliminate attitudes from TAM, considering perceived usefulness and ease of use as direct determinants of IS acceptance intention (Chau, 1996; Szajna, 1996; Venkatesh and Davis, 2000). This approach implies significant limitations for the integration of TAM and TPB in a single model (DTPB) as the main connection between both frameworks would disappear. Therefore, more evidence is required to clarify the relationship between beliefs, attitudes and intention to accept e-commerce.

Likewise, more research is needed about the decomposed beliefs that influence attitudes, subjective norm and perceived behavioural control. In particular, the TAM and the DTPB only incorporate technological attributes of the system (perceived usefulness, ease of use, and compatibility) as determinants of attitudes. However, given the business nature of e-commerce, in this specific field the consideration of the commercial attributes of the channel may provide greater insight and explanatory power about online shopping behaviour. Thus, variables such as the price, variety and quality of the products available on the Internet, the playfulness of virtual shopping experience or the information offered on the web may be relevant determinants of attitudes towards e-commerce. Similarly, more evidence is required about the specific groups whose opinions determine the subjective norm with respect to Internet shopping. Thus, the collectives propounded for other information systems or for organizational environments may not be applicable to B2C e-commerce. Similarly, additional research about the structure of beliefs that give form to perceived control on Internet shopping is needed.

Finally, it would be necessary to analyze the effect of product category in the process of e-commerce adoption. In particular, the influence of attitudes, the subjective norm or the attributes perceived in the system could vary from one product to another. Thus, the effect of perceived ease of use on attitudes towards e-commerce could be particularly important for those products whose shopping process is habitually more difficult. On the other hand, subjective norm could have a greater influence for those products and services in which fashion and trends are especially relevant, such as exclusive clothing or art pieces.

## CONCLUSION

According to the literature reviewed, the TPB, the TAM and the DTPB are models valid to explain e-commerce acceptance and use. However each of these theoretical frameworks present strong and weak points, so their use in research must be conditioned by the objective of the investigation (predictive or explanatory), and the parsimony desired in the study. Thus, TAM may be more appropriate to analyse e-commerce acceptance from a technological perspective, while the TPB and DTPB provide a deeper understanding of the factors that determine online shopping, including social pressures and facilitating conditions. Moreover, the DTPB provides greater insight into the beliefs that influence e-commerce acceptance but it is a more complex and less parsimonious model. In fact, despite the widespread use of these theories in literature about IS and e-commerce adoption, none of them have achieved universal acceptance and much research is still needed on this topic.

## REFERENCES

Ajzen, I. (1991). The Theory of Planned Behaviour. *Organizational Behavior and Human Decision Processes*, *50*, 179–511. doi:10.1016/0749-5978(91)90020-T

Bagozzi, R. P. (1992). The Self-Regulation of Attitudes, Intentions and Behaviour. *Social Psychology Quarterly*, *55*(2), 178–204. doi:10.2307/2786945

Bandura, A. (1982). Self-efficacy Mechanism in Human Agency. *The American Psychologist*, *37*, 122–147. doi:10.1037/0003-066X.37.2.122

Bhachatterjee, A. (2000). Acceptance of E-Commerce Services: The Case of Electronic Brokerages. *IEEE Transactions on Systems, Man, and Cybernetics. Part A, Systems and Humans*, *30*(4), 411–420. doi:10.1109/3468.852435

Bosnjak, M., Obermier, D., & Tuten, T. L. (2006). Predicting and explaining the propensity to bid in online auctions: a comparison of two action-theoretical models. *Journal of Consumer Behaviour*, *5*, 102–116. doi:10.1002/cb.38

Browne, M. W., & Cudeck, R. (1993). Alternative Ways of Assessing Model Fit. In K. Bollen & J.S. Long (Eds.) *Testing Structural Equation Models*. London: Sage Publications.

Burnkrant, R. E., & Page, T. J. (1988). The Structure and Antecedents of the Normative and Attitudinal Components of Fishbein's Theory of Reasoned Action. *Journal of Experimental Social Psychology*, *24*, 66–87. doi:10.1016/0022-1031(88)90044-3

Chau, P. Y. K. (1996). An Empirical Assesment of a Modified Technology Acceptance Model. *Journal of Management Information Systems*, *13*(2), 185–204.

Chen, L., Gilleson, M. L., & Sherrel, D. L. (2002). Enticing Online Consumers: An Extended Technology Acceptance Perspective. *Information & Management*, *39*, 705–719. doi:10.1016/S0378-7206(01)00127-6

Childers, T. L., Carr, C. L., Peck, J., & Carson, S. (2001). Hedonic and Utilitarian Motivations for Online Retail Shopping Behaviour. *Journal of Retailing*, *77*, 511–535. doi:10.1016/S0022-4359(01)00056-2

Davis, F. D. (1989). Perceived usefulness, perceived ease of use and user acceptance of information technology. *MIS Quarterly*, *13*(3), 319–339. doi:10.2307/249008

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User Acceptance of Computer Technology: A Comparison of Two Theoretical Models. *Management Science*, *35*(8), 982–1003. doi:10.1287/mnsc.35.8.982

Featherman, M. S., & Pavlou, P. A. (2003). Predicting E-services Adoption: A Perceived Risk Facets Perspective. *International Journal of Human-Computer Studies*, *59*, 451–474. doi:10.1016/S1071-5819(03)00111-3

Fenech, T., & O'Cass, A. (2001). Internet Users' Adoption of Web Retailing: User and Product Dimensions. *Journal of Product and Brand Management*, *10*(6), 361–381. doi:10.1108/EUM0000000006207

Gefen, D. (2003). TAM of Just Plain Habit: A Look at Experienced Online Shoppers. *Journal of End User Computing*, *15*(3), 1–13.

Gefen, D. & Straub, D. (2000). The Relative Importance of Perceived Ease of Use in IS Adoption: A Study of E-Commerce Adoption. *Journal of the Association for Information Systems, 1*.

Gentry, L., & Calantone, R. (2002). A Comparison of Three Models to Explain Shop-Bot Use on the Web. *Psychology and Marketing*, *19*(11), 945–956. doi:10.1002/mar.10045

Herrero, A., García-de-los-Salmones, M. M., & Rodríguez-del-Bosque, I. (2009). The influence of perceived risk on Internet shopping behavior: A multidimensional perspective. *Journal of Risk Research*, *12*(2), 259–277. doi:10.1080/13669870802497744

Herrero, A., & Rodríguez-del-Bosque, I. (2008). The effect of innovativeness on the adoption of B2C e-commerce: A model based on the Theory of Planned Behavior. *Computers in Human Behavior*, *24*, 2830–2847. doi:10.1016/j.chb.2008.04.008

Herrero, A., Rodríguez-del-Bosque, I., & Trespalacios, J. A. (2006). La adopción del comercio electrónico B2C: Una comparación empírica de dos modelos alternativos. *Revista Española de Investigación de Marketing ESIC*, *10*(1), 69–90.

Hsu, M. H., & Chiu, C. M. (2004a). Internet self-efficacy and electronic service acceptance. *Decision Support Systems*, *38*(3), 369–381. doi:10.1016/j.dss.2003.08.001

Hsu, M. H., & Chiu, C. M. (2004b). Predicting electronic service continuance with a decomposed theory of planned behaviour. *Behaviour & Information Technology*, *23*(5), 359–379. doi:10.1080/01449290410001669969

Keen, C., Wetzels, M., De Ruyter, K., & Feinberg, R. (2004). E-Tailers versus Retailers. Which Factors Determine Consumer Preferences. *Journal of Business Research*, *57*(7), 685–695. doi:10.1016/S0148-2963(02)00360-0

Khalifa, M., & Cheng, S. (2002). Adoption of Mobile Commerce: Role of Exposure. In *Proceedings of the 35th Hawaii International Conference on System Science*.

Lau, A., Yen, J., & Chau, P. Y. K. (2001). Adoption of On-line Trading in the Hong Kong Financial Market. *Journal of Electronic Commerce Research*, *2*(2), 58–65.

Lee, Y., Kozar, K. A., & Larsen, K. R. T. (2003). The Technology Acceptance Model: Past, Present, and Future. *Communications of the Association for Information Systems*, *12*, 752–780.

Limayem, M., Khalifa, M., & Frini, A. (2000). What Makes Consumers Buy from Internet? A Longitudinal Study of Online Shopping. *IEEE Transactions on Systems, Man, and Cybernetics. Part A, Systems and Humans*, *30*(4), 421–432. doi:10.1109/3468.852436

Lu, J., Liu, C., Yu, C.-S., & Yao, J. E. (2001). Exploring Factors Associated with Wireless Internet via Mobile Technology Acceptance in Mainland China. *Communications of the International Information Management Association*, *3*(1), 101–119.

Mathieson, K. (1991). Predicting User Intentions: Comparing the Technology Acceptance Model with the Theory of Planned Behaviour. *Information Systems Research*, *2*(3), 173–191. doi:10.1287/isre.2.3.173

Moore, G. C., & Benbasat, I. (1991). Development of an Instrument to Measure the Perceptions of Adopting an Information Technology Innovation. *Information Systems Research*, *2*(3), 192–222. doi:10.1287/isre.2.3.192

Mulaik, S. A., James, L. R., Alstine, J. V., Bennett, N., Lind, S., & Stilwell, C. D. (1989). Evaluation of goodness of fit indices for structural equation models. *Psychological Bulletin*, *105*(3), 430–445. doi:10.1037/0033-2909.105.3.430

O'Cass, A., & Fenech, T. (2003). Web Retailing Adoption: Exploring the Nature of Internet Users Web Retailing Behaviour. *Journal of Retailing and Consumer Services*, *10*, 81–94. doi:10.1016/S0969-6989(02)00004-8

Oliver, R. L., & Bearden, W. O. (1985). Crossover Effects in the Theory of Reasoned Action. *The Journal of Consumer Research*, *12*(3), 324–340. doi:10.1086/208519

Park, J., Lee, D., & Ahn, J. (2004). Risk-Focused e-Commerce Adoption Model: A Cross-Country Study. *Journal of Global Information Technology Management*, *7*(2), 6–30.

Pavlou, P. A. (2003). Consumer Intentions to Adopt Electronic Commerce – Incorporating Trust and Risk in the Technology Acceptance Model. *International Journal of Electronic Commerce*, *7*(3), 101–134.

Pavlou, P. A., & Fygenson, M. (2006). Understanding and Predicting Electronic Commerce Adoption: An Extension of the Theory of Planned Behaviour. *MIS Quarterly*, *30*(1), 115.

Rodríguez-del-Bosque, I., & Herrero, A. (2005). La aceptación de Internet y el comercio electrónico basados en las actitudes. In A.M. Gutiérrez, & M.J. Sánchez-Franco, (Ed.), *Marketing en Internet, Estrategia y Empresa*, (pp. 371-412).

Rodríguez-del-Bosque, I., & Herrero, A. (2008). Antecedentes de la utilidad percibida en la adopción del comercio electrónico entre particulares y empresas. *Cuadernos de Economía y Dirección de la Empresa*, *34*, 107–134.

Rogers, E. M. (1983). *Diffusion of Innovations*, (3rd Ed.). New York: The Free Press.

Salisbury, W. D., Pearson, R. A., Pearson, A. W., & Miller, D. W. (2001). Perceived security and World Wide Web Purchase Intention. *Industrial Management & Data Systems*, *101*(4), 165–176. doi:10.1108/02635570110390071

Schifter, D. B., & Ajzen, I. (1985). Intention, perceived control, and weight loss: An application of the theory of planned behaviour. *Journal of Personality and Social Psychology*, *49*, 842–851. doi:10.1037/0022-3514.49.3.843

Shih, H. P. (2004). An Empirical Study on Predicting User Acceptance of e-Shopping on the Web. *Information & Management*, *41*, 351–368. doi:10.1016/S0378-7206(03)00079-X

Szajna, B. (1996). Empirical Evaluation of the Revised Technology Acceptance Model. *Management Science*, *42*(1), 85–92. doi:10.1287/mnsc.42.1.85

Taylor, S., & Todd, P. A. (1995). Understanding Information Technology Usage: A Test of Competing Models. *Information Systems Research*, *6*(2), 144–176. doi:10.1287/isre.6.2.144

Teo, T. S. H., Lim, V. K. G., & Lai, R. Y. C. (1999). Intrinsic and Extrinsic Motivation in Internet Usage. *Omega International Journal of Management Science*, *27*, 25–37. doi:10.1016/S0305-0483(98)00028-0

Triandis, H. C. (1977). *Interpersonal behaviour*. New York: Brooks/Cole.

Van-der-Heijden, H., Verhagen, T., & Creemers, M. (2003). Understanding Online Purchase Intentions: Contributions from Technology and Trust Perspectives. *European Journal of Information Systems*, *12*, 41–48. doi:10.1057/palgrave.ejis.3000445

Venkatesh, V., & Davis, F. D. (2000). A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Field Studies. *Management Science*, *46*(2), 186–204. doi:10.1287/mnsc.46.2.186.11926

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User Acceptance of Information Technology: Towards a Unified View. *MIS Quarterly*, *27*(3), 425–478.

## KEY TERMS AND DEFINITIONS

**Acceptance Model:** Theoretical structure that models and explains how users come to accept and use an innovation, technology or information system.

**Attitude towards Behavior:** Overall disposition, favorable or unfavorable, towards the development of a conduct, resulting from the individuals' beliefs with respect to the behavior and its consequences.

**Facilitating Conditions:** External resource constraints to develop a behavior (Triandis, 1977).

**Perceived Behavioral Control:** Individual's perceptions with regard to the presence or the absence of the necessary resources and opportunities to develop the conduct.

**Perceived Compatibility:** Degree to which a new technology meets the habits, values and needs of the potential adopter (Rogers, 1983).

**Perceived Ease of Use:** Degree to which the user expects an information system to be free of effort (Davis, 1989).

**Perceived Usefulness:** User's subjective probability that using a specific system will increase his or her performance in a particular activity (Davis, 1989).

**Self–Efficacy:** People's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives (Bandura, 1994).

**Subjective Norm:** Effect that other people's opinion –family or friends, among others– has on the consumer's behavior.

# Chapter 68
# Effect of Perceived Risk on e-Commerce Acceptance:
## State of the Art and Future Research Directions

**Ángel Herrero-Crespo**
*Universidad de Cantabria, Spain*

**Ignacio Rodríguez-del-Bosque**
*Universidad de Cantabria, Spain*

## INTRODUCTION

The risk or uncertainty perceived on a conduct (e.g. purchasing or consuming of a product, or using an information system) by the individuals has been traditionally identified as one of the main determinants of consumer behavior. In particular, the influence of perceived risk has been specially linked to high involvement products or conducts (Laurent & Kapferer, 1985) which imply a high value or concern for the individual, and that are usually purchased after long and careful consideration. In the specific context of e-commerce, perceived risk has been traditionally identified as one of the main barriers for Internet shopping acceptance and diffusion (Korgaonkar & Wolin, 1999; Goldsmith & Lafferty, 2001; Miyazaki & Fernández, 2001; Wu & Wang, 2005). However, the empirical evidence available regarding this issue is contradictory, and some authors have found that the influence exerted by perceived risk on consumers' online shopping behavior may not be so relevant (Jarvenpaa & Todd, 1997; Herrero & Rodríguez del Bosque, 2008).

In this context, this paper examines the influence that perceived risk in online shopping has on the process of e-commerce adoption by end consumers. Therefore, first the concept of perceived risk is studied from a general perspective, examining the different theoretical approaches to this construct and how it is defined from each perspective. Moreover, the perceived risk is analyzed as a multidimensional concept, taking into consideration the different risk facets identified in literature. In each case, the empirical evidence available in the field of Inter-

DOI: 10.4018/978-1-61520-611-7.ch068

net and e-commerce is examined. Additionally, discussion about the influence of perceived risk on e-commerce adoption by end consumers is presented and future research directions on this topic are proposed.

## BACKGROUND: CONCEPT OF PERCEIVED RISK IN E-COMMERCE

Since it was introduced in the marketing and consumer behavior literature (Bauer, 1960), the perceived risk concept has been analyzed from diverse perspectives. Thus, the classical theory of decision conceives this variable as a distribution that reflects the behavior possible results, probabilities and subjective values (Pratt, 1964; Arrow, 1965). From a similar perspective, first analyses of perceived risk in the context of consumer behavior agree in defining this variable as a combination of two factors: the probability of loss as a consequence of certain behavior and the importance attributed to that loss (Kogan & Wallach, 1964; Cunningham, 1967; Cox, 1967). Nevertheless, some authors such as Sjoberg (1980) criticize this conception of perceived risk as they consider it too rigid and specific to cover such an ambiguous variable. Following this approach, Stone & Winter (1987) break away from the expectation-value traditional normative orientation and consider the perceived risk exclusively as a subjective expectation of loss (Mitchell, 1999). Finally, perceived risk has been traditionally linked to the concept of uncertainty. Thus, diverse authors have suggested that both concepts are equivalent (Bauer, 1960; Taylor, 1974). On the contrary, other researchers consider that risk and uncertainty are different concepts (Peter & Ryan, 1976; Stone & Gronhaug, 1993), but acknowledge that the distinctions between both terms have become blurred in consumer research, and risk and uncertainty are used interchangeably.

According to this approach, diverse studies have supported the disincentive effect of perceived risk or uncertainty on e-commerce acceptance and Internet shopping behavior. Hence, several authors have observed that the perceived risk has a negative effect on e-commerce adoption (Korgaonkar & Wolin, 1999; Joines et al., 2003), intention to shop on the Internet in the future (Liang & Huang, 1998; Vijayasarathy & Jones, 2000; Liao & Cheung, 2001; Salisbury et al., 2001; Pavlou, 2003; Kim et al., 2008; Herrero et al., 2009), transactions frequency (Miyazaki & Fernández, 2001), attitudes toward e-commerce (Jarvenpaa & Todd, 1997; Vijayasarathy & Jones, 2000; Fenech & O'Cass, 2001; Van der Heijden et al., 2003; Hsu & Chiu, 2004a; Shih, 2004; Herrero et al., 2009) and e-service satisfaction (Hsu & Chiu, 2004b). However, other authors have not found a significant influence of perceived risk on e-commerce acceptance (Herrero & Rodríguez del Bosque, 2008) or have found contradictory evidence (Wu & Wang, 2005), raising reasonable doubts about this issue.

## MULTIDIMENSIONAL APPROACH TO PERCEIVED RISK ON E-COMMERCE

A traditional research stream in perceived risk literature focuses on the identification and analyses of the risk facets that affect consumer behavior. In this sense, it is worth pointing out that, although very different classifications have emerged on this matter (Cunningham, 1967; Roselius, 1971; Jacoby & Kaplan, 1972; Peter & Ryan, 1976; Ingene & Hughes, 1985; Stone & Gronhaug, 1993), it is possible to identify five facets of perceived risk common to most of the approaches: economic, performance, social, time and psychological risks. Furthermore, with the development of information technologies, an additional dimension has been proposed: privacy risk (Jarvenpaa & Todd, 1997; Lim, 2003). Table 1 shows a definition for each one of these facets.

In the context of e-commerce research, few studies have analyzed the influence of perceived

*Table 1. Definition of the main perceived risk facets proposed in marketing literature (Adapted from Featherman & Pavlou, 2003)*

| Dimension | Definition |
|---|---|
| Economic, monetary or financial risk | The potential monetary outlay associated with the initial purchase price as well as the subsequent maintenance cost of the product, and the potential financial loss due to fraud. |
| Functional or Performance risk | The possibility of the product malfunctioning and not performing as it was designed and advertised and therefore mailing to deliver the desired benefits. |
| Psychological risk | Potential loss of self-esteem (ego loss) from the frustration of not achieving a buying goal. |
| Social risk | Potential loss of status in one's social group as a result of adopting a product or service, looking foolish or untrendy. |
| Time risk | Potential loss of time associated with making a bad purchasing decision by wasting time researching and making the purchase, only to have to replace it if it does not perform to expectations. |
| Privacy risk | Potential loss of control over personal information, Such as when information about you is used without your knowledge or permission. |

risk from a multidimensional perspective. On this matter, it is worth mentioning Jarvenpaa & Todd's (1997) contributions, which confirm the impact of economic, performance, social, physical and privacy risks facets on attitudes toward Internet shopping, but they do not observe their influence on future behavior intention. On the other hand, Forsythe & Shi (2003) analyze the effect that performance, financial, time and privacy risk facets have on e-commerce adoption and they observe that the first three facets affect the purchase frequency, while expenditure is only influenced by the economic component. More recently, Herrero et al. (2009) observe that financial, performance, social, time, psychological and privacy risk facets influence attitudes towards e-commerce and Internet shopping intention through overall risk perceived in e-commerce. With a more limited perspective, diverse studies have supported the influence of perceived risk specific facets on e-commerce adoption. Particularly, the empirical evidence available regarding this issue shows that shopping behavior on the Internet is negatively influenced by economic (Van den Poel & Leunis, 1999; Bhatnagar et al., 2000), performance (Dahlén, 1999; Bhatnagar et al., 2000), social (Eastlick & Lotz, 1999) and privacy (Swaminathan et al., 1999; Liu et al., 2005) risks. Nevertheless, there is not a consensus in the literature regarding which are the main facets of perceived risk that influence Internet shopping behavior.

## FUTURE RESEARCH DIRECTIONS

Although perceived risk has been traditionally identified as one of the main barriers for Internet shopping acceptance, the empirical evidence available regarding this issue is insufficient. Therefore, additional research is needed to clarify how perceived risk affects e-commerce acceptance and usage.

Firstly, the empirical evidence available about the influence of perceived risk dimensions in the scope of e-commerce and Internet shopping is limited and contradictory. Thus, although some authors have confirmed that shopping behavior on the Internet is negatively influenced by different risks facets, other studies have not obtained the same results (Forsythe & Shi, 2003; Lim, 2003). Moreover, the studies that have focused on the influence exerted by perceived risk facets on Internet shopping behaviour have considered a wide range of dependant variables as attitudes toward e-commerce (Jarvenpaa & Todd, 1997; Herrero et al., 2009), online shopping intention (Jarvenpaa & Todd, 1997; Eastlick & Lotz, 1999; Van den Poel & Leunis, 1999; Herrero et al., 2009), purchase

*Table 2. Definition perceived risk sources (Adapted from Lim, 2003)*

| Source | Definition |
|---|---|
| Technology risk | Degree to which individuals believe that if the purchase products or services through the Internet they will suffer losses caused by the Internet and its related technologies. |
| Vendor risk | Degree to which individuals believe that if the purchase products or services through the Internet they will suffer losses caused by Internet vendors |
| Consumer risk | Degree to which individuals believe that if the purchase products or services through the Internet they will suffer losses caused by social pressure (received from their families, friends or colleagues). |
| Product risk | Degree to which individuals believe that if the purchase products or services through the Internet they will suffer losses caused by products. |

frequency (Forsythe & Shi, 2003) or expenditure (Swaminathan et al., 1999; Forsythe & Shi, 2003). Therefore, the empirical evidence available does not provide a clear and consistent explanation of how the diverse dimensions of perceived risk influence Internet shopping behavior.

Likewise, it would be necessary to complement the study of perceived risk dimensions with the analyses of the sources of perceived uncertainty (Lim, 2003). Thus, while the traditional facets of perceived risk represent potential negative consequences of consumers' behaviour little attention has been paid to the study of the sources of such risk facets. The relevance of this issue is evident, as identifying the sources of perceived risk may allow Internet vendors to target their resources appropriately to reduce consumers' perceived uncertainty in online shopping. In this sense, Lim (2003) propounds four sources of risk perceived by consumers in B2C e-commerce (Table 2): technology risk, vendor risk, consumer risk, and product risk. The empirical evidence available regarding this topic is however very limited, and much research is needed to clarify which factors give place to consumer's risk perceptions about e-commerce and Internet shopping.

Finally, it would be necessary to analyze the influence of perceived risk on Internet shopping behaviour for different types of products and services. In this sense, it seems logical to think that the impact of perceived risk may vary notably between tangible goods and services, as well as between products of high and low implication. Moreover, the effect of diverse dimensions of perceived risk may be different depending of the product to purchase or its attributes. Thus, financial risk could have a more intensive influence for product categories characterized by higher prices while performance risk may be particularly relevant in the case of technological products. Similarly, social risk perceptions could have a greater influence for those products and services in which fashion and trends are especially relevant.

## CONCLUSION

Although perceived risk in e-commerce has been traditionally identified as one of the main determinants of Internet shopping behavior, the empirical evidence available regarding this topic is still insufficient and new research is need. Firstly, some authors have pointed out that the disincentive effect of perceived risk on e-commerce acceptance and usage may not be as relevant as expected (Jarvenpaa & Todd, 1997; Herrero & Rodríguez del Bosque, 2008). Moreover, there is not a consensus in literature about how perceived risk influence Internet shopping behavior. In particular, some authors have studied the effect exerted by this variable from a global perspective (Liang & Huang, 1998; Vijayasarathy & Jones, 2000; Pavlou, 2003; Van der Heijden et al., 2003; Hsu & Chiu, 2004a; Hsu & Chiu, 2004a), while other researchers have applied a multidimensional approach, considering different facets of perceived risk in e-commerce (Jarvenpaa & Todd, 1997; Bhatnagar et al., 2000; Forsythe & Shi, 2003; Herrero et al., 2009). In addition, the empirical evidence available about the influence of perceived risk dimensions is contradictory, and more research is needed to confirm which are the main facets of perceived risk that influence e-commerce acceptance and use. Finally, little attention have been paid in the literature to the identification of the sources of consumer's risk perceptions, an issue that is particularly relevant to take the appropriate measures to reduce perceived uncertainty in e-commerce.

Therefore, despite the fact that perceived risk has been traditionally considered as one of the main barriers for e-commerce acceptance and use, much research is still needed to clarify how this influence is exerted and how Internet vendors can reduce the different dimensions of risk perceived by consumers.

## REFERENCES

Arrow, K. (1965). *Aspects of the Theory of Risk Bearing*. Helsinki, Finland: Yrjö Hahnsson Foundation.

Bauer, R. A. (1960). Consumer Behavior as Risk Taking. In R.S. Hancock (Ed.), *Dynamic Marketing for a Changing World*, (pp. 389-398).

Bhatnagar, A., Misra, S., & Rao, H. R. (2000). On Risk, Convenience, and Internet Shopping behaviour. *Communications of the ACM*, *43*(11), 98–105. doi:10.1145/353360.353371

Cox, D. F. (1967). *Risk Taking and Information Handling in Consumer Behavior*. Boston: Harvard University Press.

Cunningham, S. M. (1967). The Major Dimensions of Perceived Risk. In D.F. Cox (Ed.) *Risk Taking and Information Handling in Consumer Behavior*. Boston: Harvard University Press.

Dahlén, M. (1999). Closing in on the Web Consumer – A Study of Internet Shopping. In E. Bohlin, K. Brodin, A. Lundgren, & B. Thorngren (Eds.), *Convergence in Communications and Beyond*, (pp. 1-18).

Eastlick, M. A., & Lotz, S. (1999). Profiling Potential Adopters and Non-adopters of an Interactive Electronic Shopping Medium. *International Journal of Retail & Distribution Management*, *27*(8), 209–223. doi:10.1108/09590559910278560

Featherman, M. S., & Pavlou, P. A. (2003). Predicting E-services Adoption: A Perceived Risk Facets Perspective. *International Journal of Human-Computer Studies*, *59*, 451–474. doi:10.1016/S1071-5819(03)00111-3

Fenech, T., & O'Cass, A. (2001). Internet Users' Adoption of Web Retailing: User and Product Dimensions. *Journal of Product and Brand Management*, *10*(6), 361–381. doi:10.1108/EUM0000000006207

Forsythe, S. M., & Shi, B. (2003). Consumer Patronage and Risk Perceptions in Internet Shopping. *Journal of Business Research*, *56*(1), 867–875. doi:10.1016/S0148-2963(01)00273-9

Goldsmith, R. E., & Lafferty, B. A. (2001). Innovative Online Buyers. In *Proceedings of the Society for Marketing Advances.*

Herrero, A., García de los Salmones, M. M., & Rodríguez del Bosque, I. (2009). The influence of perceived risk on Internet shopping behavior: A multidimensional perspective. *Journal of Risk Research*, *12*(2), 259–277. doi:10.1080/13669870802497744

Herrero, A., & Rodríguez del Bosque, I. (2008). Explaining B2C e-commerce acceptance: An integrative model based on the framework by Gatignon and Robertson. *Interacting with Computers*, *20*(2), 212–224. doi:10.1016/j.intcom.2007.11.005

Hsu, M. H., & Chiu, C. M. (2004a). Internet self-efficacy and electronic service acceptance. *Decision Support Systems*, *38*, 369–381. doi:10.1016/j.dss.2003.08.001

Hsu, M. H., & Chiu, C. M. (2004b). Predicting electronic service continuance with a decomposed theory of planned behaviour. *Behaviour & Information Technology*, *23*(5), 359–379. doi:10.1080/01449290410001669969

Ingene, C. A., & Hughes, M. A. (1985). Risk Management by Consumers. In J. Sheth (Ed.), *Research in Consumer Behavior 1*, (pp. 103-158). Greenwich, UK: JAI Press Inc.

Jacoby, J., & Kaplan, B. (1972). The Components of Perceived Risk. In *Proceedings of the Third Annual Conference of the Association for Consumer Research*, (pp. 382-393).

Jarvenpaa, S. L., & Todd, P. A. (1997). Is There a Future for Retailing on the Internet. In R.A. Peterson (Ed.) *Electronic Marketing and the Consumer*, (pp. 139-154). Thousand Oaks, CA: Sage Publications.

Joines, J. L., Scherer, C. W., & Scheufele, D. A. (2003). Exploring Motivations for Consumer Web Use and their Implications for E-Commerce. *Journal of Consumer Marketing*, *20*(2), 90–108. doi:10.1108/07363760310464578

Kim, D. J., Ferrin, D. L., & Rao, R. (2008). A trust-based consumer decision-making model in electronic commerce: The role of trust, perceived risk, and their antecedents. *Decision Support Systems*, *44*, 544–564. doi:10.1016/j.dss.2007.07.001

Kogan, N., & Wallach, M. A. (1964). *Risk-taking: A Study in Cognition and Personality*. New York: Holt, Rhinehart & Winston.

Korgaonkar, P. K., & Wolin, L. D. (1999). A Multivariate Analysis of Web Usage. *Journal of Advertising Research*, *39*(2), 53–68.

Laurent, G., & Kapferer, J. (1985). Measuring Consumer Involvement Profiles. *JMR, Journal of Marketing Research*, *22*, 41–53. doi:10.2307/3151549

Liang, T.-P., & Huang, J.-S. (1998). An Empirical Study on Consumer Acceptance of Products in Electronic Markets: A Transaction Cost Model. *Decision Support Systems*, *24*, 29–43. doi:10.1016/S0167-9236(98)00061-X

Liao, Z., & Cheung, M. T. (2001). Internet-based E-Shopping and Consumer Attitudes: An Empirical Study. *Information & Management*, *38*(5), 299–306. doi:10.1016/S0378-7206(00)00072-0

Lim, N. (2003). Consumers' perceived risk: Sources versus consequences. *Electronic Commerce Research and Applications*, *2*, 216–238. doi:10.1016/S1567-4223(03)00025-5

Liu, C., Marchewka, J. T., Lu, J., & Yu, C.-S. (2005). Beyond Concern – A Privacy-trust-behavioral Intention Model of Electronic Commerce. *Information & Management*, *42*(3), 289–304. doi:10.1016/j.im.2004.01.003

Mitchell, V. W. (1999). Consumer Perceived Risk: Conceptualisations and Models. *European Journal of Marketing*, *33*(1), 163–195. doi:10.1108/03090569910249229

Miyazaki, A. D., & Fernandez, A. (2001). Consumer Perceptions of Privacy and Security Risks for Online Shopping. *The Journal of Consumer Affairs*, *35*(1), 27–44.

Pavlou, P. A. (2003). Consumer Intentions to Adopt Electronic Commerce – Incorporating Trust and Risk in the Technology Acceptance Model. *International Journal of Electronic Commerce*, *7*(3), 101–134.

Peter, J. P., & Ryan, M. J. (1976). An Investigation of Perceived Risk at the Brand Level. *JMR, Journal of Marketing Research*, *13*(2), 184–188. doi:10.2307/3150856

Pratt, J. W. (1964). Risk Aversion in the Small an in the Large Firm. *Econometrica*, *32*, 122–136. doi:10.2307/1913738

Roselius, T. (1971). Consumer Rankings of Risk Reduction Methods. *Journal of Marketing*, *35*(1), 56–61. doi:10.2307/1250565

Salisbury, W. D., Pearson, R. A., Pearson, A. W., & Miller, D. W. (2001). Perceived security and World Wide Web Purchase Intention. *Industrial Management & Data Systems*, *101*(4), 165–176. doi:10.1108/02635570110390071

Shih, H. P. (2004). An Empirical Study on Predicting User Acceptance of e-Shopping on the Web. *Information & Management*, *41*, 351–368. doi:10.1016/S0378-7206(03)00079-X

Sjoberg, L. (1980). The Risks of Risk Analysis. *Acta Psychologica*, *45*(August), 301–321. doi:10.1016/0001-6918(80)90039-6

Stone, R. N., & Gronhaug, K. (1993). Perceived Risk: Further Considerations for Marketing Discipline. *European Journal of Marketing*, *27*(3), 39–50. doi:10.1108/03090569310026637

Stone, R. N., & Winter, F. W. (1985). *Risk in Buyer Behavior Contexts: A Clarification*. Working Paper 1216 EWP 860505, College of Commerce and Business Administration, University of Illinois.

Swaminathan, V., Lepkowska-White, E., & Rao, B. P. (1999). Browsers of Buyers in Cyberspace? An Investigation of Factors Influencing Electronic Exchange. *Journal of Computer-Mediated Communication*, *5*(2).

Taylor, J. W. (1974). The Role of Risk in Consumer Behavior. *Journal of Marketing*, *38*(2), 54–60. doi:10.2307/1250198

Van den Poel, D., & Leunis, J. (1999). Consumer Acceptance of the Internet as a Channel of Distribution. *Journal of Business Research*, *45*(3), 249–256. doi:10.1016/S0148-2963(97)00236-1

Van der Heijden, H., Verhagen, T., & Creemers, M. (2003). Understanding Online Purchase Intentions: Contributions from Technology and Trust Perspectives. *European Journal of Information Systems*, *12*, 41–48. doi:10.1057/palgrave.ejis.3000445

Vijayasarathy, L. R., & Jones, J. M. (2000). Print and Internet Catalog Shopping: Assessing Attitudes and Intentions. *Internet Research: Electronic Networking Applications and Policy*, *10*(3), 191–202. doi:10.1108/10662240010331948

Wu, J.-H., & Wang, S.-C. (2005). What drives mobile commerce? An empirical evaluation of the revised technology acceptance model. *Information & Management*, *42*, 719–729. doi:10.1016/j.im.2004.07.001

## KEY TERMS AND DEFINITIONS

**Economic (Monetary or Financial) Risk:** The potential monetary outlay associated with the initial purchase price as well as the subsequent maintenance cost of the product, and the potential financial loss due to fraud

**Functional (or Performance Risk):** The possibility of the product malfunctioning and not performing as it was designed and advertised and therefore mailing to deliver the desired benefits.

**Perceived Risk:** Consumers' subjective expectation of loss derived from a behavior.

**Privacy Risk:** Potential loss of control over personal information, Such as when information about you is used without your knowledge or permission.

**Product Risk:** Degree to which individuals believe that if the purchase products or services through the Internet they will suffer losses caused by products.

**Psychological Risk:** Potential loss of self-esteem (ego loss) from the frustration of not achieving a buying goal.

**Social Risk:** Potential loss of status in one's social group as a result of adopting a product or service, looking foolish or untrendy.

**Technology Risk:** Degree to which individuals believe that if the purchase products or services through the Internet they will suffer losses caused by the Internet and its related technologies.

**Time Risk:** Potential loss of time associated with making a bad purchasing decision by wasting time researching and making the purchase, only to have to replace it if it does not perform to expectations.

**Vendor Risk:** Degree to which individuals believe that if the purchase products or services through the Internet they will suffer losses caused by Internet vendors.

# Chapter 69
# Third Party Internet Seals:
## Reviewing the Effects on Online Consumer Trust

**Peter Kerkhof**
*VU University of Amsterdam, the Netherlands*

**Guda van Noort**
*University of Amsterdam, the Netherlands*

## ABSTRACT

*Buying online is still perceived as risky. A key strategy of online marketers to increase consumer trust in online ordering is to display privacy and security seals on their web sites. Although research indicates that these Internet seals do not necessarily mean better safety for online consumers, findings of several other studies demonstrated that these safety cues do influence consumer responses. The goal of this chapter is to provide the reader with an overview of findings regarding the persuasiveness of Internet seals and to reflect upon possible explanatory mechanisms for these effects. Future research directions and managerial implications for e-business are provided.*

## INTRODUCTION

Consumers perceive buying in online stores as more risky than buying in conventional stores (e.g., Miyazaki & Fernandez, 2001). Third party verification and Internet seals are important means to convey a sense of safety to potential customers. For example, many online sites show their Verisign or Trustwave security seal to convince consumers that transactions can be done safely. Similarly, many online stores proudly show their Bizrate top-ranked store awards on their homepage, or display their membership of the CNET certified store program. All these safety cues serve to persuade customers that the online store is a safe environment to conduct a purchase. The questions at hand are whether these third party security seals are indeed effective in reducing perceived risk, what determines their effectiveness, and whether a lower sense of risk as a result of encountering a third party seal is substantiated by objectively lower risks for websites carrying such a seal.

DOI: 10.4018/978-1-61520-611-7.ch069

## BACKGROUND

Many web stores display third party Internet seals on their homepage to inform consumers about their adherence to rules regarding privacy and security. Well-known examples include Verisign, Trustwave, BBBOnline, Trust.e, Validated Site, and Trust Guard. Third party Internet seals serve to promote a sense of safety among online consumers. A great body of research has shown that considerations regarding safety and risk are an impediment for shopping in an online environment (e.g., Jarvenpaa, Tractinsky, & Vitale, 2000; Miyazaki & Fernandez, 2001; Pavlou, 2003; Ranganathan & Ganapathy, 2002). Most of the risks that consumers experience on the Internet can be categorized as privacy risks and security risks. Privacy risks pertain to attempts of the online retailer to collect, use and distribute information about consumers without prior permission or even awareness of the consumer. Security risks refer to either the security of the Internet itself, or to concerns about the competence and integrity of the online retailer (Miyazaki & Fernandez, 2001).

Despite the inherent insecurity of online shopping, consumer spending on the Internet is rapidly growing. Apparently, consumers have established ways to find places that they consider safe. To establish whether a web store is safe, consumers typically do not study the privacy regulations or the conditions of use (Milne & Culnan, 2004). Instead, they rely on online cues that provide information about website privacy and security and that can be processed in a relatively effortless manner. In information economics, cues that inform the other party about characteristics such as quality or safety that cannot easily be observed, and that are relevant to a sale or an agreement are called signals (Spence, 1973). Signaling theory assumes a rational consumer that takes into account that for a firm it would be economically ill-advised to send signals that imply product or service qualities that cannot be substantiated.

Third party Internet seals are signals send to consumers to inform them that the firm adheres to certain standards regarding security and /or privacy, and that there would be adverse consequences of not adhering to these standards. Aiken and Boush (2006) note several problems in the use of third party Internet seals as signals: most consumers are unfamiliar with the (firms issuing the) seals, and the firms issuing the seals are paid by the firms carrying the seals. Others raise the question whether the most commonly used seals really denote different practices in dealing with Internet security and privacy. The evidence regarding this last question is mixed. Miyazaki and Krishnamurthy (2002) coded the privacy policy compliance of 60 major commercial websites that displayed either a third party privacy seal or no privacy seal. Their main finding was that the actual privacy policy did not differ between seal holders and non-seal holders. More recently, LaRose and Rifon (2006) compared 200 websites that either carried the Trust.e privacy seal, the BBBOnline seal or no privacy seal. The Trust.e and BBBOnline websites provided consumers with more information about their privacy regulations, deposited fewer cookies, reported more often a formal procedure for consumer complaints and provided more assurances for data security. Interestingly, websites displaying privacy seals asked for more personal information (last names, credit card number, email addresses) than websites without privacy seals. Thus, the question remains whether carrying a third party Internet seal is a reliable signal of web store safety and security.

## ARE ONLINE SAFETY CUES PERSUASIVE?

Even though an Internet seal does not necessarily mean better safety for online consumers, it might still have the effect of lowering the perception of risk among consumers. Several studies have been published about the question whether consumers perceive websites that display third party Internet seals as safer than websites without such a seal. Most of these studies employ experimental designs. In a typical experimental study, half of the participants are exposed to a website carrying a third party privacy or security seal, the other participants visit a website without such a seal. Several such studies have shown effects, particularly for respondents who think that they are in risk when shopping online. Miyazaki and Krishnamurthy (2002) showed their participants websites with the BBBOnline seal, the Trust.e seal, or no seal at all. The presence of a seal led to more favorable attitudes towards the privacy policy of the web store, and made consumers more willing to disclose personal information. This effect only occurred for the participants who perceived Internet shopping as risky, however this interaction effect could not be replicated in a follow up study.

Using a similar kind of design, LaRose and Rifon (2007) found that people who had been exposed to a warning about their privacy expected more negative outcomes, but only when the warning was not accompanied by a privacy seal. Thus, again only those who perceived risk were affected by the third party seal. The intention to disclose information about oneself on the website was higher on the website carrying a privacy seal, regardless of the privacy warning. In a similar vein, but departing from a different theoretical framework, Van Noort, Kerkhof, and Fennis (2008) demonstrated that the effect of Internet seals depends on the consumer goal. Consumers whose aim is to prevent negative outcomes rather than obtain positive outcomes (as is the case for many online consumers, see Van Noort, Kerkhof, and Fennis, 2007) are affected more strongly by Internet seals and reported lower risk perception, more positive attitudes towards the site, and higher purchase intentions.

Internet seals are not the only signals firms can use to convince consumers that their web store is safe. Firms can also use objective-source ratings like those published in Consumer Reports to lower risk perceptions and enhance trust. Alternatively, firms may try and overcome the impression that a web store comes without the huge investments that a brick-and-mortar store demands. High investments in advertising signal to consumers that a firm is certain about future profits and communicating these investments has been shown to positively affect consumer attitudes towards a brand (Kirmani, 1990). Departing from signaling theory, Aiken and Boush (2006) tested which of these three types of signaling best predicted consumer attitudes, and found that third party seals have the greatest effects on the trustworthiness of the web store, on beliefs about privacy and security and on the willingness to disclose personal information. Peterson, Meinert, Criswell II, and Crossland (2007) compared the effect of seals to the effect of self-reported privacy statements. Compared to a control condition without seal or privacy statement, Internet seal did show a positive effect on the willingness to disclose information, but a strong privacy statement had a stronger effect.

Not all studies report positive effects and some report effects on some dependent variables but not on others. For example, Kim, Ferrin, and Rao (2008) found effects of the presence of a third party seal on perceived risk, but not on consumer trust. They explain the latter by the low level of awareness of the meaning of third party seals among their participants: almost 75% did not know that websites are sometimes endorsed by third parties. McKnight, Kacmar, and Choudhury (2004) studied the effects of privacy assurances and industry endorsement seals on consumer trust in the web store within the context of services (i.e., legal advice). They found no support for the trust enhancing effects of third party Internet seals. Several other studies did not find an effect of third part seals on consumer attitudes and intentions (e.g., Houston and Taylor, 1999; Kimery & McCord, 2002).

A few studies have delved into the question which mechanisms may explain when and why Internet seals are effective in persuading online customers. Yang, Hung, Sung, and Farn (2006) depart from the Elaboration Likelihood Model (ELM; Petty & Cacioppo, 1986). The ELM states that information may be processed in either a relatively unthinking and automatic way (the peripheral route) and in a more elaborative way (the central route). People tend to reserve elaborative processing for important matters, for matters which they are knowledgeable about, and for situations in which they have the time and knowledge to do so. These conditions are typically not met for consumers shopping online. Instead, these consumers rely on the signals (peripheral cues) sent by the web store. Following this reasoning, Yang et al. (2006) find that third party seals help to build trust especially among consumers who are low in product involvement or high in (trait) anxiety. Consumers high in product involvement rely more on (high quality) product information.

Another limiting condition for the persuasiveness of Internet seals may be that Internet seals work mainly for consumers who feel they are at risk. This may be a risk specific to the purchase they plan to conduct, but this may also be a more general feeling of vulnerability, as is shown in the effect of trait anxiety reported by Yang et al. (2006), and in the effect of being focused on preventing negative outcomes as reported by Van Noort, Kerkhof, and Fennis (2008). Thus, consumers need not necessarily consciously perceive a web store as unsafe, even when they are generally anxious or in a situation where they are geared towards not making a mistake, Internet seals are more likely to affect consumers' online trust and risk perception.

## ISSUES, CONTROVERSIES, PROBLEMS

The literature so far has been quite unsystematic in the sense that there is a lot of variation in the materials used to test the effectiveness of third party Internet seals in lowering risk perceptions. This may explain why no explanations have been offered (or tested) as to why some studies do find effects of third party Internet seals on consumer attitudes, whereas others do not find such effects. Studies have been conducted among fictitious and real web stores, and among well-known or unknown web stores, Internet seals have been placed on the homepage versus the page where consumers actually make a purchase decision, and different types of products and services have been used to test the effects of Internet seals. A systematic (meta-)analysis of the influence of these differences on seal effectiveness would help to better understand the working of Internet seals and the conditions that mitigate their effects. Moreover, it may help to explain unexpected and contradictory findings.

More attention should be paid particularly to the different types of seals that were tested on their persuasiveness and to how consumers understand these seals. These seals all relate to different kinds of assurances, but it is still unclear how consumers perceive these seals. Houston and Taylor (1999) showed that seals sometimes are perceived incorrectly, and that consumers attribute more assurance to seals than they should. Also, among consumers the awareness of what Internet seals mean is very low (Kim, Steinfield, & Lai, 2008). Thus, consumers are not only unaware of the ins and outs of privacy and security regulations in general and the specific regulations of the stores they attend online, but they are also unaware of what it means to display a third party Internet seal. In fact, most consumers do not even recognize the seals that are used most often on the Internet (Kim, Ferrin, & Rao, 2008).

Aiken and Boush (2006) raise the question whether there is an optimum number of Internet seals on a web page and whether exceeding that number might lead to the perception of more risk and to less web store trust. In their own study, these authors find no effect of the number of signals on a web page, but in no experimental condition were the participants exposed to more than three signals. Yet, another study (Van Noort, 2009) examined a total of four seals commonly used in the context of online auctions and demonstrated a linear relationship between the number of signals and online spending. Future studies should look at the possibility that adding more Internet seals undermines the effectiveness of the Internet seals.

## SOLUTIONS, RECOMMENDATIONS, AND FUTURE RESEARCH DIRECTIONS

Third party Internet seals are often not recognized by consumers and may not always reflect a better practice of dealing with privacy and security but have nonetheless been shown to be effective in lowering consumer risk perception in several studies. One can wonder about whether this reflects an ideal practice of consumer dealing with safety on the Internet. Many think it does not and plead for consumer education on these matters. However, one should not be too optimistic about the effects of consumer education. Kim et al. (2008) describe the effects of an educational intervention aimed at increasing consumers' awareness of security and privacy issues. They conclude that education does help to increase awareness and the perceived importance of Internet seals. However, a host of other measures (e.g., web store trustworthiness, perceived web site information quality) did not show a significant association with the presence of Internet seals. Consumer education is needed, but at the same time may require large and enduring efforts to be effective

Several managerial recommendations for enhancing the effectiveness of Internet seals are presented and discussed in academic research, for example by LaRose and Rifon (2006). The presentation of seals on the web site might be standardized and made more salient by banishing advertisements and distracting graphics from places close to the seals. Privacy and security regulations may be standardized and presented in such a way that they are easily accessible and clearly understood by consumers. However, to our knowledge, no attempts are currently made to start a process of standardization. Another suggestion, made by Pollach (2006, 2007) regarding privacy statements, is that businesses could increase consumers' trust if they do not only address what they do with user data, but also what they do *not* do. Uncertainties about privacy risks may be reduced if consumers can learn about what practices a business does not engage in. Also, online privacy policies could reduce more uncertainties if the language used would be more exact and transparent.

Although many studies report positive effects of third party Internet seals, many questions remain unanswered. The empirical findings discussed show evidence for the persuasiveness of Internet seals, but sometimes are contradicting or rather incomparable since effects are studied on different consumer responses, and using different kinds of seals. Future research should focus on examining the relations between these responses (i.e., mediating processes between variables) and on the underlying mechanisms. Moreover, findings considering the persuasiveness of Internet seals are rather limited to self-report measures. Therefore, in studying mediating and moderating processes, persuasiveness should be studied to the full domain of consumer responses, also by using implicit measures.

In studying underlying processes, future research could focus on the information processing style of safety cues. On the one hand, Internet seals are symbols, visual elements of a web site that might serve as a heuristic. Furthermore, during online shopping, consumers are probably mostly involved with their shopping goals and less with informational symbols because they do not directly facilitate the actual product selection and its actual payment. This would imply a heuristic processing style and relatively low levels of elaboration (cf. the findings by Yang et al., 2006). On the other hand, it can also be assumed that consumers are motivated to prevent their online perceived risks and to reduce uncertainties regarding online shopping. Following the ELM (Petty & Cacioppo, 1986) this would then imply higher levels of elaboration. More research is needed to test these assumptions.

## CONCLUSION

The goal of this chapter was to provide the reader with an overview of findings regarding the persuasiveness of Internet seals and to reflect upon possible explanatory mechanisms. To reach this goal, we have summarized the effects found in a great number of studies that have been conducted on this topic and looked at whether or not persuasive effects were found, and how these findings are explained. Based on this review, the evidence for possible effects of Internet seals on online consumer trust and risk perception is mixed. Several studies show that consumers perceive less risk and are more trusting web stores that display a third party Internet seal. Third party assurances through Internet seals thus do seem to convey to online consumers a sense of safety. However, other studies show no effect of third party seals and more research is needed to establish which factors determine whether an Internet seal is effective in persuading consumers that a web store is safe. To solve these inconsistencies, future research on Internet seals should focus on the conditions under which Internet seals are effective. An important step would be to conduct a meta-analysis on the studies that already have been conducted to test the effect of Internet seals on online trust.

Fortunately, for consumers there are alternative ways to distinguish between bad and good on the Internet. Social media, like online consumer forums, may be better understood than Internet seals by online consumers. Also, retailer reputation is a powerful signal of quality. Still, Internet seals could help to boost e-commerce. More systematic research on third party seal effectiveness, better consumer education and a better differentiation by Internet seals between good and bad practices regarding privacy and security on the Internet may all help to create effective Internet seals.

## REFERENCES

Aiken, K. D., & Boush, D. M. (2006). Trustmarks, objective-source ratings, and implied investments in advertising: Investigating online trust and the context-specific nature of Internet signals. *Journal of the Academy of Marketing Science*, *34*(3), 308–323. doi:10.1177/0092070304271004

Houston, R. W., & Taylor, G. K. (1999). Consumer perceptions of CPA WebtrustSM assurances: Evidence of an expectation gap. *International Journal of Auditing*, *3*(2), 889–105. doi:10.1002/(SICI)1099-1123(199907)3:2<89::AID-IJA44>3.0.CO;2-5

Jarvenpaa, S., Tractinsky, N., & Vitale, M., M. (2000). Consumer trust in an Internet store. *Information Technology and Management Journal*, *1*, 45–71. doi:10.1023/A:1019104520776

Kim, D. J., Ferrin, D. L., & Rao, H. R. (2008). A trust-based consumer decision-making model in electronic commerce: The role of trust, perceived risk, and their antecedents. *Decision Support Systems*, *44*(2), 544–564. doi:10.1016/j.dss.2007.07.001

Kim, D. J., Steinfield, C., & Ying-Ju Lai, Y.-J. (2008). Revisiting the role of Web assurance seals in business-to-consumer electronic commerce. *Decision Support Systems*, *44*(4), 1000–1015. doi:10.1016/j.dss.2007.11.007

Kimery, K. M., & McCord, M. (2002). Third-party assurances: mapping the road to trust in e-retailing. [JITTA]. *Journal of Information Technology Theory and Application*, *4*(2), 63–82.

Kirmani, A. (1990, September). The effect of perceived advertising costs on brand perceptions. *The Journal of Consumer Research*, *17*, 160–171. doi:10.1086/208546

LaRose, R., & Rifon, N. J. (2006). Your privacy is assured - of being disturbed: websites with and without privacy seals. *New Media & Society*, *8*(6), 1009–1029. doi:10.1177/1461444806069652

LaRose, R., & Rifon, N. J. (2007). Promoting i-safety: Effects of privacy warnings and privacy seals on risk assessment and online privacy behavior. *The Journal of Consumer Affairs*, *41*(1), 127–149. doi:10.1111/j.1745-6606.2006.00071.x

McKnight, Kacmar, & Choudhury. (2004). Shifting factors and the ineffectiveness of third party assurance seals: A two-stage model of initial trust in a web business. *Electronic Markets*, *14*(3), 252–266. doi:10.1080/10196780420002452 63

Milne, G. R., & Culnan, M. J. (2004). Strategies for reducing online privacy risks: Why consumers read (or don't read) online privacy notices. *Journal of Interactive Marketing*, *18*(3), 15–29. doi:10.1002/dir.20009

Miyazaki, A. D., & Fernandez, A. (2000). Internet privacy and security: An examination of online retailer disclosures. *Journal of Public Policy & Marketing*, *19*(1), 54–61. doi:10.1509/jppm.19.1.54.16942

Miyazaki, A. D., & Fernandez, A. (2001). Consumer perceptions of privacy and security risks for online shopping. *The Journal of Consumer Affairs*, *35*(1), 27–44.

Miyazaki, A. D., & Krishnamurthy, S. (2002). Internet seals of approval: Effects on online privacy policies and consumer perceptions. *The Journal of Consumer Affairs*, *36*(1), 28–49.

Pavlou, P. A. (2003). Consumer acceptance of electronic commerce: Integrating trust and risk with the technology acceptance model. *International Journal of Electronic Commerce*, *7*(3), 101–134.

Peterson, D., Meinert, D., Criswell, J. II, & Crossland, M. (2007). Consumer trust: privacy policies and third-party seals. *Journal of Small Business and Enterprise Development*, *14*(4), 654–669. doi:10.1108/14626000710832758

Petty, R. E., & Cacioppo, J. T. (1986). *From Communication and Persuasion: Central and Peripheral Routes to Attitude Change*. New York: Springer-Verlag.

Pollach, I. (2006). Privacy statements as a means of uncertainty reduction in WWW interactions. *Journal of Organizational and End User Computing*, *18*(1), 21–46.

Pollach, I. (2007). What's wrong with online privacy policies? *Communications of the ACM*, *50*(9), 103–108. doi:10.1145/1284621.1284627

Ranganathan, C., & Ganapathy, S. (2002). Key dimensions of business-to-consumer web sites. *Information & Management*, *39*, 457–465. doi:10.1016/S0378-7206(01)00112-4

Spence, M. (1973). Job market signaling. *The Quarterly Journal of Economics*, *87*(3), 355–374. doi:10.2307/1882010

Van den Poel, D., & Leunis, J. (1999). Consumer acceptance of the Internet as a channel of distribution. *Journal of Business Research*, *45*(3), 249–256. doi:10.1016/S0148-2963(97)00236-1

Van Noort, G. (2009). *Validating the persuasiveness of online safety cues: The effect of multiple cues on online spending* Paper presented at the 8th ICORIA Conference, Klagenfurt, Austria.

Van Noort, G., Kerkhof, P., & Fennis, B. M. (2007). Online versus conventional shopping: Consumers' risk perception and regulatory focus. *Cyberpsychology & Behavior*, *10*(5), 731–733. doi:10.1089/cpb.2007.9959

Van Noort, G., Kerkhof, P., & Fennis, B. M. (2008). The persuasiveness of online safety cues: the impact of prevention focus compatibility of web content on consumers' risk perceptions, attitudes, and intentions. *Journal of Interactive Marketing*, *22*(4), 58–72. doi:10.1002/dir.20121

Yang, S. C., Hung, W. C., Sung, K., & Farn, C. K. (2006). Investigating initial trust toward e-tailers from the elaboration likelihood model perspective. *Psychology and Marketing*, *23*(5), 429–445. doi:10.1002/mar.20120

## ADDITIONAL READING

Biswas, D., & Biswas, A. (2004). The diagnostic role of signals in the context of perceived risks in online shopping: Do signals matter more on the web? *Journal of Interactive Marketing*, *18*(3), 30–45. doi:10.1002/dir.20010

Hu, X., Lin, Z., & Zhang, H. (2003). Myth or reality: effect of trust-promoting seals in electronic market. In Petrovic, O., Posch, R., Marhold, F. (Eds.), *Trust in Network Economy*, Idea Group, Hershey, PA, pp. 143-150.

Kim, D. J., Sivasailam, N., & Rao, H. R. (2004). Information assurance in B2C websites for information goods/services. *Electronic Markets*, *14*(4), 344–359. doi:10.1080/10196780412331311784

McKnight, D. H., & Chervany, N. L. (2002). What trust means in e-commerce customer relationships: An interdisciplinary conceptual typology. *International Journal of Electronic Commerce*, *6*(2), 35–59.

Tan, Y. H., & Thoen, W. (2001). Toward a generic model of trust for electronic commerce. *International Journal of Electronic Commerce*, *5*(2), 61–74.

## KEY TERMS AND DEFINITIONS

**Online Consumer Trust:** The online consumer's general belief or expectancy that a specific online firm and/or third party can be relied upon.

**Privacy Risk:** The risk that information about online consumers collected for commercial purposes is not treated in a fair and responsible manner.

**Security Risk:** The risk deriving from either the competence or integrity of an online firm or from the Internet itself that the storage or transmission of information about online consumers is not secure.

**Third Party Internet Seals:** Signals sent to consumers to inform them that the online firm adheres to certain standards regarding security and /or privacy.

# Chapter 70
# The Importance of Gender, IT Experience, and Media-Rich Social Cues on Initial Trust in E-Commerce Websites

**Khalid AlDiri**
*University of Bradford, UK*

**Dave Hobbs**
*University of Bradford, UK*

**Rami Qahwaji**
*University of Bradford, UK*

## INTRODUCTION

The rapid advance of the Internet and global information technology has changed the way many people view shopping and undertake daily transactions. Despite the Internet advantages, the rate of Internet shopping remains low; commonly explained by a lack of trust in the new shopping mode (Kim & Tadisina, 2005).

Consumer trust may be even more important in electronic transactions than in traditional forms, lacking the assurance provided in traditional settings through formal proceedings, receipts and face-to-face interactions. Since trust should play an essential role in online transactions, identifying the antecedents of a consumer's trust is important in the context of Internet transactions so that consumers can feel relaxed and confident.

However, heretofore gender differences and their impact in a technological environment were largely ignored in HCI research. In fact, there has been a general lack of investigative studies of gender in the context of information technology (IT). However, several recent studies have indicated that there may be interesting differences in how males and females perceive and use information technology. Female shopping online is gradually increasing, although relatively little is known about gender differences related to attitudes, behaviour, activities and design preferences when shopping on the web.

Also, research has yet to consider the impact of consumers' cumulative online knowledge and experiences regarding their reactions to e-vendors' trust. It is believed that as consumers gain more

DOI: 10.4018/978-1-61520-611-7.ch070

knowledge and experience with the online environment, their perceptions, attitudes and behaviours will evolve.

### Research Objectives

This research believes it is essential to establish design guidelines for increasing website trustworthiness, and aims to investigate how to increase the perceived trustworthiness of vendor websites. Attractive people in media cues (photo, video clip, avatar and audio) have been frequently utilized by the marketing industry to stimulate affective responses from consumers, while in the field of Business-to-Consumer (B2C) e-commerce they have been rarely used, even in recent years (Riegelsberger, Sasse, & McCarthy, 2005). Research into the effects of social presence cues (or interpersonal cues) represented in media cues on B2C e-commerce trust is scarce and the findings contradictory (Corritore, Kracher, & Wiedenbeck, 2003). Hence, this study investigates this element. In addition, this study further tests the effects of multiple forms of media cues on trust, based on the perceptions of different groups of users in order to investigate the effects of media cues on males and females and between IT experts and novices; all with respect to vendor website trustworthiness.

## THEORETICAL BACKGROUND AND HYPOTHESES

### Trust

Trust is a highly complex and multi-dimensional phenomenon (AlDiri, Hobbs & Qahwaji, 2008) that has been widely studied but remaining difficult to describe because of its dynamic, evolving and multi-faceted nature (Ambrose & Johnson, 1998). Basically, the key concepts of trust, highlighted in the literature, are risk, vulnerability, expectation, confidence and exploitation (Gefen & Straub, 2004).

The perception of three characteristics – ability, benevolence and integrity (trust beliefs) (Mayer, Davis & Schoorman, 1995) – can lead to the willingness of the trusting party to rely upon the trustee (trust intention) (McKnight, Choudhury & Kacmar, 2002). These three specific factors are often not observable directly, but are inferable from signals in the website interface (McKnight et al., 2002).

Many researchers in human computer interaction (HCI) have studied trust in an online context. The following factors have all been discussed as influencing trust (For more information on trust see (AlDiri et al., 2008):

- Computer error.
- Appropriate content.
- Conveying of expertise.
- Adequate information.

However, the web contains enormous numbers of alternatives, in vendors, products and prices, making it trivial to switch to different online stores after an initial visit. Thus this study focuses on the initial trust that develops after a customer's first interaction with a website.

### Online Trust and Media Cues

Various representations of social presence cues can be embedded in technology today in the form of media cues (e.g. photo, audio, video and avatar). However, research on media cue usage in websites is conflicting, with some studies finding them helpful while others finding them neutral or even negative (Corritore et al., 2003). Rich media representations may result in higher levels of trust in mediated interactions something supported by research that suggests richer representations give more interpersonal cues perhaps leading to increased trustworthiness (e.g. Nielsen, 2004).

## The Effect of Consumer Gender and Media Cues on Initial Trust In B2C E-Commerce

Literature relevant to this topic is scattered across different areas that tend to stay separate and, therefore, not well-integrated. Many empirical studies have demonstrated significant gender differences across such diverse fields as information science, human-computer interaction, economics, library science, psychology, advertising and marketing studies (AlDiri, Hobbs, & Qahwaji, 2007).

Although the literature is extensive, only a modest amount of research exists on the role of gender in online trust and the interaction between gender and media cues with respect to e-vendor trust assessment. However, since media cues represent a source that can be used for emitting interpersonal (social presence) cues, several empirical studies have demonstrated significant gender differences across various tasks and traits. Men often do better on spatial direction tasks while females usually score better on decoding verbal and nonverbal tasks (Meyers-Levy, 1989). Females were more visually oriented, more intrinsically motivated, and more romantic (Holbrook, 1986). Jones, Stanaland, & Gelb (1998) found that men and women have significant differences in their reaction to visual images which affects their recognition. In psychology, research literature shows that women can be more easily persuaded than men by nonverbal communications (Becker, 1986).

This research also aims to investigate the relationship between online trust and the gender of the user. It takes an exploratory look at whether consumers with different genders (a) differ significantly in their trusting of the vendor website, and (b) differ in relying on media cues during assessment of their first impression of e-commerce vendor trustworthiness. Hence the following research hypotheses were proposed:

**H1-a:** *Across websites embedded with media cues there will be significant differences in trustworthiness between females and males.*

**H1-b:** *Richer media cue representations will have a higher positive trust toward an e-vendor website for females compared to males.*

## The Interaction Between Consumer IT Experience and Media Cue on Initial Trust

Rieh has shown that user characteristics must be investigated for website usage to be properly understood (Rieh, 2003). IT experience may be yet another definable characteristic by which to examine subgroup differences, and cumulative Internet experience will impact both affective and cognitive components of online trust. However, many studies (e.g. Rieh, 2003) suggest that web novices tend to rely on the most basic and attractive features of the website interface they use, while web experts use their experience and can retrieve knowledge to facilitate their information processing and have sufficient knowledge to differentiate between relevant and irrelevant information.

Also, Fogg (2002) introduced a prominence-interpretation theory that describes how people assess the credibility of websites. This theory states that two things happen when people assess credibility online: 1) the user notices something, and 2) the user makes an interpretation. However, the experience and involvement of the user in regards to subject matter or website conventions represent major affective factors in this theory.

Another support of the proposition regarding this important point in recent online trust research can be found in persuasion research. Much persuasion literature (e.g. Chaiken & Maheswaran, 1994) suggests that people employ very different processing strategies when evaluating trust in different environments – and a number of two-process theories of judgment under different conditions of involvement issue have emerged: a heuristic strategy – where people base decisions on only the most apparent information. The second process is a systematic strategy that involves the detailed processing of message content. These studies describe experiments that show that People with low involvement adopted a heuristic approach to evaluating a message and were primarily influenced by the attractiveness, whereas those with high involvement adopted a systematic approach presenting more arguments to support their judgment.

Consumers with a high level of online experience are likely to have different perceptions and preferences for the attributes of the online features compared to consumers lacking such experience. Investigating this gap in knowledge in our research area has not been tackled before. However, as a result of the foregoing, the following research hypotheses were proposed:

**H2-a:** *Across websites embedded with media cues there will be significant differences in trustworthiness between IT experts and IT novices.*

**H2-b:** *Richer media cue representations will have a higher positive trust toward an e-vendor website for IT novices compared to IT experts.*

## RESEARCH METHODOLOGY

The hypothesis-testing laboratory experimental approach was used for this study, allowing relatively easy control of intervening variables. While allowing a high level of experimental control for independent variables while keeping resource requirements relatively low, a greater emphasis to maximize validity of the laboratory situation was required. Additionally, it also allows inducement of experimental laboratory financial risk that represents an important factor when investigating a complex context like online trust (Keser, 2002, Bohnet & Frey, 1999). However, it is acknowledged that financial risk in a laboratory situation does not fully model real-world complex risk, since laboratory experiments use sessions that take only a few hours and long term effects investigations generally cannot be undertaken.

This study combined two methods of collecting data by using behavioural measures, and questionnaires. In behavioural measures, rather than asking individuals for their own inferences regarding their behaviour, the researcher directly inferred it. This experiment controlled the trustworthiness of the e-commerce vendor (trustee) and the participants played the role of the trustor, having to make trust decisions based on the website interface (surface cues) they perceived. This approach observes trusting action (e.g. participant's assessment of an e-commerce vendor website) and investment of participation pay to make inferences about the participant's internal non-observable level of trust both under financial risk. As in a real situation, trusting a trustworthy vendor yielded a gain (increased participation pay), whereas trusting an untrustworthy one resulted in a loss (reduced participation pay) see Appendix.

### Experiment Participants

The study subjects comprised faculty members in the colleges of computer and information sciences in two of Saudi Arabia's Universities, males and females as they represented IT experts, and also students studying at the foundation level of computer and information science, this group represented the novice group. The sampling frames targeted towards an equal distribution between sexes and the level of expertise in order to satisfy the study objectives.

### Experiment Materials

This experiment used semi-functional copies of four existing e-commerce vendor websites whose trustworthiness was known to the researcher.

Vendor trustworthiness had been collated by independent agencies (e.g. BizRate.com). A usability test for the four experimental websites was made using the checklist developed by (Keevil, 1998). The results showed that the four websites had almost the same usability index.

However, this study investigated the effect of two media cues (media representations): video clip and avatar. Each of these media cues can be manipulated by the culture effects by using it either in a Saudi fashion or Western fashion. These media cue representations spoke in five seconds the same text (greeting), but in different languages (Arabic and English). The avatar was created with many features such as synchronized lip movements and cues of liveliness (e.g. face movement and eye blinks). However, the experiment websites display scenario was designed by a predefined method to make sure that all media cues were displayed in all websites and to avoid the participants learning effects.

## Data Collection

The experiment was designed to involve four tasks; the first was a questionnaire eliciting socio-demographic data, the second and the third were the behavioural measures (assessment, and investment) that have been adapted from (Riegelsberger et al., 2005), while the fourth was a trust questionnaire that has been adapted from Kammerer (2000), for more detail see Appendix. To examine any prior familiarity with the vendors, participants were shown logos and names of all e-commerce vendors included in the study and were asked whether they had seen the vendors' sites or shopped from them before. This served as a screening procedure and satisfied our condition for investigating initial trust.

## Data Analysis

The total number of participants was 32 of which 50% were male and 50% were female. The ages ranged from 18 to 50 years; the majority of people who responded were between 18 and 25 years representing a proportion of 50%.

The data analysis for this experiment was based on the context that the data followed an approximately normal distribution. Subsequently, a one way ANOVA can be performed since it represents a powerful and common statistical procedure, and if the results indicate a statistically significant outcome then a Least Square Difference (LSD) post hoc test and contrast test, to indicate the nature of the significance, can be applied (Sheskin, 2004).

## Identifying the Effects of Media Cues on Gender Factor With Respect To Vendor Trustworthiness

A one-way ANOVA was performed to assess the potential differences between the four websites for the following categories of participants:

- Male Experts vs. Female Experts.
- Male Novices vs. Female Novices.

Depending on the significance of the test statistic for the ANOVA, follow up comparisons were performed to assess the nature of the differences using contrast comparisons, where differences were observed, 95% confidence intervals for the average differences were calculated and specified. The analysis yielded that there were significant differences between the above groups with respect to vendor trustworthiness across all websites and throughout all study trust measures. The analysis yielded that the rating of female participants was significantly more than males throughout all study trust measures. Also, the analysis yielded that the greatest effectiveness or manipulation of media cues came from the Saudi video, the Saudi avatar, and then the Western video respectively, and the final one was a plain website without any media cues. These results appeared consistently in all key measures of vendor trustworthiness in the experiment. Thus related hypotheses are confirmed for all three keys of trust measures.

Since this study implemented three kinds of trust measures, used four e-vendors websites, and analyzed two different categories, the data analysis covered a huge range of data and due to the space limitation in this article we could not display it here.

### Identifying the Effects of Media Cues on Experience Factor With Respect To Vendor Trustworthiness

The same previous analysis procedures were performed to assess the potential differences between the four websites for the following categories of participants:

- Male Experts vs. Male Novices.
- Female Experts vs. Female Novices.

However, the analysis yielded that there were significant differences between the above groups with respect to vendor trustworthiness across all websites, and throughout all study measures. The rating of novice participants was significantly more than the experts throughout all study measures. Nevertheless, the analysis also yielded that the greatest effectiveness of media cues came from the Saudi video clip, the avatar, and then the Western video clip respectively, and the final one was a plain website without any media cues. Also, these results appeared consistently in all key measures of vendor trustworthiness in the experiment.

The findings signify the importance of the media cues and how they can interact with IT experiences to yield significant improvements with respect to vendor trustworthiness. Thus hypotheses are confirmed for all three key measures.

## DISCUSSION

### Media Cues and Participants' Gender

One of the main questions addressed by this study was to investigate the effect of visual media cues on one of the most important user characteristics, gender, and considered how this interaction affected the trustworthiness of e-commerce vendor sites. The aim was to identify whether the strategy of adding a media cue holds when tested across several vendors' sites and different types of media cues – and when trust is measured by different kinds of tools and under financial risk.

There was a noteworthy difference between male and female subjects with respect to vendor website trustworthiness in all study measurements.

The findings of this study are in line with many empirical studies that have demonstrated significant gender differences across a variety of tasks and traits (e.g. Meyers-Levy, 1989). Females may be more accurate than men in decoding nonverbal cues, and more visually oriented, intrinsically motivated, and more subjective compared to males (Meyers-Levy, 1989). Men and women have significant differences in their reaction to visual images which in turn affect their recall and recognition (Jones et al. 1998). Visual cues can be seen as tools that have a higher impact on online choices, and gender may be a basis for visual discrimination used to attract online shoppers. Also, using the selectivity model by (Meyers-Levy & Maheswaran, 1991), males do not engage in comprehensive processing of all available information but instead are selective. In contrast, females tend to use a comprehensive strategy and attempt to assimilate all available cues.

However, in cognitive theories, the research literature contains evidence of dependable gender differences in persuasiveness, with women being more easily persuaded than men (e.g. Becker, 1986). Women respond to nonverbal stimuli by evoking more associative, imagery-laced interpretations, and more elaborate descriptions than male. Men have been depicted as more analytical and logical in processing orientation, whereas women are more subjective and intuitive (Becker, 1986).

### Media Cues and Participants' IT Experience

The empirical findings provide interesting insights. Both media cues and IT experience of participants appear to play an important role in determining trust in an e-vendor. However, the finding of this study is consistent with what was hypothesized.

The interpretation of these results can be done through analyzing that, in an initial interaction; the assessment of whether a party can be trusted depends, generally speaking, on a pre experience of each party that develops through lifelong interaction. Once interaction with the trusted party takes place, this experience is mitigated. Likewise, a customer's perceived trustworthiness of an e-vendor change as he get acquainted with the Internet and learns more of its capabilities. Based on that, an expectation can be set forth regarding differences between novice and expert IT consumers. Novice and expert IT customers are likely to differ in their trust in the e-vendor. Additionally, novice customers who lack enough experience with IT are likely to depend heavily on the acquaintance of superficial antecedents that are presented in the website, while expert customers should be based on actual experience and knowledge.

However, the findings of this study are consistent with the findings of Fogg (2002) and his Prominence-Interpretation Theory, (Stanford, Tauber, Fogg & Marable, 2002), and with many persuasion studies (e.g. Albaracin & Kumkale, 2003) that been introduced in theoretical background section. This study found that experts (those having a high involvement with the website) were highly influenced by factors such as information quality and source and perceived motive, while in contrast the ordinary consumers (having a low involvement with the website) were much more influenced by the attractiveness of website design.

## CONCLUSION

This experiment first investigated gender effectiveness with respect to identifying the trustworthiness of e-commerce vendors based on surface cues. Secondly, this experiment tested the effectiveness of users' IT experience with respect to identifying the trustworthiness of e-commerce vendors based on surface cues. Thirdly, this experiment went deeper to investigate the effect of different forms of visual media cues, i.e. visual media cues (video clip and avatar) represented in an e-commerce vendor's homepage on user trust. This study found support for earlier claims that users' perceived trust for a vendor fluctuates based on the surface cues they perceive in the interface of the website with respect to their gender: female participants trusted vendors' websites on average more than the male participants. Also, the results support the earlier claims that users perceived trust for a vendor indeed differs based on the surface cues they perceive in the interface of the website with respect to their IT experience: novice participants trusted vendor websites on average more than the expert participants. A clear picture emerged regarding the effect of the media cues. Video clip was found to have a significantly more positive effect than avatar on vendor websites' trust as perceived by the experiment participants across all websites in the study and across all groups of participants, and across all trust measures.

Finally, the experiments in this research were conducted in the form of laboratory experiments. This approach had several benefits such as the possibility of controlling potential sources of error variance and experimentally manipulating the variables. However, it put limitations on the level and type of financial risk that could be observed. Furthermore, with the limited length of experiments, laboratory sessions made it difficult to study long-term effects. Further research suggests that it will indeed be important to investigate user trust over longer periods of time. Also, while the study samples provide us with a good understanding of the online behaviour of a different educated in computer and information systems consumer group, they may not provide insights into the behaviour of other consumers, as Internet use is exploding across all demographics. Finally, our research results are limited due to the sample size.

## REFERENCES

Al-Diri, K., Hobbs, D., & Qahwaji, R. (2008). The Human Face of e-Business: Engendering Consumer Initial Trust Through the use of Images of Sales Personnel on e-Commerce Websites. *International Journal of E-Business Research*, *4*(4), 58–78.

Al-Diri, K., Hobbs, D. J., & Qahwaji, R. (2007) The effect of Consumer Gender and Media Cue on Initial Trust in B2C E-Commerce. In *Proceedings of the Eighth Informatics Workshop*, (pp. 35-36). University of Bradford, UK.

Albarracin, D., & Kumkale, G. (2003). Affect as information in persuasion: A model of affect identification and discounting. *Journal of Personality and Social Psychology*, *84*, 453–469. doi:10.1037/0022-3514.84.3.453

Ambrose, P. J., & Johnson, G. J. (1998). *A trust based model of buying behaviour in electronic retailing.* Paper presented at the Fourth Conference of the Association for Information Systems.

Becker, B. (1986). Influence again: An examination of reviews and studies of gender differences in social influence. In *The psychology of gender: Advances through meta-analysis*, (pp. 178–209).

Bohnet, I., & Frey, B. S. (1999). The sound of silence in prisoner's dilemma and dictator games. *Journal of Personality and Social Psychology*, *38*, 43–57.

Chaiken, S., & Maheswaran, D. (1994). Heuristic processing can bias systematic processing: Effects of source credibility, argument ambiguity, and task importance on attitude judgment. *Journal of Personality and Social Psychology*, *66*, 460–473. doi:10.1037/0022-3514.66.3.460

Corritore, C., Kracher, B., & Wiedenbeck, S. (2003). On-line trust: concepts, evolving themes, a model. *International Journal of Human-Computer Studies*, *58*(6), 737–758. doi:10.1016/S1071-5819(03)00041-7

Fogg, B. J. (2002). *Stanford Guidelines for Web Credibility A Research Summary from the Stanford Persuasive Technology Lab*. Retrieved October 29, 2005, from http://www.webcredibility.org/guidelines

Gefen, D., & Straub, D. (2004). Consumer trust in B2C e-Commerce and the importance of social presence: experiments in e-Products and e-Services. *Omega*, *32*(6), 407–424. doi:10.1016/j.omega.2004.01.006

Holbrook, M. (1986). Aims, Concepts, and Methods for the Representation of Individual Differences in Esthetic Responses to Design Features. *The Journal of Consumer Research*, *13*(3), 337. doi:10.1086/209073

Jones, M., Stanaland, A., & Gelb, B. (1998). Beefcake and Cheesecake: Insights for Advertisers. *Journal of Advertising*, *27*(2).

Kammerer, M. (2000). *Die Bestimmung von Vertrauen in Internetangebote*. Zurich: Lizenziatsarbeit der Philisophischen Fakultaet der Universitaet Zurich.

Keevil, B. (1998, September 24-26). *Measuring the Usability Index of Your Web Site*. Paper presented at the annual Special Interest Group on Systems Documentation conference SIGDOC98, Quebec City, Province of Quebec, Canada.

Keser, C. (2002). *Trust and Reputation Building in E-Commerce.* CIRANO Working Paper 2002-75. Montreal, Canada: Cirano.

Kim, E., & Tadisina, S. (2005). Factors Impacting Customers' Initial Trust in E-Businesses: An Empirical Study. In *Proceedings of the Hawaii International Conference on System Sciences*, Big Island, HI, (pp. 1-10).

Mayer, R. C., Davis, J. H., & Schoorman, F. D. (1995). An integrative model of organizational trust. *Academy of Management Review*, *3*(20), 709–734. doi:10.2307/258792

McKnigh, D. H., Choudhury, V., & Kacmar, C. (2002). Developing and validating trust measures for e-commerce: An integrative typology. *Information Systems Research*, *13*(3), 334. doi:10.1287/isre.13.3.334.81

Meyers-Levy, J. (1989). *Gender differences in information processing: A selectivity interpretation*. Lexington: Lexington Books.

Meyers-Levy, J., & Maheswaran, D. (1991). Exploring Differences in Males' and Females' Processing Strategy. *The Journal of Consumer Research*, *18*(June), 63–70. doi:10.1086/209241

Nielsen, J. (2004). *Designing for Web Usability*. Indianapolis: New Riders Publications.

Riegelsberger, J., Sasse, M., & McCarthy, J. (2005). The mechanics of trust: A framework for research and design. *International Journal of Human-Computer Studies*, *62*(3), 381–422. doi:10.1016/j.ijhcs.2005.01.001

Rieh, S. (2003). Investigating Web searching behavior in home environments. Paper presented at the *Proceedings of the American Society for Information Science and Technology.*

Sheskin, D. J. (2004). *Handbook of Parametric and Nonparametric Statistical Procedures.* Boca Raton, FL: CRC Press.

Stanford, J., Tauber, E., Fogg, B., & Marable, L. (2002). *Experts vs. Online Consumers: A Comparative Credibility Study of Health and Finance Web Sites*. Retrieved October 13, 2006, from http://www.consumerwebwatch.org/news/report3_credibilityresearch/slicedbread

## KEY TERMS AND DEFINITIONS

**Avatar:** is a virtual representation of a human figure which is created and controlled by a computer programme.

**Business-to-Customer (B2C):** One of the most common models in e-commerce. In B2C e-commerce, the transactions are made between businesses and individual consumers.

**Culture:** is characterized as the degree to which people share attributes, values, beliefs and behaviors.

**E-Commerce:** describes the process of buying, selling, or exchanging products, services, and information via computer networks, including the Internet.

**Gender:** refers to the differences between men and women.

**Social Presence Cues:** are the Para-verbal and non-verbal signals that make a person aware of the presence of other people, it used to describe media effects on interpersonal perception.

**Video Clip:** A short video presentation.

## APPENDIX

### Assessment Measure

In this measure, participants were asked to imagine that they had enough money to buy a laptop that would serve their needs for the next two years assuming that all sites offered the product they were looking for at the same price with the same condition.

Then they were asked to rate vendors' trustworthiness on a scale from 1 for untrustworthy website to 10 for a fully trusted website. Participants deduced the trustworthiness of the vendor under research and tested their accuracy of estimation to find the trustworthiness of the e-commerce vendor from the website under a high stimuli financial risk, since their financial incentive gain was guaranteed but the amount depended on how close their assessment was. The participants' financial incentive was designed using certain mathematical formulas that satisfied this criterion.

### Investment Measure

Participants had to infer from the vendor's website interface the observable trust-cues. Based on the level of trust that resulted from these inferences, they had to decide whether and to what extent they should make themselves vulnerable, in other words engage in trusting action. Participants could invest nothing or go up to the amount gained from the assessment measure in each website. As they could invest in four websites, participants' decisions for this measure could potentially impact their final pay. The amount risked on a particular vendor was taken as a measure of the level of trust a participant had in this vendor.

# Chapter 71
# Using the Internet to Study Human Universals

**Gad Saad**
*Concordia University, Canada*

## INTRODUCTION & BACKGROUND

Many human preferences, choices, emotions, and actions occur in universally similar manners because they are rooted in our common biological heritage. As such, irrespective of whether individuals are Peruvian, French, or Togolese, they are likely to share commonalities as a result of their shared Darwinian histories. In the current article, I provide a brief overview of how the Internet is a powerful tool for investigating such human universals. Given my work at the nexus of evolutionary theory and consumption, I begin with an example from marketing.

Few marketing scholars are versed in evolutionary theory and related biological formalisms (Saad, 2007a; Saad, 2008a). As such, they generally view the environment as the key driver in shaping consumption patterns. This is part and parcel of the blank slate view of the human mind (Pinker, 2002), which purports that humans are born with empty minds that are subsequently filled via a wide range of socialization forces (e.g., parents, advertising content, or movies). Given that marketing scholars rely heavily on the expansive shoulders of socialization in explaining consumption, they are strong proponents of cultural relativism namely the notion that cultures need to be investigated from an emic perspective. Hence, marketers spend much of their efforts cataloging endless cross-cultural differences, seldom recognizing that there are numerous commonalities shared by consumers around the world.

A long-standing and yet to be resolved debate in international marketing is whether it is best to standardize one's advertising message across cultural settings or tailor-make it to each local culture (Agrawal, 1995; Theodosiou & Leonidou, 2003). Saad (2007a, chapter 4) proposed that the key reason

DOI: 10.4018/978-1-61520-611-7.ch071

that this matter has yet to be satisfactorily resolved is that marketers have not used the appropriate meta-framework for deciding which phenomena are culture-specific versus those that are human universals. Evolutionary psychology is exactly such a framework as it permits scholars to catalog marketing phenomena into three distinct categories (see Saad, 2007b, for additional details): (1) Emic-based consumption patterns that are outside the purview of evolutionary psychology as they are rooted in historical and cultural specificity. For example, that the French consume more wine than Saudis (religious edict against drinking alcohol) has nothing to do with evolutionary theory; (2) Cross-cultural differences that are rooted in adaptive processes. For example, some culinary traditions utilize a greater amount of spices than others, as a means of protecting against food-borne pathogens. It turns out that a country's latitude (which correlates with its ambient temperature) is a predictor of the extent to which spices will be used (Sherman & Billing, 1999), and this effect is greater for meat dishes as compared to vegetable dishes, since the former are more likely to contain food pathogens (Sherman & Hash, 2001). In other words, these culinary cross-cultural differences are adaptations to local environments; and (3) Human universals that are manifestations of the common biological heritage that are shared by all humans. Examples here include the universal recognition that facially symmetric individuals are beautiful, and the universal penchant for highly caloric foods.

Given its global reach, the Internet affords scholars with the capacity to explore a wide range of evolutionary-based human universals, a topic that I address in the remainder of this article. Incidentally, not only can the Internet be used to study human universals but also the Internet's own evolution can be modeled as a Darwinian process (Dovrolis, 2008).

## UNCOVERING HUMAN UNIVERSALS AND FOSSILS OF THE HUMAN MIND IN THE ONLINE MEDIUM

In their quest to understand the evolution of the human mind, evolutionary behavioral scientists including behavioral ecologists, Darwinian anthropologists, and evolutionary psychologists have cataloged a wide range of human universals (Brown, 1991; Norenzayan & Heine, 2005). The premise is that some universal phenomena transcend time and space and hence are manifestations of our evolved biology. As an example, Dr. David P. Schmitt founded the International Sexuality Description Project, which seeks to explore human universals dealing with sexuality. Surveys have been administered in 56 different nations spanning six continents, and 28 languages (cf. Schmitt et al., 2003). Such an extraordinarily laborious endeavor is greatly facilitated by the ability to use the Internet to collect cross-cultural data using online surveys. It is important to note that the reliability and validity of data collected via web-based surveys have been found to be no lesser than their offline counterparts (Gosling, Vazire, Srivastava, & John, 2004). Interested readers can refer to Birnbaum (2004) who provides a detailed discussion of the pros and cons of conducting Internet-based behavioral research, and Ilieva, Baron, and Healey (2002) who contrast several methods for collecting survey data, including the Web, when carrying out marketing research across national boundaries.

Saad (2007a) argued that since the human mind does not fossilize, one of the ways to understand its evolution is to explore cultural products that have been created by it, throughout vastly different time periods and cultural settings. Take songs as an example. Humans have been singing songs (or uttering poems) for thousands of years in wildly varying cultural traditions. Are there any universal similarities when it comes to this form of human expression? What, if any, are the similarities between King Solomon's Song of Songs, contemporary Bollywood movie love songs, hip hop songs, and the poetry of troubadours of the middle ages? For one, the great majority of songs deal with mating irrespective of the musical genre. This is perhaps not surprising given that humans are a sexually reproducing species. Secondly, the specific lyrical contents are highly indicative of evolved and hence universal mating preferences. For example, men are much more likely to sing about women's beauty whereas women are much more likely to discuss men's social status (see Saad, 2007a, chapter 5 for additional details). Given the number of websites that serve as repositories for song lyrics (in numerous languages), the Internet can be used to conduct content analyses of song lyrics across cultural settings. In the same way that paleontologists painstakingly excavate fossil and skeletal remains as a means of understanding the evolutionary history of a species, the Internet can be used to excavate fossils of the human mind (i.e., cultural products) in an attempt to understand the evolutionary forces that have shaped our human nature. Next, I turn to a study that I recently conducted along those lines.

Saad (2008b) investigated men's near-universal preference for women who possess waist-to-hip ratios of 0.70 (see Singh, 2002 for a review of the evolutionary reasons for such a preference). Using the Internet, 1,068 online profiles of female escorts were coded. Data were collected from 48 countries (25 countries in Europe; 13 in Asia; 6 in Latin America; and Canada, the United States, Australia, and New Zealand). The objective was to determine whether the WHRs that female escorts advertise online are congruent with men's evolved preference. Incidentally, the term "near-universal" recognizes the fact that men's WHR preferences are responsive to environmental contingencies. For example, in cultures where caloric scarcity and uncertainty are more likely to occur, men's WHR preferences tend to be slightly higher (see chapters in Swami & Furnham, 2008 for additional details regarding the malleability of men's WHR preferences). Saad obtained the following WHR per regional breakdown: Europe = 0.703; Asia = 0.712; Oceania = 0.75; Latin America = 0.691; North America = 0.763. The global WHR was 0.72. Additionally, Saad conducted a content analysis of the WHRs of sex dolls as advertised on a firm's web site. As expected, given men's evolved preferences, the mean WHR for the ten advertised dolls was 0.68 (see Kock et al. 2008, p. 139, for additional details). Whereas this last study could conceivably have been conducted in an offline medium (e.g., by ordering a physical catalog of the sex dolls), the escort study would have been next-to-impossible to complete without the Internet. In other words, the online medium affords scholars with the opportunity to have access to global data at their fingertips.

## FUTURE RESEARCH DIRECTIONS

Given the power of the Internet both in its ability to facilitate cross-cultural research as well as its capacity to serve as an endless repository of cultural materials, the future research opportunities at the nexus of evolutionary theory and the online medium are fertile. Possible research agendas might include:

1. Conduct content analyses on other cultural products of relevance to business as a means of demonstrating human universals. For example, assuming that advertising repositories exist on the Internet as originating from widely different countries, it becomes relatively easy to conduct content analyses of ads to explore factors that are either similar or different across cultures.
2. Establish whether an evolutionary-based finding in the offline world replicates in the online medium. For example, Dunbar (2003) summarizes research that demonstrates that evolutionarily speaking, humans evolved in bands of roughly 150 individuals. The psychologist Eliot R. Smith reported to me

during my visit to Indiana University in 2007 that in his research on online social networks (e.g., *Facebook* or *MySpace*) he found that the average number of e-friends that people had was 150. This is consistent with Golder, Wilkinson, and Huberman (2007) who found that the median number of friends for a set of 4.2 million *Facebook* users was 144. Hence, the same optimal size that is operative in the offline world replicates in the online medium. See Mahfouz, Philaretou, and Theocharous (2008), Kock (2008; 2005), and Stenstrom, Stenstrom, Saad, and Cheikhrouhou (2008), for works that have explored such correspondences between the offline and online worlds.

## CONCLUSION

The proverbial global village has become a reality given the interconnectivity that is afforded by the Internet (Barabási, 2002). That said, the Internet bears to light a more fundamental connection linking all members of the global village namely our common and evolved biological-based human nature. Hence, rather than strictly focusing on identifying cross-cultural differences in the online world (cf. Cyr, 2008; Maynard & Tian, 2004; Robbins & Stylianou, 2003, each of whom explored how firms' web sites are designed and/or evaluated differently across cultural settings), scholars can also develop a deeper understanding of our common and evolved human nature via the use of the Internet.

## REFERENCES

Agrawal, M. (1995). Review of a 40-year debate in international advertising: Practitioner and academician perspectives to the standardization/adaptation issue. *International Marketing Review*, *12*(1), 26–48. doi:10.1108/02651339510080089

Barabási, A.-L. (2002). *Linked: The new science of networks*. New York: Basic Books.

Birnbaum, M. H. (2004). Human research and data collection via the Internet. *Annual Review of Psychology*, *55*, 803–832. doi:10.1146/annurev.psych.55.090902.141601

Brown, D. E. (1991). *Human Universals*. New York: McGraw Hill.

Cyr, D. (2008). Modeling web site design across cultures: Relationships to trust, satisfaction, and e-loyalty. *Journal of Management Information Systems*, *24*(4), 47–72. doi:10.2753/MIS0742-1222240402

Dovrolis, C. (2008). What would Darwin think about clean-slate architectures? *Computer Communication Review*, *38*(1), 29–34. doi:10.1145/1341431.1341436

Dunbar, R. I. M. (2003). The social brain: Mind, language, and society in evolutionary perspective. *Annual Review of Anthropology*, *32*(1), 163–181. doi:10.1146/annurev.anthro.32.061002.093158

Golder, S., Wilkinson, D., & Huberman, B. (2007). Rhythms of social interaction: Messaging within a massive online network. *3rd International Conference on Communities and Technologies* (CT2007). East Lansing, MI. June 28-30, 2007.

Gosling, S. D., Vazire, S., Srivastava, S., & John, O. P. (2004). Should we trust web-based studies? A comparative analysis of six preconceptions about Internet questionnaires. *The American Psychologist*, *59*(2), 93–104. doi:10.1037/0003-066X.59.2.93

Ilieva, J., Baron, S., & Healey, N. M. (2002). Online surveys in marketing: Pros and cons. *International Journal of Market Research*, *44*(3), 361–376.

Kock, N. (2005). Media richness or media naturalness? The evolution of our biological communication apparatus and its influence on our behavior toward E-communication tools. *IEEE Transactions on Professional Communication*, *48*(2), 117–130. doi:10.1109/TPC.2005.849649

Kock, N. (2008). E-collaboration and e-commerce in virtual worlds: The potential of Second Life and World of Warcraft. *International Journal of e-Collaboration*, *4*(3), 1–13.

Kock, N., Hantula, D. A., Hayne, S., Saad, G., Todd, P. M., & Watson, R. T. (2008). Darwinian perspectives on electronic communication. *IEEE Transactions on Professional Communication*, *51*(2), 133–146. doi:10.1109/TPC.2008.2000327

Mahfouz, A. Y., Philaretou, A. G., & Theocharous, A. (2008). Virtual social interactions: Evolutionary, social psychological and technological perspectives. *Computers in Human Behavior*, *24*(6), 3014–3026. doi:10.1016/j.chb.2008.05.008

Maynard, M., & Tian, Y. (2004). Between global and glocal: Content analysis of the Chinese web sites of the 100 top global brands. *Public Relations Review*, *30*(3), 285–291. doi:10.1016/j.pubrev.2004.04.003

Norenzayan, A., & Heine, S. J. (2005). Psychological universals: What are they and how can we know? *Psychological Bulletin*, *131*(5), 763–784. doi:10.1037/0033-2909.131.5.763

Pinker, S. (2002). *The blank slate: The modern denial of human nature*. New York: Viking.

Robbins, S. S., & Stylianou, A. C. (2003). Global corporate web sites: An empirical investigation of content and design. *Information & Management*, *40*(3), 205–212. doi:10.1016/S0378-7206(02)00002-2

Saad, G. (2007a). *The evolutionary bases of consumption*. Mahwah, NJ: Lawrence Erlbaum.

Saad, G. (2007b). *Homo consumericus*: *Consumption phenomena as universals, as cross-cultural adaptations, or as emic cultural instantiations*. Submitted manuscript.

Saad, G. (2008a). The collective amnesia of marketing scholars regarding consumers' biological and evolutionary roots. *Marketing Theory*, *8*(4), 425–448. doi:10.1177/1470593108096544

Saad, G. (2008b). Advertised waist-to-hip ratios of online female escorts: An evolutionary perspective. *International Journal of e-Collaboration*, *4*(3), 40–50.

Schmitt, D. P., & 118 Members of the International Sexuality Description Project. (2003). Universal sex differences in the desire for sexual variety: Tests from 52 nations, 6 continents, and 13 islands. *Journal of Personality and Social Psychology*, *85*(1), 85–104. doi:10.1037/0022-3514.85.1.85

Sherman, P. W., & Billing, J. (1999). Darwinian gastronomy: Why we use spices. *Bioscience*, *49*(6), 453–463. doi:10.2307/1313553

Sherman, P. W., & Hash, G. A. (2001). Why vegetable recipes are not very spicy. *Evolution and Human Behavior*, *22*(3), 147–163. doi:10.1016/S1090-5138(00)00068-4

Singh, D. (2002). Female mate value at a glance: Relationship of waist-to-hip ratio to health, fecundity and attractiveness. *Neuroendocrinology Letters*, *23*(suppl. 4), 81–91.

Stenstrom, E., Stenstrom, P., Saad, G., & Cheikhrouhou, S. (2008). Online hunting and gathering: An evolutionary perspective on sex differences in website preferences and navigation. *IEEE Transactions on Professional Communication*, *51*(2), 155–168. doi:10.1109/TPC.2008.2000341

Swami, V., & Furnham, A. (Eds.). (2008). *The body beautiful: Evolutionary and sociocultural perspectives*. Basingstoke, UK: Palgrave Macmillan.

Theodosiou, M., & Leonidou, L. C. (2003). Standardization versus adaptation of international marketing strategy: An integrative assessment of the empirical research. *International Business Review*, *12*(2), 141–171. doi:10.1016/S0969-5931(02)00094-X

## KEY TERMS AND DEFINITIONS

**Blank Slate/Tabula Rasa:** The premise that humans are born with empty minds that are subsequently filled by a wide range of socialization forces. This has been the central dogma of the great majority of social scientists, many of whom are referred to as social constructivists.

**Cultural Relativism:** The tenet that all cultures are inherently different from one another and hence must be evaluated using their own idiosyncratic contexts. In this sense, it is antithetical to the existence of human universals.

**Evolutionary Behavioral Science:** The application of Darwinian approaches to study behavioral phenomena. Hence, behavioral ecology, Darwinian anthropology, and evolutionary psychology are sub-disciplines within the greater field of Evolutionary Behavioral Science.

**Fossils of the Human Mind:** Since the human mind does not fossilize, scientists can investigate cultural products across a wide range of cultural and temporal settings, as a means of understanding the evolution of the human mind.

**Global versus Local Advertising:** The strategic decision to either create one advertising copy that is transportable to all cultural settings (global) or tailor-make the message and associated semiotics to be in line with idiosyncratic cultural differences (local).

**Human Universal:** A phenomenon that is found in the same form irrespective of cultural setting and/or time period. Such universals are typically construed as rooted in a common biological and evolutionary-based heritage.

**Waist-to-Hip Ratio:** A morphological metric that is used by both men and women in evaluating the phenotypic quality of prospective mates.

# Chapter 72

# The Neurocognitive and Evolutionary Bases of Sex Differences in Website Design Preferences: Recommendations for Marketing Managers

**Eric Stenstrom**
*Concordia University, Canada*

**Gad Saad**
*Concordia University, Canada*

## INTRODUCTION

Marketing managers habitually use sex as a form of segmentation since it satisfies several requirements for efficient implementation including profitability, identifiability, accessibility, and measurability (Darley & Smith, 1995). Nevertheless, sex differences in marketing remain under-researched and continue to be a source of confusion for managers (Hupfer, 2002). Sex differences in cognitive processing are particularly relevant to e-business managers given that online consumers must process various types of spatial and perceptual information while navigating online. Despite the large body of evidence documenting consistent sex differences in cognition (Kimura, 2004), there is a paucity of research exploring how male and female consumers respond differently to various website design aspects (Cyr & Bonanni, 2005; Moss, Gunn, & Heller, 2006; Simon, 2001). Moreover, the few studies that have examined sex differences in online preferences were not grounded in any consilient theoretical framework.

The main objective of this paper is to examine how sex differences in the processing of spatial and perceptual information lead to differential preferences in website design for men and women. We argue that sex differences in website design preferences are best understood within a framework based on both recent findings in neurocognitive psychology and on evolutionary theory (as originally reported in Stenstrom, Stenstrom, Saad, & Cheikhrouhou, 2008). Such a framework would enable e-business managers to tailor the design of their websites ac-

DOI: 10.4018/978-1-61520-611-7.ch072

cording to the sex ratio of their clientele. In other words, depending on whether a website is equally visited by both sexes, or largely visited by only one of the two sexes, will determine the design features of the site in question. The structure of this chapter is as follows. First, the latest cognitive and neuropsychological evidence relating to sex differences in spatial and perceptual processing are explored, including a discussion of the particular selective pressures that have led to their emergence. This section also includes an examination of how these sex differences are likely to translate into the corresponding sex differences in the online processing of information. Next, website design recommendations for e-business managers are put forth, followed by a discussion of possible future research avenues.

## BACKGROUND

Researchers have highlighted the importance of website design as an antecedent of e-satisfaction (Evanschitzkya, Iyer, Hessea, & Ahlerta, 2004; Szymanski & Hise, 2000) and trust (Cho, 2006). Yet, few papers have investigated how various website design aspects are differentially appreciated by men and women (Cyr & Bonanni, 2005; Simon, 2001), and have done so without any consilient theoretical grounding. Our framework is based on the evolutionary underpinnings of sex differences in cognition, these being founded on the differential roles assumed by men and women throughout our evolutionary history. Specifically, whereas men predominantly hunted, women primarily gathered. This division of labor exerted a sex-specific selective pressure on various aspects of human cognition, leading to male cognitive abilities specialized for hunting and female cognitive abilities specialized for gathering (Alexander, 2003; Geary 1995; New, Krasnow, Truxaw, & Gaulin, 2007; Silverman & Eals, 1992). In the ensuing section, sex differences in spatial and perceptual processing are reviewed in light of the evolutionary forces that led to their development. In addition, the findings from the few studies that have investigated how men and women process online information differently are discussed within the context of our proposed framework.

## SEX DIFFERENCES IN COGNITIVE PROCESSING AND WEBSITE DESIGN PREFERENCES

### Spatial Processing

Sex differences in the processing of spatial information have been studied widely, particularly with regards to navigation, object location, and spatial rotation. It has been suggested that men evolved a large-scale, orientation-based (i.e., Euclidean) navigational style due to the fact that hunting required the tracking of animals over novel expansive terrain while maintaining one's spatial orientation in order to find a direct route back home. In contrast, women are believed to have evolved a short-scale, landmark-based (i.e., topological) navigational style given that gathering necessitated the collection of various fruits and plants in relatively close proximity to home (Choi & Silverman, 1996; Silverman & Eals, 1992). Numerous studies have demonstrated sex differences in navigational styles and abilities that are in line with the notion that males and females have inherited sexually dimorphic navigational propensities. When completing navigational tasks or when providing directions, women rely mainly on landmarks, whereas men focus more on Euclidean properties of the environment (Dabbs, Chang, Strong, & Milun, 1998; Galea & Kimura, 1993; Saucier et al., 2002). Men are more proficient than women in route-learning tasks in virtual three-dimensional mazes in terms of time efficiency and errors committed (Moffat, Hampson & Hatzipantelis, 1998), as well as accuracy in pointing in the direction of the maze's starting point (Lawton & Morrin, 1999). The male advantage in navigation is also evident in environments resembling those traveled by ancestral hunters. After being lead through a long, circuitous route through a wooded area, men performed better than women in pointing to the starting position and returning to it via the most direct route (Silverman et al., 2000).

In the online realm, navigating through websites seems to rely on similar cognitive processes to those operative in naturalistic environments. Websites are hierarchically structured and require navigation through various pages. When browsing online, clicking on links to go from one page to the next is likely processed cognitively in a similar manner as when navigating from one physical area to another. In line with this reasoning, Simon (2001) reported that women were more likely to favor websites with pull-down menus rather than those that require clicking through numerous levels of pages. Given that a pull-down menu can serve as a landmark, this finding suggests that women might also utilize a landmark navigational style in the online realm. In addition, this finding implies that women may disfavor deep navigational structures that necessitate browsing through multiple levels of pages void of a landmark. Cyr and Bonanni (2005) asked participants to select a digital camera on a major electronics website and measured the participants' reactions to the website task. Women rated the website as being more difficult to navigate than did men. However, the study was limited given that no website design elements were manipulated as a means of establishing a causal relationship between a website's navigational structure and ease of navigation. Stenstrom, Stenstrom, Saad, and Cheikhrouhou (2008) recently conducted a pilot study examining how efficiently men and women perform product search tasks in one of two book websites that vary in navigational structure. Whereas both sites had the exact same informational content, one site was wide but shallow with two levels of navigational depth, whereas the other was deep but narrow with five levels of depth. Compared to women, men reported taking less time performing the search task in the website with a deeper structure that required navigation through various levels of web pages. In addition, men appeared to be more efficient in the deeper website compared to the wider website by reportedly spending less time conducting the tasks in the deeper structure than their male counterparts who navigated in the wider one. These results suggest that a website with a deeper navigational structure is better suited for the male orientation navigational style than the female landmark style.

Women have evolved the ability to outperform men in spatial tasks that gauge object-location memory. Ancestral foraging required the ability to remember the location of a wide variety of static food sources and the detection of subtle changes in the environment as the food sources ripened over time (Silverman & Eals, 1992). The female advantage in object-location memory has been demonstrated utilizing a variety of paper-and-pencil and computer-mediated tasks (Alexander, Packard, & Peterson, 2002; Eals & Silverman, 1994; Lejbak, Vrbancic, & Crossley, 2009; Voyer, Postma, Brake, & Imperato-McGinley, 2007). This female advantage has also been found in naturalistic environments. At a farmer's market, women pointed more accurately towards the location of various food products that had been previously seen (New et al., 2007).

Numerous studies have shown that men tend to outperform women in mental spatial rotation tasks. Geary (1995) proposed that this male advantage in spatial rotation tasks stems from the spatial requirements of hunting, namely throwing projectiles at moving targets. In both pencil-paper and computer-mediated tasks that require the mental rotation of complex shapes, males perform better in matching objects that are different only in their three-dimensional spatial orientation (Hubona & Shirah, 2006; Shepard & Metzler, 1971; Voyer, Voyer, & Bryden, 1995). Sex differences in spatial rotation processing are evident in the differential patterns of brain activation between men and women when engaged in such tasks.

Functional magnetic resonance imaging (fMRI) studies examining mental rotation have yielded sex differences in spatial task-related activation patterns (Jordan, Wustenberg, Heinze, Peters, & Jancke, 2002).

Males appear to utilize a more effective and automatic "bottom-up" spatial processing pattern whereas females use a more cognitively effortful "top-down" neural strategy during spatial rotation tasks (Butler et al., 2006). The manner in which men and women differentially process the rotation of objects is particularly relevant to web design. Advances in web design technologies have enabled consumers to visualize products in three-dimensions while allowing them to control their rotation. However, given its high production costs, the use of rotation technology is mainly used for relatively high-priced products (e.g., cars). The benefit of investing in the three-dimension portrayal of products likely depends on the sex of one's consumer base. In line with this reasoning, Cyr and Bonanni (2005) found that men perceived the three-dimensional portrayal of a digital camera, via a set of photos taken from several different angles, as being more meaningful than did women. In sum, the literature suggests that men and women have evolved dimorphic spatial cognitions that engender sex differences in online preferences. Next, sex differences in perceptual processing are explored.

## Perceptual Processing

Men and women possess specialized perceptual systems also rooted in the ancestral sex-specific roles in food foraging and game hunting (Alexander, 2003). Sex differences in perceptual processing, which are particularly relevant to the online realm, include the processing of movement, form, and color. Neurologically speaking, the human visual system can be categorized into the parvocellular and magnocellular processing streams (Bullier, Schall, & Morel, 1996; Milner, Paulignan, Dijkerman, Michel, & Jeannerod, 1999). The female perceptual system is biased towards the parvocellular pathway, which deals primarily with the processing of colors. On the other hand, the male perceptual system is biased towards the magnocellular pathway, which is predominantly responsible for the processing of motion and spatial information. Given that foraging required the identification of edible plants and ripe fruits from large varieties of vegetation, a more developed parvocellular visual pathway would have provided ancestral women with a significant adaptive advantage. For men, a more developed magnocellular visual pathway was crucial for successfully detecting moving animals and throwing projectiles at them as accurately as possible (Alexander, 2003).

That men and women have inherited sexually differentiated perceptual systems is supported by numerous empirical findings. Men display faster reaction times (Silverman, 2006) and judge the relative velocity and trajectory of moving objects more accurately than do women (Law, Pellegrino, & Hunt, 1993; Poduska & Phillips, 1986). Males also have an accuracy advantage when throwing projectiles (Watson & Kimura, 1991). Furthermore, motion-related perceptual sex differences appear very early in development. For example, one-day-old boys have been found to exhibit stronger preferences for moving objects than one-day-old girls (Connellan, Baron-Cohen, Wheelwright, Batki, & Ahluwalia, 2000). Given that the male perceptual system is more sensitive to moving stimuli, males should pay more attention to, and make more efficient use of, moving web elements. In line with this reasoning, Simon (2001) reported that a greater number of surveyed males favored websites that had extensive animated objects and graphics as compared to females. Likewise, Cyr and Bonanni (2005) found that men conveyed a preference towards the animations and interactivity of a website more so than did women.

Although males tend to perform better in motion-related tests, females have an advantage in tasks involving the processing of colors and object features. For example, females outperform males both in object and form discrimination (Overman, Pate, Moore, & Peuster, 1996), as well as in color naming tasks (Bornstein, 1985). In addition, whereas only an estimated 0.4% of women have inherited color blindness or green-red perception deficiencies, their prevalence in men is estimated at 8% (Birch, 1993). In the online medium, Cyr and Bonanni (2005) reported that women were more attracted to the colors of a website than were men. It is also possible that the use of vibrant red and green hues might be particularly appreciated by women given that the ability to perceive these two colors is particularly dependent on the parvocellular pathway (Hendry & Reid, 2000). In addition, since women have an advantage in discriminating between objects and forms, it is likely that they will be less distracted by visual clutter and respond more favorably to a large number of product images located on a single web page. To sum up, men and women have inherited specialized cognitions that manifest themselves in the online world as sexually differentiated website preferences. Recommendations to e-business managers are proposed next.

## Recommendations

Given the aforementioned literature on sex differences in spatial and perceptual processing, e-business managers should tailor their websites according to the sex of their target market. For websites intended for a primarily male market, we recommend a deep rather than wide navigational structure to suit the male navigational style. We also advise e-business managers to invest in dynamic web elements in order to capture and maintain the interest of male browsers. In addition, the use of web elements which are displayed three-dimensionally, and those that can be rotated by users are more likely to be worth the investment for a male clientele. Given the female advantage in object-location memory, women will likely be more proficient than men in remembering the locations of products presented within a wide array of items on a single web page. Thus, men will likely benefit more from website programs that assist in finding a previously-viewed product for purchase. Finally, the use of colors to portray meaning should be used with greater caution for a male clientele given the relatively high prevalence of color-blindness in men. For websites designed for a primarily female market, we recommend having noticeably visible landmarks on every web page to clearly indicate their location within the site, in order to suit the female navigational style. Likewise, the use of pull-down menus that enable navigation while staying on the home page, as well as the emphasis on the choice of colors are more likely to be appreciated by the female clientele. Future research avenues are explored next followed by our concluding remarks.

## FUTURE RESEARCH DIRECTIONS

The framework and recommendations proposed herein can be empirically tested in future studies. Additionally, to further investigate sex differences in online navigational style, clickstream analyses could shed light on the particular navigational paths taken by men and women (cf., Kalczynski, Sénécal, & Nantel, 2006). Research relating to the response to movement might be enriched via the use of eye tracking technology to test sex differences in attention to moving website elements (e.g., banner ads). Another worthy avenue of future research would be to consider within-subject variations in cognitive abilities. For instance, a woman's navigational and mental rotation abilities have been found to depend on which phase of her menstrual cycle that she is in (Hausmann, Slabbekoorn, Van Goozen, Cohen-Kettenis, & Güntürkün, 2000). Accordingly, might women's website preferences change across their menstrual cycles? Finally, our framework can be extended to other computer-mediated environments such as videos games, as well as other elements of a firm's marketing mix such as advertising and product design (for an evolutionary perspective on sex differences in brand design preferences, see Moss, Hamilton, & Neave, 2007).

## CONCLUSION

E-business managers must make important decisions such as how to structure their websites, whether to use moving elements, which color schemes to use, and whether to invest in portrayals of rotating products. We posit that the optimal design will likely depend on whether the given consumer base is primarily male or female. By better understanding the cognitive and evolutionary bases of sex differences in website design preferences, e-business managers will be better able to meet the needs of their online clientele.

## REFERENCES


Alexander, G. M. (2003). An evolutionary perspective of sex-typed toy preferences: Pink, blue, and the brain. *Archives of Sexual Behavior*, *32*(1), 7–14. doi:10.1023/A:1021833110722

Alexander, G. M., Packard, M. G., & Peterson, B. S. (2002). Sex and spatial position effects on object location memory following intentional learning of object identities. *Neuropsychologia*, *40*(8), 1516–1522. doi:10.1016/S0028-3932(01)00215-9

Birch, J. (1993). *Diagnosis of defective colour vision*. New York: Oxford University Press.

Bornstein, M. H. (1985). On the development of color naming in young children: Data and theory. *Brain and Language*, *26*(1), 72–93. doi:10.1016/0093-934X(85)90029-X

Bullier, J., Schall, J. D., & Morel, A. (1996). Functional streams in occipito-frontal connections in the monkey. *Behavioural Brain Research*, *76*(1-2), 89–97. doi:10.1016/0166-4328(95)00182-4

Butler, T., Imperato-McGinley, J., Pan, H., Voyer, D., Cordero, J., & Zhu, Y. S. (2006). Sex differences in mental rotation: Top-down versus bottom-up processing. *NeuroImage*, *32*(1), 445–456. doi:10.1016/j.neuroimage.2006.03.030

Cho, J. (2006). The mechanism of trust and distrust formation and their relational outcomes. *Journal of Retailing*, *82*(1), 25–35. doi:10.1016/j.jretai.2005.11.002

Choi, J., & Silverman, I. (1996). Sexual dimorphism in spatial behaviors: Applications to route-learning. *Evolution & Cognition*, *2*(2), 165–171.

Connellan, J., Baron-Cohen, S., Wheelwright, S., Batki, A., & Ahluwalia, J. (2000). Sex differences in human neonatal social perception. *Infant Behavior and Development*, *23*(1), 113–118. doi:10.1016/S0163-6383(00)00032-1

Cyr, D., & Bonanni, C. (2005). Gender and website design in e-business. *International Journal of Electronic Business*, *3*(6), 565–582. doi:10.1504/IJEB.2005.008536

Dabbs, J. M. Jr, Chang, E. L., Strong, R. A., & Milun, R. (1998). Spatial ability, navigation strategy, and geographic knowledge among men and women. *Evolution and Human Behavior*, *19*(2), 89–98. doi:10.1016/S1090-5138(97)00107-4

Darley, W. K., & Smith, R. E. (1995). Gender differences in information processing strategies: An empirical test of the selectivity model in advertising response. *Journal of Advertising*, *24*(1), 41–56.

Eals, M., & Silverman, I. (1994). The hunter-gatherer theory of spatial sex differences: Proximate factors mediating the female advantage in recall of object arrays. *Ethology and Sociobiology*, *15*(2), 95–105. doi:10.1016/0162-3095(94)90020-5

Evanschitzkya, H., Iyer, G. R., Hessea, J., & Ahlerta, D. (2004). E-satisfaction: A re-examination. *Journal of Retailing*, *80*(3), 239–247. doi:10.1016/j.jretai.2004.08.002

Galea, L. A. M., & Kimura, D. (1993). Sex differences in route learning. *Personality and Individual Differences*, *14*(1), 53–65. doi:10.1016/0191-8869(93)90174-2

Geary, D. C. (1995). Sexual selection and sex differences in spatial cognition. *Learning and Individual Differences*, *7*(4), 289–301. doi:10.1016/1041-6080(95)90003-9

Hausmann, M., Slabbekoorn, D., Van Goozen, S. H. M., Cohen-Kettenis, P. T., & Güntürkün, O. (2000). Sex hormones affect spatial abilities during the menstrual cycle. *Behavioral Neuroscience*, *114*(6), 1245–1250. doi:10.1037/0735-7044.114.6.1245

Hendry, S. H. C., & Reid, R. C. (2000). The koniocellular pathway in primate vision. *Annual Review of Neuroscience*, *23*, 127–153. doi:10.1146/annurev.neuro.23.1.127

Hubona, G. S., & Shirah, G. W. (2006). The Paleolithic stone age effect? Gender differences performing specific computer-generated spatial tasks. *International Journal of Technology and Human Interaction*, *2*(2), 24–48.

Hupfer, M. (2002). Communicating with the agentic woman and the communal man: Are stereotypic advertising appeals still relevant? *Academy of Marketing Science Review, 2002*(3). Retrieved from http://www.amsreview.org/articles/hupfer03-2002.pdf

Jordan, K., Wustenberg, T., Heinze, H. J., Peters, M., & Jancke, L. (2002). Women and men exhibit different cortical activation patterns during mental rotation tasks. *Neuropsychologia*, *40*(13), 2397–2408. doi:10.1016/S0028-3932(02)00076-3

Kalczynski, P., Sénécal, S., & Nantel, J. (2006). Predicting online task completion with clickstream complexity measures: A graph-based approach. *International Journal of Electronic Commerce*, *10*(3), 123–143. doi:10.2753/JEC1086-4415100305

Kimura, D. (2004). Human sex differences in cognition: Fact, not predicament. *Sexualities, Evolution & Gender*, *6*(1), 45–53.

Law, D. J., Pellegrino, J. W., & Hunt, E. B. (1993). Comparing the tortoise and the hare: Gender differences and experience in dynamic spatial reasoning tasks. *Psychological Science*, *4*(1), 35–40. doi:10.1111/j.1467-9280.1993.tb00553.x

Lawton, C. A., & Morrin, K. A. (1999). Gender differences in pointing accuracy in computer-simulated 3D mazes. *Sex Roles*, *40*(1-2), 73–92. doi:10.1023/A:1018830401088

Lejbak, L., Vrbancic, M., & Crossley, M. (2009). The female advantage in object location memory is robust to verbalizability and mode of presentation of test stimuli. *Brain and Cognition*, *69*(1), 148–153. doi:10.1016/j.bandc.2008.06.006

Milner, A. D., Paulignan, Y., Dijkerman, H. C., Michel, F., & Jeannerod, M. (1999). A paradoxical improvement of misreaching in optic ataxia: New evidence for two separate neural systems for visual localization. *Proceedings. Biological Sciences*, *266*(1434), 2225–2229. doi:10.1098/rspb.1999.0912

Moffat, S. D., Hampson, E., & Hatzipantelis, M. (1998). Navigation in a "virtual" maze: Sex differences and correlation with psychometric measures of spatial ability in humans. *Evolution and Human Behavior*, *19*(2), 73–87. doi:10.1016/S1090-5138(97)00104-9

Moss, G., Gunn, R., & Heller, J. (2006). Some men like it black, some women like it pink: Consumer implications of differences in male and female website design. *Journal of Consumer Behaviour*, *5*(4), 328–341. doi:10.1002/cb.184

Moss, G., Hamilton, C., & Neave, N. (2007). Evolutionary factors in design preferences. *Journal of Brand Management*, *14*(4), 313–323. doi:10.1057/palgrave.bm.2550073

New, J., Krasnow, M. M., Truxaw, D., & Gaulin, S. J. C. (2007). Spatial adaptations for plant foraging: Women excel and calories count. *Proceedings. Biological Sciences*, *274*(1626), 2679–2684. doi:10.1098/rspb.2007.0826

Overman, W. H., Pate, B. J., Moore, K., & Peuster, A. (1996). Ontogeny of place learning in children as measured in the radial arm maze, Morris search task, and open field task. *Behavioral Neuroscience*, *110*(6), 1205–1228. doi:10.1037/0735-7044.110.6.1205

Poduska, E., & Phillips, D. G. (1986). The performance of college students on Piaget-type tasks dealing with distance, time, and speed. *Journal of Research in Science Teaching*, *23*(9), 845–848. doi:10.1002/tea.3660230908

Saucier, D. M., Green, S. M., Leason, J., MacFadden, A., Bell, S., & Elias, L. J. (2002). Are sex differences in navigation caused by sexually dimorphic strategies or by differences in the ability to use the strategies? *Behavioral Neuroscience*, *116*(3), 403–410. doi:10.1037/0735-7044.116.3.403

Shepard, R. N., & Metzler, J. (1971). Mental rotation of three-dimensional objects. *Science*, *171*(972), 701–703. doi:10.1126/science.171.3972.701

Silverman, I. (2006). Sex differences in simple visual reaction time: A historical meta-analysis. *Sex Roles*, *54*(1-2), 57–69. doi:10.1007/s11199-006-8869-6

Silverman, I., Choi, J., MacKewn, A., Fisher, M., Moro, J., & Olshansky, E. (2000). Evolved mechanisms underlying wayfinding: Further studies on the hunter-gatherer theory of spatial sex differences. *Evolution and Human Behavior*, *21*(3), 201–213. doi:10.1016/S1090-5138(00)00036-2

Silverman, I., & Eals, M. (1992). Sex differences in spatial abilities: Evolutionary theory and data. In J. H. Barkow, L. Cosmides, & J. Tooby (Eds.), *The adapted mind: Evolutionary psychology and the generation of culture,* (pp. 533-549). New York: Oxford University Press.

Simon, S. J. (2001). The impact of culture and gender on web sites: An empirical study. *The Data Base for Advances in Information Systems*, *32*(1), 18–37.

Stenstrom, E., Stenstrom, P., Saad, G., & Cheikhrouhou, S. (2008). Online hunting and gathering: An evolutionary perspective on sex differences in website preferences and navigation. *IEEE Transactions on Professional Communication*, *51*(2), 155–168. doi:10.1109/TPC.2008.2000341

Szymanski, D. M., & Hise, R. T. (2000). E-satisfaction: An initial examination. *Journal of Retailing*, *76*(3), 309–322. doi:10.1016/S0022-4359(00)00035-X

Voyer, D., Postma, A., Brake, B., & Imperato-McGinley, J. (2007). Gender differences in object location memory: A meta-analysis. *Psychonomic Bulletin & Review*, *14*(1), 23–38.

Voyer, D., Voyer, S., & Bryden, M. P. (1995). Magnitude of sex differences in spatial abilities: A meta-analysis and consideration of critical variables. *Psychological Bulletin*, *117*(2), 250–270. doi:10.1037/0033-2909.117.2.250

Watson, N. V., & Kimura, D. (1991). Nontrivial sex differences in throwing and intercepting: Relation to psychometrically-defined spatial functions. *Personality and Individual Differences*, *12*(5), 375–385. doi:10.1016/0191-8869(91)90053-E

## ADDITIONAL READING

Buss, D. M. (1999). *Evolutionary psychology: The new science of the mind*. Boston, MA: Allyn and Bacon.

Dennis, C., & McCall, A. (2005). The savannah hypothesis of shopping. *Business Strategy Review*, *16*(3), 12–16. doi:10.1111/j.0955-6419.2005.00368.x

Ecuyer-Dab, I., & Robert, M. (2004). Have sex differences in spatial ability evolved from male competition for mating and female concern for survival? *Cognition*, *91*(3), 221–257. doi:10.1016/j.cognition.2003.09.007

Joseph, R. (2000). The evolution of sex differences in language, sexuality, and visual-spatial skills. *Archives of Sexual Behavior*, *29*(1), 35–66. doi:10.1023/A:1001834404611

Pinker, S. (2002). *The blank slate: The modern denial of human nature*. New York: Penguin Putnam.

Saad, G. (2007). *The evolutionary bases of consumption*. Mahwah, NJ: Lawrence Erlbaum.

## KEY TERMS AND DEFINITIONS

**Euclidean Navigation:** A navigational strategy that utilizes geometrical properties of the environment such as distances, angles, and cardinal directions.

**Evolutionary Psychology:** The study of the adaptive functions of the mind and how its cognitive structure was shaped by natural and sexual selection to solve recurrent problems that existed in human ancestral environments.

**Functional Magnetic Resonance Imaging (fMRI):** A neuroimaging technique that measures neural activity in the brain and allows the mapping of particular brain areas associated with various psychological phenomena.

**Hunter-Gatherer Theory:** The proposition that the sexual division of labor that existed throughout human evolution when men primarily hunted while women predominately gathered led to the evolution of sex-specific cognitive abilities.

**Neurocognitive Psychology:** The study of cognitive functions and their associations to particular brain areas and neural pathways.

**Pull-Down Menu:** A list of navigational options that appears only when the item is selected.

**Topological Navigation:** A navigational strategy that relies predominantly on landmarks and their relational properties.

# Chapter 73
# Exploring Video Games from an Evolutionary Psychological Perspective

**Zack Mendenhall**
*Concordia University, Canada*

**Marcelo Vinhal Nepomuceno**
*Concordia University, Canada*

**Gad Saad**
*Concordia University, Canada*

## INTRODUCTION AND BACKGROUND

Video games are a relatively recent form of entertainment whose sales growth has been enormous (almost 700% from 1996 to 2007), with sales for 2007 reaching 9.5 billion dollars in the US (Entertainment Software Association, 2007). This figure does not include the sales of hardware components such as consoles and accessories, or subscriptions to high-speed Internet providers. To contextualize this sales figure, the US cinema industry garnered 9.6 billion dollars domestically in the same year (MPAA, 2007). The video game industry is so robust that it appears to be impervious to the current economic crisis (Economist, December 20, 2008).

Video game research typically follows one of two avenues. Authors either champion games for their positive effects on users (hand-eye coordination, problem solving, and teamwork, for instance) or lament them for promoting violence (see Mäyrä, 2008 for a broad overview of gaming studies). More recent work (Ducheneaut et al., 2006) has focused on descriptive statistics of online gamers, but all these streams of research tend to rely on "Blank Slate" reasoning (Pinker 2002), leading them to overlook robust explanations of video gaming phenomena. Of relevance to the current article, video games are seldom studied from an evolutionary psychological perspective (but see Cherney & Poss, 2008; Kock, 2008; Mazur, Susman, & Edelbrock, 1997). On a related note, Stenstrom et al. (2008) find evidence for sex-differentiated strategies in navigating websites, with these results being potentially applicable to the video gaming context. In the current paper we demonstrate how an evolutionary psychological (EP)

DOI: 10.4018/978-1-61520-611-7.ch073

approach could elucidate why this entertainment choice has increased in popularity, and how it is related to our evolved human nature. We begin by describing relevant video game genres, to illustrate the latest developments and trends in the industry. Subsequently we highlight links between some of these genres and EP principles.

Different game genres tend to attract players with highly heterogeneous demographics, personalities, and motivations to play. Whereas the industry has developed numerous genres, we restrict our discussion to two major genres that are highly distinguishable from one another: *Massively Multiplayer Online Role Playing Games (MMORPG)* and *First Person Shooters (FPS)*. *MMORPG*s are based on the classic pen-and-paper role-playing games. These games were originally played in a setting similar to that in which one might play a board game (i.e., around a kitchen table, with friends and family). The RPG was created during the 1970s and since then has quickly evolved. Traditionally the RPG is an interpretive game in which the participants create characters and role-play as their character in an imaginary world. Players aim to become powerful entities in that world, and typically cooperate in that pursuit. The objective of traditional RPGs is vague. There is no end-point (as in most games); one simply 'adventures' until one dies or gets bored. Killing monsters and saving princesses are common threads, however.

RPGs established a style of game play that MMORPGs inherited. Central to this style is the notion that an avatar grows in power over time. This concept was formalized by implementing 'experience points' and 'levels.' As characters slay monsters or complete quests, they are awarded 'experience points.' When they have accumulated a sufficient amount of experience points, they 'level up.' Characters begin at level 1, and each subsequent level up requires more experience points than the previous. By digitizing the rules of traditional RPGs, MMORPGs have obviated many of the problems native to the pen-and-paper format. Players of MMORPGS do not have to keep tabs of their own experience points, levels, or calculate damage, for instance. Aspects of the game which required rote computation are now handled by the computer.

*First Person Shooter* games are the most frequently studied genre by scholars wishing to correlate video games to real-world violence. In these games, the avatar is controlled using the first person perspective. To succeed in the game, the player must use a variety of weapons (rifles, laser guns, chainsaws, etc.) to shoot, dismember, or subdue enemies. This genre of game often comes in two modes. In the story-driven mode, which can be played either alone or as part of a team, enemies are controlled by fairly advanced artificial intelligences. The second (and more popular) mode is "player versus player," which encourages direct competition between human players (and not against an artificial intelligence). In time, players become skilled tacticians and will form teams (often called clans) of compatible players and compete online and/or in official tournaments. A major selling point of FPSs is the competitiveness that is triggered amongst the relevant consumer base.

## KEY EVOLUTIONARY PSYCHOLOGY CONCEPTS

The basic tenet of EP is that evolution does not only shape physical traits but also mental ones. Furthermore, EP posits that the human mind consists of domain-specific mechanisms that have evolved to solve specific evolutionarily relevant challenges. EP has developed into a field with immense explanatory power. Interested readers can refer to Barkow, Cosmides, and Tooby (1992) and Buss (2005a) for exhaustive overviews of areas in which EP has been applied. It is important to note that EP is most often employed to understand *ultimate* causes of phenomena, in contrast to *proximate* ones. For example, a proximate explanation of the subjective enjoyment of sex would involve detailed analyses of the neuronal mechanisms at work. An ultimate explanation attempts to clarify *why* (in the adaptive sense of the question) sex is pleasurable (to ensure the extension of one's genes).

Two core concepts from EP will be used herein to analyze video games. The first is the Savanna Principle, which posits that if a theory is discordant with the environmental realities in which *Homo sapiens* evolved, it will eventually be rejected (Kanazawa, 2004). However, a theory that is congruent with the ancestral environment in which humans have evolved will be more likely to withstand scientific scrutiny. For example, any theory that posits no innate sex differences is incongruent with the Savanna Principle, as it is clear that the two sexes have faced some adaptive problems that are sex-specific. For the current purposes, one can argue that successful video games are those that adhere most closely to central tenets of the Savanna Principle. Secondly, Saad (2007) highlighted the fact that mental traits (as compared to corporeal ones) do not leave a fossil record. Whereas osteologists and biological anthropologists have documented the phylogenetic history of *Homo sapiens* through their meticulous collection of fossil remains, no such fossil or skeletal record exists for the evolution of the human mind. As such, Saad suggests that cultural products can be understood as fossils of the human mind. One can apply this logic in analyzing the contents of video games.

## VIDEO GAMES AS 'SAVANNA SIMULATORS'

Our minds possess features that are designed to optimize survival and reproduction in the African savanna, as it was during the Pleistocene era. Such an environment had predators, prey, mates, family, friends, enemies, and natural hazards. Contemporary humans enjoy many of the same pursuits as those tackled long ago by our ancestors. Since modern technological environments change faster than our genes do, the value propositions of modern day products can be thought of as appealing to our 'Savanna' psychology. Thus, successful products often cater to our survival and reproduction (e.g., fast food restaurants cater to our evolved liking for highly caloric food sources). The lack of engaging plotlines in hardcore pornography is driven by the recognition that men have an evolved penchant for 'no-strings-attached' sexual encounters. Accordingly, the themes in pornographic movies replicate contents that are congruent with evolved male psychology. With that in mind, what are the evolved proclivities that video games must indulge in order to satisfy consumer needs?

Video games provide consumers with a virtual experience. It only makes good sense then that the best-selling of these experience packages are ones which most effectively and efficiently tap into the psychological motives that were shaped by natural and sexual selection in the Pleistocene savanna. It follows that we should expect certain game features to necessarily accord with the rules of 'reality' as our minds have evolved to perceive it. For example, adhering to tenets of folk physics is rather important in a video game. Accordingly, this has accelerated technological advances that accurately recreate believable physical laws in virtual worlds. In any recently developed FPS game, if an avatar is shot from behind while standing on a balcony, he will properly fold over that balcony and tumble to his doom with 'satisfying' realism. That said, some game elements could be construed as forms of escapism including the ability to fly (which is hardly congruent with folk physics and/or folk biology). Interestingly, many of these "reality-busting" abilities are reserved for expert players. In other words, escapism from the constraints of our biological reality could be viewed as a reward (e.g., *World of Warcraft* allows only extremely high-level players to ride on flying mounts). In so doing, these violations of reality become badges of honor meant to signal one's proficiency and status to other players.

Knowing one's position within a hierarchy of social status is an enduring problem for social species, and thus, humans have evolved mechanisms for signaling and interpreting status (Cummins, 1996). In the MMORPG, this task is expedited. Every character's level is an honest signal of ability, and the information can be acquired by simply clicking on the appropriate button. No player can lie about their level as occurs in real life where people oftentimes misinform others regarding their achieved status. In most game genres, other evolutionarily important phenomena are artificially (conspicuously) present. Most character options are hyperbolically sex-typed (see the female characters in the recent *Age of Conan*, and the male characters in the *Gears of War* series). This sex-typing invariably exaggerates sexually attractive characteristics. For female characters, faces tend to have highly estrogenized features (large, narrow-set eyes, round faces, small noses, small chins, and full lips), as well as fertile-looking bodies (low waist-to-hip ratios, symmetric bosoms and bottoms, and a youthful gait). On the other hand, faces of male characters tend to be testosteronized (wide-set eyes, larger noses, square jaw, large cleft chins, and thin lips), and bodies tend to exude physical dominance (tall, exceedingly muscular, and far more agile than any real-life, comparably-sized body builder).

Games are designed at the level at which human beings have evolved to perceive reality. Richard Dawkins communicated this point eloquently when he stated: "…there is more to truth than meets the eye; or than meets the all too limited human mind, evolved as it was to cope with medium-sized objects moving at medium speeds through medium distances in Africa." (2003, p. 19). This is why game designers only bother to recreate environments at the medium scale. Games are not colorful recreations of a generic reality, but recreations of an adaptive (and thus, biased) *human* reality, with certain psychologically salient (evolutionarily relevant) elements distilled down to their most compelling forms. Elucidating all of the different psychological mechanisms to which video games appeal would be a lengthy endeavor, so the present article focuses on one broad theme: the manner by which video games provide players with a forum to acquire and signal status, at a 'cost' (financially and biologically) that is far lower than any real-life equivalent.

## DIGITAL 'PEACOCKING': GAMES AS CONDUITS FOR SIGNALING STATUS

Evolution by natural selection is a process whereby wasteful traits are typically selected out of the gene pool. If so, what might explain the evolution of the peacock's tail, which is large, colorful, and iridescent, implying that it requires a lot of energy and resources to grow and to preen, and it serves to make the peacock an *easier* meal for a Bengal tiger—natural predator of the peacock? Darwin suggested that ornaments could evolve through *sexual* (as opposed to *natural)* selection. If a trait yielded reproductive benefits, it could be selected notwithstanding the fact that its conspicuousness resulted in a shorter lifespan to the organism. However, in the case of the peacock's tail, the disadvantage of such a tail (via natural selection) appears to be so great that sexual selection would seem insufficient to yield its evolution.

In 1975, the Israeli biologist Amotz Zahavi solved the puzzle via "the handicap principle." Zahavi's discovery originated from work with a different avian species (Arabian babbler), but the principle generalizes to peacocks. It posits that peacocks with the largest, brightest, and most ornate tails probably possess the best genes. The reason that this signal is accurate is *precisely because* such tails are also the most encumbering. Therefore, any peacock surviving *despite* his tremendous tail is signaling that he has the necessary traits to survive. Signals are indicators of traits that are otherwise not directly observable including fertility, genetic quality, or dominance. For an excellent book on the evolution of the human mind as a signaling device, the reader is referred to Miller (2000).

Signaling is both ubiquitous and diverse in *Homo sapiens*. We signal with clothes, vocabulary, grades, degrees, mastery of trivia, cars, houses, etc. Within the video gaming context, status-signaling was originally accomplished in arcade games by having one's initials positioned on a scoreboard, which would scroll by while the machine idled. In order to get your initials on the screen, you had to be an elite player, and many rolls of quarters and endless hours were lost in the pursuit. Since the only way to achieve a high score is to play well, one's score serves as a credible signal of playing ability. For a telling example of status signaling (and cheating) among arcade gamers, see the documentary film *The King of Kong* (2007).

The primary mode of signaling in the player versus player mode of a FPS is via one's score. Points are accrued by defeating enemies, and lost by accidentally harming oneself or one's teammates. It is safe to conclude that the player with the highest score was not only more accurate with weapons but also was better at predicting enemy behavior, memorizing the locations of useful items and weapons in the arena, and had excellent hand-eye coordination and three-dimensional spatial rotation skills. More complex scoring schemes include partial credit for assistance in kills and in accomplishing group objectives when appropriate. In such a communal situation a high score can act as a signal of sportsmanship or of loyalty toward a team. Note that coalitional thinking with its requisite loyalty to in-group members is an adaptive mental mechanism (cf. Kurzban, Tooby, & Cosmides, 2001). At times, skilled players engage in self-handicapping by using only low-power weapons. In so doing they augment the credibility (honesty) of their achieved score (signal) by making it (the score) more difficult to acquire. Incidentally, all kills are broadcast in real time to all of the players. As such, everyone knows who killed you and with which weapon you were killed. In attempting to elucidate the ultimate cause of these dominance-signaling behaviors, we must consider the adaptive payoffs that such competitive signaling might have had, an issue to which we turn to next.

For most animals, intra-sexual competition is usually resolved prior to the occurrence of serious injuries. This is accomplished via signaling. If one male detects that his rival has a reasonably better chance to defeat him, he will slink away, perhaps defeated but alive to fight another day. In social species, a sufficient number of these encounters between many different individuals will stratify them into dominance hierarchies. Sporting seasons (which involve repeated tests of skill and the determination of a 'champion team') are an excellent example of dominance stratification among humans (see De Block & Dewitte, 2009 for a Darwinian-based approach for studying sports). FPSs offer consumers the ability to vicariously slay rivals without risking death, time, money or the energy needed to master a sport. Daly and Wilson (1988) and Buss (2005b) have contributed vastly to our understanding of the evolutionary roots of violence among *Homo sapiens*. They uncovered startling evidence of sex-differentiation in the propensity for violence, and particularly so when reproductive success is at stake. Accordingly, evolutionary theory can explain the overrepresentation of males who play FPSs, as such virtual games trigger men's greater penchant for violence.

In MMORPGs, signaling is taken even further than in FPSs. As previously discussed, players accumulate publicly displayed levels. These serve to objectively differentiate characters in terms of how powerful they are. Additionally, players' accoutrements (such as swords, axes, boots, spaulders, and helmets) serve as signals of their accomplishments. Certain items can only be gained through highly intricate teamwork over an extended period of time with focused effort.

Characters are often seen in garish, intricate, matching sets of armor (like a peacock's tail). These armor sets can take months for a player to acquire, so they act as reliable signals of dedication, skill, and teamwork.

Since humans are a social species with highly altricial (dependent) offspring, perseverance through hard times and dedication to cooperative endeavors are desirable traits to possess. This is particularly true for women when evaluating prospective mates. In order to be selected by women, men will most often brag about their occupational accomplishments, their income, and their potential for career advancement. They will also derogate other men along these same dimensions (Schmitt & Buss, 1996). It is perhaps not surprising then that some of the attractive design features of MMORPGs are those that appeal to this universal desire for social status.

One might argue that dedicated gamers are wasting their time acquiring virtual status when they could be expending the same amount of effort into achieving "real-world" status. In the high-risk, high-reward pursuit of status in real life, the chance that one might exert substantial effort and not experience the expected bump in status is daunting. From an evolutionary perspective, organisms need not be concerned with maximizing the *accuracy* of their decisions, but in *minimizing* the cost of errors (Haselton & Buss, 2000). When we look at MMORPGs through this lens, it seems clear that players are receiving feedback that they are growing in status and prestige at a rate that is more rapid and more predictable than that which they can experience in the real world. Despite the dedication required to acquire status-imbuing items and levels, there is *certitude* to their availability. We propose that this is precisely the computational tradeoff that takes place in the mind of the MMORPG enthusiast: "I can put in the same amount of time and energy elsewhere and risk getting nothing back, or I can put it into my MMORPG and become a master of a virtual domain."

Ultimately, the MMORPG and the FPS are successful because they offer users a psychological experience that was, during the evolution of our species, a rare but honest signal of a fitness-promoting activity. The gaming industry has designed products that harness these evolved motives by tricking our brains to respond in universally predictable manners albeit in a novel online medium.

## FUTURE RESEARCH DIRECTIONS

Given the paucity of research at the intersection of evolutionary psychology and gaming studies, the future research opportunities appear endless. In addition to the ideas that we have presented in this paper that have yet to be empirically tested, we provide below a list of possible topics worthy of investigation:

- Do economic rules in MMORPGs conform to evolved mechanisms meant to reduce cheating?
- Do the sizes of 'raid' groups in virtual war games approximate that of hunter-gatherer war bands?
- Does the sexually dimorphic 2D:4D finger ratio, which is shaped by an individual's in utero exposure to sex-specific hormones, correlate with gaming preferences? In other words, do masculinized (feminized) ratios map onto masculinized (feminized) gaming preferences? In some preliminary research conducted by our group, there appears to be some evidence for this effect.
- How does anonymity affect behavior? Since players are represented by their avatars, which fitness-related indulgences might they pursue without fearing any social repercussions?
- Players often belong to publicly announced groups called 'guilds.' How does game

design reflect evolved in-group and out-group dynamics?

- Do games that are more popular with each of the two sexes possess features that map onto sex-specific adaptive problems? For example, *The Sims* is the best-selling game of all time, and women constitute the majority of players. Many of the pursuits in this game (e.g., running a family and developing meaningful and intimate relationships) are stronger drivers of the female psyche.
- Do virtual landscapes correspond to evolutionary-based landscape preferences as postulated by prospect-refuge theory (Orians & Heerwagen, 1992)?
- Are there sex differences in games such as *Second Life* that replicate evolutionary-based sex differences in the offline world? For example, are women more likely to seek meaningful and intimate relationships in *Second Life* whereas men are more likely to desire short-term mating opportunities? In other words, are evolved behaviors in the offline world transferable to the virtual medium (Lucas & Sherry, 2004)?

## CONCLUSION

Traditionally, videogames have been studied using non-evolutionary approaches. In the present paper, we discussed how the success of the videogame industry can be analyzed using an evolutionary psychological approach. EP is grounded in a parsimonious and consilient meta-framework, and thorough empirical research. Based on constructs derived from evolutionary science (the savanna principle and the handicap principle), we suggest that gamers' motives include strong desires both to compete in dominance hierarchies and to conspicuously signal social status. The future research opportunities at the nexus of evolutionary theory and gaming studies are highly promising.

## REFERENCES


Barkow, J., Cosmides, L., & Tooby, J. (Eds.). (1992). *The adapted mind: Evolutionary psychology and the generation of culture*. New York: Oxford University Press.

Buss, D. M. (Ed.). (2005a). *The handbook of evolutionary psychology*. New York: Wiley.

Buss, D. M. (2005b). *The Murderer Next Door: Why the Mind is Designed to Kill*. New York: Penguin.

Cherney, I. D., & Poss, J. L. (2008). Sex differences in nintendo Wii™ performance as expected from hunter-gatherer selection. *Psychological Reports*, *102*, 745–754. doi:10.2466/PR0.102.3.745-754

Cummins, D. D. (1996). Dominance hierarchies and the evolution of human reasoning. *Minds and Machines*, *6*, 463–480.

Daly, M., & Wilson, M. (1988). *Homicide*. Piscataway, NJ: Aldine Transaction.

Dawkins, R. (2003). *A devil's chaplain*. Boston: Mariner Books.

De Block, A., & Dewitte, S. (2009). Darwinism and the cultural evolution of sports. *Perspectives in Biology and Medicine*, *52*(1), 1–16. doi:10.1353/pbm.0.0063

Ducheneaut, N., Yee, N., Nickell, E., & Moore, R. J. (2006). Building an MMO With Mass Appeal: A Look at Gameplay in World of Warcraft. *Games and Culture*, *1*(4), 281–317. doi:10.1177/1555412006292613

Economist, The. (2008). *Play On*. Retrieved January 15, 2009, from http://www.economist.com/business/displayStory.cfm?source=hptextfeature&story_id=12815694

Entertainment Software Association. (2007). *Industry Facts.* Retrieved January 15, 2009, from: http://www.theesa.com/facts/index.asp

Haselton, M. G., & Buss, D. M. (2000). Error management theory: A new perspective on biases in cross-sex mind reading. *Journal of Personality and Social Psychology*, *78*, 81–91. doi:10.1037/0022-3514.78.1.81

Kanazawa, S. (2004). The savanna principle. *Managerial and Decision Economics*, *2*, 41–54. doi:10.1002/mde.1130

Kock, N. (2008). E-collaboration and e-commerce in virtual worlds: The potential of Second Life and World of Warcraft. *International Journal of e-Collaboration*, *4*(3), 1–13.

Kurzban, R., Tooby, J., & Cosmides, L. (2001). Can race be erased? Coalitional computation and social categorization. *Proceedings of the National Academy of Sciences of the United States of America*, *98*(26), 15387–15392. doi:10.1073/pnas.251541498

Lucas, K., & Sherry, J. L. (2004). Sex differences in video game play: A communication-based explanation. *Communication Research*, *31*(5), 499–523. doi:10.1177/0093650204267930

Mäyrä, F. (2008). *An introduction to game studies: Games in culture*. London: Sage.

Mazur, A., Susman, E. J., & Edelbrock, S. (1997). Sex difference in testosterone response to a video game contest. *Evolution and Human Behavior*, *18*(5), 317–326. doi:10.1016/S1090-5138(97)00013-5

Miller, G. F. (2000). *The mating mind: How sexual choice shaped human nature.* New York: Doubleday.

Motion Picture Association of America. (2007). *Entertainment Industry Market Statistics*. Retrieved January 15, 2009, from: http://www.mpaa.org/USEntertainmentIndustryMarketStats.pdf

Orians, G. H., & Heerwagen, J. H. (1992). Evolved responses to landscapes. In J. H. Barkow, L. Cosmides, & J. Tooby (Eds.), *The adapted mind: Evolutionary psychology and the generation of culture* (pp. 555–580). New York: Oxford University Press.

Pinker, S. (2002). *The blank slate: The modern denial of human nature.* New York: Viking.

Saad, G. (2007). *The evolutionary bases of consumption*. Mahwah, NJ: Lawrence Erlbaum.

Schmitt, D. P., & Buss, D. M. (1996). Strategic self-promotion and competitor derogation: Sex and context effects on the perceived effectiveness of mate attraction tactics. *Journal of Personality and Social Psychology*, *70*, 1185–1204. doi:10.1037/0022-3514.70.6.1185

Stenstrom, E., Stenstrom, P., Saad, G., & Cheikhrouhou, S. (2008). Online hunting and gathering: An evolutionary perspective on sex differences in website preferences and navigation. *IEEE Transactions on Professional Communication*, *51*(2), 155–168. doi:10.1109/TPC.2008.2000341

Zahavi, A. (1975). Mate selection: A selection for a handicap. *Journal of Theoretical Biology*, *53*, 205–221. doi:10.1016/0022-5193(75)90111-3

## KEY TERMS AND DEFINITIONS

**Evolutionary Psychology:** The study of the human mind as consisting of domain-specific mental capacities, as forged by the dual forces of natural and sexual selection.

**First Person Shooter (FPS):** A video-game genre in which the player views the scenario from the eyes of the protagonist and wherein the challenge is based mostly on shooting a wide range of enemies.

**Handicap Principle:** A theory that explains the evolution of costly traits (e.g., peacock's tail) via sexual selection.

**Massively Multiplayer Online Role-Playing Game (MMORPG):** A video-game genre in which players assume the role of a fictional character through which they interact with an immense number of players through the Internet. In MMORPGs, the scenario (world) in which the game takes place continues to evolve even when the player is away from the game.

**Savanna Principle:** Hypotheses regarding human behavior that do not account for *Homo sapiens'* evolutionary history in African savannas will, in time, be falsified.

**Sexual Selection:** The evolution of morphological traits or behaviors as a result of intersexual wooing (e.g., plumage coloration in some male birds) or intra-sexual competition (e.g., moose antlers used for combat).

**Signaling Theory:** The study of how animals including humans typically communicate their value along unobservable traits (e.g., risk-taking proclivity or dominance).

**Ultimate Causation:** The adaptive reason behind a particular phenomenon of interest. For example, the greater proclivity for men to engage in violent forms of intra-sexual competition is rooted in the evolutionary force of sexual selection.

**Virtual World:** An online/digital environment such as *Second Life* wherein individuals simultaneously interact, typically through the use of self-chosen avatars.

# Chapter 74
# An Integrated Model for E-CRM in Internet Shopping:
## Evaluating the Relationship between Perceived Value, Satisfaction and Trust

**Changsu Kim**
*Yeongnam University, Korea*

**Weihong Zhao**
*Jiangxi Normal University, China*

**Kyung Hoon Yang**
*University of Wisconsin-La Crosse, USA*

## INTRODUCTION

Customer relationship management in electronic commerce (e-CRM) is one of the fastest growing management techniques adopted by online enterprises (Letaifa & Perrien, 2007). Much research has been done on topics such as e-CRM management (Romano & Fjermestad, 2003; Letaifa & Perrien, 2007), e-CRM marketing techniques (Jackson & Wang 1995; Pan & Lee, 2003), the adoption of e-CRM in organizations (Wu & Wu, 2005), and e-CRM applications that facilitate Internet business (Wang & Head 2001; Adebanjo, 2003; Joo & Sohn, 2008). Still, many online enterprises encounter difficulties implementing effective e-CRM because they tend to overlook customer's perspective on e-CRM issues (Woodcock & Starkey, 2001).

The objective of this study is to develop an integrated e-CRM model by investigating the psychological process that occurs when a customer maintains a long-term relationship with an Internet online retailer. By highlighting key factors, a series of dynamic linkages among these factors affecting customer long-term relationship orientation are empirically investigated. Finally, managerial implications and limitations are discussed in the conclusion.

DOI: 10.4018/978-1-61520-611-7.ch074

## BACKGROUD

### Overview of Web-Based Customer Relationship Management

E-CRM is a newly developed customer-oriented business philosophy that reorients online enterprise operations in order to improve customer satisfaction, loyalty, and retention (Adebanjo, 2003; Pan & Lee, 2003; Letaifa & Perrien, 2007). Many of the e-CRM facets that are analyzed in the literature correspond to the stages discussed in Oliver's cognitive-affective-cognitive-action model for loyalty (1980). In the next three sections, e-CRM is explained in terms of the cognitive, affective, and cognitive stages that lead to the final stage of "action loyalty."

### Explanation of Cognitive Belief

Purchasing stages in Internet shopping can be classified into five phases: information research, placing an order, requesting post-purchase services, delivery options and online payment (Nour & Fadlalla, 2000). Through these experiences, customers have a cognitive response related to the perceived benefits and costs of a purchase from a specific retailer (Zeithaml 1988). Cognition can also be described as awareness, knowledge, or beliefs that may or may not have been derived from previous shopping experiences (Fishbein, 1967).

According to the Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975; Ajzen & Fishbein, 1980), an individual's performance is determined by his or her behavioral intentions, which are jointly determined by cognitive factors such as attitudes and subjective norms. As an extended model of TRA, the Theory of Planned Behavior (TPB) was derived by adding the perceived behavioral control as a determinant of behavior (Ajzen, 1985). Davis (1989) proposed the Technology Acceptance Model (TAM), based on TRA and TPB, to explain and predict the user's acceptance of information systems or information communication technology (ICT). In TAM, cognitive beliefs such as the perceived usefulness and perceived ease of use are counted as key factors for technology acceptance. The three theories (TRA, TPB, and TAM) have been widely validated and are widely used to predict or explain the cognitive behavior in social psychology.

### Explanation of Affective Experience

The expectation-confirmation theory (ECT) has suggested that satisfaction is the primary motivation for the continued purchase of a product or service (Oliver, 1980). The majority of previous studies consider satisfaction to be an effective response to an expectancy confirmation involving a cognitive process (Pascoe 1983; Melone 1990; Taylor 1994; Oliver, 1997). Anderson and Srinivasan (2003) suggest that customer satisfaction should be evaluated as a positive, indifferent, or negative feeling following the customer's initial experience with the service. This affective evaluation is identical to the notion of attitude in the IS-use literature (Melone 1990), and the attitude-intention association validated in IS-use research provides additional support for the association between satisfaction and choice or continued usage (Davis, 1989; Mathieson 1991; Taylor & Todd 1995).

### Explanation of Cognitive Behavior

Geyskens et al. (1996) describe commitment as a customer's long-term orientation toward a business relationship. Morgan and Hunt (1994), Kalafatis and Miller (1997), and Wu and Cavusgil (2006) consider commitment as the crucial factor in determining long-term customer retention. Morgan and Hunt's (1994) empirically validated and widely accepted commitment-trust theory (CTT) claims that long-term relationships are built on the foundation of mutual "trust-commitment," which is similar to the process of creating long-term traditional buyer-seller relationships (Wu & Cavusgil, 2006; Pan et al., 2006). Because of the connection between customer commitment and the buyer-seller relationship, inducing customer commitment is a crucial issue for the development and implementation of an e-CRM strategy.

On the basis of CTT, some researchers have analyzed the importance of trust in online relationships as a cognitive response to cognitive beliefs and affective experiences (Lee & Turban, 2001; McKnight & Chervany, 2002). Lack of trust has been regarded as one of the greatest factors inhibiting online business (Marti & Garcia-Molina, 2006). On the other hand, Business Week (2001) reported that customers are willing to frequently buy from the most trusted sites. Thus, online retailers rely on strong trust to build committed, cognitive customer behavior.

## An Integrated Model for E-CRM in Internet Shopping

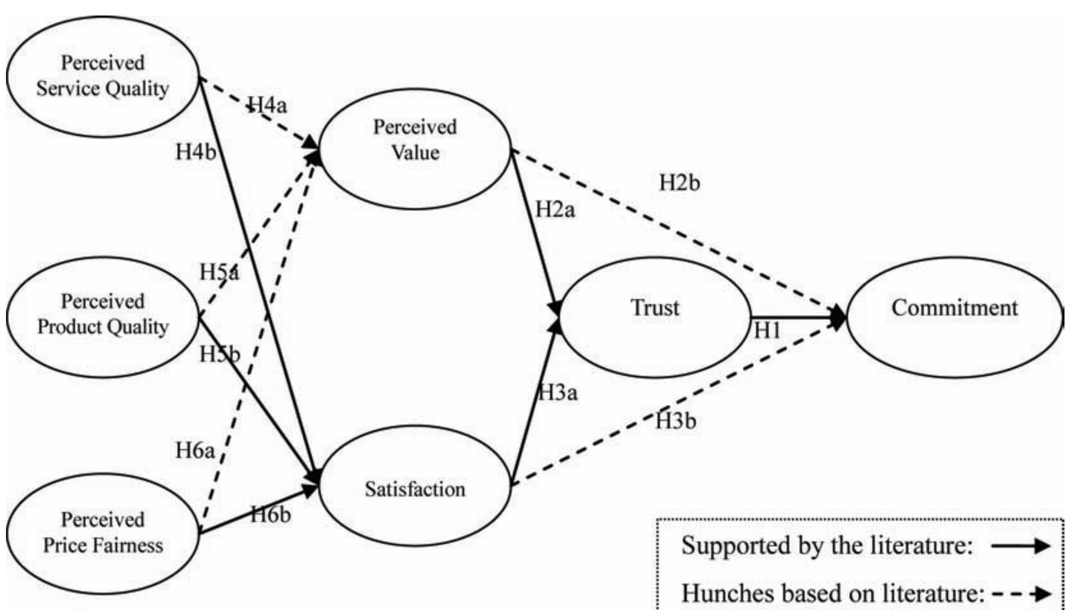
Based on the theoretical background, this study suggests that e-CRM should satisfy customers' psychological needs and induce them to commit to long-term relationships.

Previous studies from manifold research areas such as technology and human factors have contributed to successful e-CRM. The majority of studies have focused on factors that affect customers' long-term relationship orientation (Cole et al. 1999; Sukpanich & Chen 1999; Liu & Arnett 2000; Phau & Poon 2000; Vellido et al. 2000). Less research has been centered on an integrated conceptual model to explain why customers commit to a long-term exchange relationship with a specific online retailer.

To address this gap in the research, this study concentrates on customers' cognitive beliefs, affective experiences and cognitive behaviors in order to propose an integrated model for e-CRM that identifies a series of linkages among the psychological variables of perceived value, satisfaction and trust. In addition, three key exogenous variables affecting shopping experiences are considered for the integrated model (see Figure 1).

As shown in Figure 1, trust is regarded as the key factor affecting customer relationship commitment

*Figure 1. An integrated model for e-CRM in internet shopping*



(Morgan and Hunt 1994; McKnight & Chervany, 2002; Flavian et al., 2006). Perceived value (as a cognitive belief) and satisfaction (as an affective experience) directly and indirectly influence trust (as conative behaviors) and commitment. According to related literature, however, this cognitive belief or affective experience alone is insufficient; both are critical antecedents to behavioral intention, which can be considered a cognitive behavior (Cronin et al., 2000; Parasuraman & Grewal, 2000; Sirdeshmukh et al., 2002).

In examinations of exogenous factors influencing customer commitment, most studies have focused on service quality (Sharma & Patterson, 1999; Zeithaml et al., 2000; Venetis & Ghauri, 2004; Joo & Sohn, 2008). Much attention has been given to the intangibility of service quality (Bebko, 2000; Elliot & Fowell, 2000; Crosby & Johnson, 2004; Joo & Sohn, 2008). These studies emphasize that service quality is a necessary but not sufficient factor leading to customer commitment to a long-term relationship. Perceived product quality is also regarded as an important exogenous factor related to customer commitment (Elliot & Fowell, 2000; Crosby & Johnson, 2004). Price, which has been investigated in previous studies (Voss et al., 1998; Crosby & Johnson, 2004; Homburg et al., 2005), is another important factor influencing customer commitment.

## CONCLUSION

Based on customers' cognitive, affective and cognitive experiences in Internet shopping, this study, from a customer perspective, proposes an integrated e-CRM model identifying a series of linkages among the main psychological variables affecting customer commitment. Moreover, most of the linkages proposed in the integrated model are found to be significant (see Table 1).

There are managerial implications for these findings. First, the integrated model shows factors that explain why customers maintain long-term exchange relationships. The proposed integrated e-CRM model can provide an understanding about what brings customers back. For example, online customers commit to an e-store when the service quality, product quality, and price fairness are perceived as beneficial and satisfactory. Therefore, as presented in the model, successful e-CRM needs to effectively enhance customer value management, customer satisfaction management, and customer trust management through ICT in order to induce customer commitment.

Second, the integrated model suggests that perceived value and satisfaction, as cognitive and affective antecedents, influence online trust directly; however, they influence customer commitment through trust only indirectly. Trust is the core factor that directly affects relationship commitment. Thus, it is critically important for online retailers to build customer trust in the shopping context. Providing superior value and a satisfying shopping experience are two effective ways to build customer trust.

Third, the results clearly suggest that superior value and customer satisfaction originate from superior perceived service or product quality, and from perceived price fairness. Thus, for online retailers, a successful implementation of e-CRM should integrate business and ICT to work closely together to effectively offer superior customer value and satisfaction via customized services or products, and competitive pricing.

## FUTRUE RESEARCH DIRECTIONS

First, the study of an e-CRM integrated model based on customers' perspectives is relatively new to e-commerce researchers. In future, additional research efforts are needed to evaluate the validity of the e-CRM integrated model. Second, the model's constructs need to be measured more completely, with multi-dimensional instruments. Finally, the research findings gathered from university students need greater generalization

*Table 1. A summary of the model's hypotheses and results*

| Hypotheses | Estimate | C.R. | Results | Basis of hypothesis |
|---|---|---|---|---|
| H1: Trust ⇒ commitment | 0.66 | 5.22*** | Strongly Supported | Supported by the literature |
| H2a: Perceived value ⇒ trust | 0.27 | 3.66** | Supported | Supported by the literature |
| H2b: Perceived value ⇒ commitment | -0.07 | -0.78 | Rejected | Hunches based on literature |
| H3a: Satisfaction ⇒ trust | 0.58 | 8.24*** | Strongly Supported | Supported well by the literature |
| H3b: Satisfaction ⇒ commitment | 0.27 | 2.63* | Weakly Supported | Hunches based on literature |
| H4a: Perceived service quality ⇒ perceived value | 0.25 | 2.21 | Rejected | Hunches based on literature |
| H4b: Perceived service quality ⇒ satisfaction | 0.44 | 3.32** | Supported | Supported by the literature |
| H5a: Perceived product quality ⇒ perceived value | 0.17 | 2.72** | Supported | Hunches based on literature |
| H5b: Perceived product quality ⇒ satisfaction | 0.50 | 6.64*** | Strongly Supported | Supported by the literature |
| H6a: Perceived price fairness ⇒ perceived value | 0.55 | 7.89*** | Strongly Supported | Hunches based on literature |
| H6b: Perceived price fairness ⇒ satisfaction | 0.20 | 2.88* | Weakly Supported | Supported by the literature |

in B2C e-commerce. There may be limitations related to using university students in the survey. However, online access and purchasing power among students is high. As stated previously, the focus of the study is on the development of an integrated model. Thus, additional research efforts are needed to evaluate the validity of the proposed model and research findings.

## REFERENCES


Adebanjo, D. (2003). Classifying and Selecting e-CRM Applications: an Analysis-Based Proposal. *Management Science*, *41*(6), 570–577.

Ajzen, I., & Fishbein, M. (1980). The Prediction of Behavior From Attitudinal and Normative Variables. *Journal of Experimental Social Psychology*, *6*(4), 466–487. doi:10.1016/0022-1031(70)90057-0

Anderson, R. E., & Srinivasan, S. S. (2003). E-satisfaction and E-loyalty: A Contingency Framework. *Psychology and Marketing*, *20*(February), 123–138. doi:10.1002/mar.10063

Bebko, C. P. (2000). Service Intangibility and Its Impact on Consumer Expectations of Service Quality. *Journal of Services Marketing*, *14*(1), 9–26. doi:10.1108/08876040010309185

Cole, M., O'Keefe, R. M., & Siala, H. (1999). From the User Interface to the Consumer Interface. *Information Systems Frontiers*, *1*(4), 349–361. doi:10.1023/A:1010009923913

Cronin, J., J., Brady, M. K. and Hult, G. T. (2000). Assessing the Effects of Quality, Value, and Customer Satisfaction on Consumer Behavioral Intentions in Service Environments. *Journal of Retailing*, *76*(2), 193–218. doi:10.1016/S0022-4359(00)00028-2

Crosby, L. A., & Johnson, S. L. (2004). Making the Intangible…Tangible. *Marketing Management, 13*(3, May/June), 12-13.

Davis, F. D. (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly*, *13*(3), 319–340. doi:10.2307/249008

Elliot, S., & Fowell, S. (2000). Expectations versus Reality: A Snapshot of Customer Experiences with Internet Retailing. *International Journal of Information Management*, (20): 323–336. doi:10.1016/S0268-4012(00)00026-8

Fishbein, M. (1967). *Readings in Attitude Theory and Measurement*. New York: Wiley.

Fishbein, M., & Ajzen, I. (1975). *Beliefs, Attitude, Intention and Behavior: An Introduction to Theory and Research*. Reading, MA: Addison-Wesley.

Flavian, C., Guinaliu, M., & Gurrea, R. (2006). The Role Played by Perceived Usability, Satisfaction and Consumer Trust on Website Loyalty. *Information & Management*, *43*, 1–14. doi:10.1016/j.im.2005.01.002

Geyskens, I., Steenkamp, J., Steenkamp, E. M., Scheer, L. K., & Kumar, N. (1996). The Effects of Trust and Interdependence on Relationship Commitment: a Trans-Atlantic Study. *International Journal of Research in Marketing*, *13*, 303–317. doi:10.1016/S0167-8116(96)00006-7

Jackson, R., & Wang, P. (1995). *The convergence of database marketing and interactive media networks*. In E. Forrest & R. Mizerski, (Eds.), *Interactive Marketing: The Future Present* (pp. 355-372). Lincolnwood, IL: NTC Publishing Group.

Joo, Y. G., & Sohn, S. Y. (2008). Structural Equation Model for Effective CRM of Digital Content Industry. *Expert Systems with Applications*, *34*, 63–71. doi:10.1016/j.eswa.2006.08.016

Kalafatis, S. P., & Miller, H. (1997). A Re-examination of the Commitment-Trust Theory. In H. G. Gemünden, T. Ritter, & A. Walter, (eds.), *Relationships and Networks in International Markets* (pp. 213-27). Oxford, UK: Pergamon.

Lee, M., & Turban, E. (2001). Trust Model for Consumer Internet Shopping. *International Journal of Electronic Commerce*, *6*(1), 75–91.

Letaifa, S. B., & Perrien, J. (2007). The Impact of E-CRM on Organizational and Individual Behavior: The Effect of the Remuneration and Reward System. *International Journal of E-Business Research*, *3*(2), 13–23.

Liu, C., & Arnett, K. P. (2000). Exploring the Factors Associated with Web site Success in the Context of Electronic Commerce. *Information & Management*, *38*(October), 23–34. doi:10.1016/S0378-7206(00)00049-5

Marti, S., & Garcia-Molina, H. (2006). Taxonomy of Trust: Categorizing P2P Reputation Systems. *Computer Networks*, *50*, 472–484. doi:10.1016/j.comnet.2005.07.011

Mathieson, K. (1991). Predicting User Intentions: Comparing the Technology Acceptance Model with the Theory of Planned Behavior. *Information Systems Research*, *2*(3), 173–191. doi:10.1287/isre.2.3.173

McKnight, D., & Chervany, N. (2002). What Trust Menas in e-Commerce Customer Relationship: an Interdisciplinary Conceptual Typology. *International Journal of Electronic Commerce*, *6*(2), 35–59.

Melone, N. P. (1990). A Theoretical Assessment of the User-satisfaction Construct in Information Systems Research. *Management Science*, *36*(1), 76–81. doi:10.1287/mnsc.36.1.76

Morgan, R. M., & Hunt, S. E. (1994). The Commitment-Trust Theory of Relationship Marketing. *Journal of Marketing*, *58*(July), 20–38. doi:10.2307/1252308

Nour, M. A., & Fadlalla, A. (2000). A Framework for Web Marketing Strategies. *Information Systems Management*, 41–50.

Oliver, R. L. (1980). A Cognitive Model of the Antecedents and Consequences of Satisfaction Decisions. *JMR, Journal of Marketing Research*, *17*(November), 460–469. doi:10.2307/3150499

Oliver, R. L. (1997). *Satisfaction: A Behavioral Perspective on the Consumer*. New York: McGraw-Hill.

Pan, G., Pan, S. L., Newman, M., & Flynn, D. (2006). Escalation and De-escalation of Commitment: a Commitment Transformation Analysis of an e-Government Project. *Information Systems Journal*, *16*, 3–21. doi:10.1111/j.1365-2575.2006.00209.x

Pan, S. L., & Lee, J. (2003). Using e-CRM for a United View of the Customer. *Communications of the ACM*, *46*(4), 95–99. doi:10.1145/641205.641212

Parasuraman, A., & Grewal, D. (2000). The Impact of Technology on the Quality-Value-Loyalty Chain: A Research Agenda. *Journal of the Academy of Marketing Science*, *28*(1), 168–174. doi:10.1177/0092070300281015

Pascoe, G. C. (1983). Patient Satisfaction in Primary Health Care: A Literature Review and Analysins. *Evaluation and Program Planning*, *6*, 185–197. doi:10.1016/0149-7189(83)90002-2

Phau, I., & Poon, S. M. (2000). Factors Influencing the types of Products and Services Purchased over the Internet. *Internet Research*, *10*(2), 102–113. doi:10.1108/10662240010322894

Romano, N. C., & Fjermesad, J. (2003). Electronic Commerce Customer Relationship Management: A Research Agenda. *Information Technology and Management*, *4*, 233–258. doi:10.1023/A:1022906513502

Sharma, N., & Patterson, P. G. (1999). The Impact of Communication Effectiveness and Service Quality on Relationship Commitment in Consumer Professional Services. *Journal of Services Marketing*, *13*(2), 151–170. doi:10.1108/08876049910266059

Sirdeshmukh, D., Singh, J., & Sabol, B. (2002). Consumer Trust, Value, and Loyalty in Relational Exchanges. *Journal of Marketing*, *66*, 15–37. doi:10.1509/jmkg.66.1.15.18449

Sukpanich & Chen. (1999). Antecedents of Desirable Consumer Behaviors in Electronic Commerce. In *Proceedings of 5th Americas Conference on Information Systems*, Omnipress, Milwaukee, WI.

Taylor, S. A. (1994). Distinguishing Service Quality from Patient Satisfaction in Developing Health care Marketing Strategies. *Hospital & Health Services Administration*, *39*(2), 221–236.

Taylor, S. A., & Todd, P. A. (1995). Understanding Information Technology Usage: A Test of Competing Models. *Information Systems Research*, *6*(2), 144–176. doi:10.1287/isre.6.2.144

Vellido, A., Lisboa, P. J. G., & Meehan, K. (2000). Quantitative Characterization and Prediction of Online Purchasing Behavior: A Latent Variable Approach. *International Journal of Electronic Commerce*, *4*(4).

Venetis, K. A., & Ghauri, P. N. (2004). Service Quality and Customer Retention: Building Long-term Relationships. *European Journal of Marketing*, *38*(11/12), 1577–1598. doi:10.1108/03090560410560254

Voss, G. B., Parasuraman, A., & Grewal, G. (1998). The Roles of Price, Performance, and Expectations in Determining Satisfaction in Service Exchanges. *Journal of Marketing*, *62*(October), 46–61. doi:10.2307/1252286

Wang, F., & Head, M. (2001). Designing Web-based Information Systems for E-commerce. In *Proceedings of the 224 World Congress on the Management of Electronic Commerce*, Hamilton, Canada.

Woodcock, N., & Starkey, M. (2001). I wouldn't Start from Here' Finding a Way in CRM projects. *Journal of Database Marketing*, *18*(1), 61–74. doi:10.1057/palgrave.jdm.3240059

Wu, F., & Cavusgil, S. T. (2006). Organizational Learning, Commitment, and Joint Value Creation in Interfirm Relationships. *Journal of Business Research*, *59*, 81–89. doi:10.1016/j.jbusres.2005.03.005

Wu, I. L., & Wu, K. W. (2005). A Hybrid Technology Acceptance Approach for Exploring e-CRM Adoption in Organizations. *Behaviour & Information Technology*, *24*(4), 303–316. doi:10.1080/0144929042000320027

Zeithaml, V. (1988). Consumer Perceptions of Price, Quality, and Value: A Means-End Model and Synthesis of Evidence. *Journal of Marketing*, *52*(3), 2–22. doi:10.2307/1251446

Zeithaml, V., Parasuraman, A., & Malhotra, A. (2000). *e-Service Quality: Definition, Dimensions and Conceptual Model*. Working Paper, Marketing Science Institute, Cambridge, MA.

## KEY TERMS AND DEFINITIONS

**Commitment:** is defined as customer's behavioral intention to continue a business relationship. It refers not only to a customer's future transactional intentions, but also to the purposefulness of these intentions, distinguishing a committed relationship from a mere transactional one. It reflects the affective and cognitive motivations that maintain a long-term relationship and the tendency to resist changing preferences.

**e-CRM:** is defined as customer relationship management techniques adopted by online enterprises in the electronic commerce. It is based on the belief that developing long-term relationships with customers is the best way to gain customer loyalty.

**Perceived Price Fairness:** is defined as an evaluation of the overall price fairness when considering both monetary and non-monetary costs of acquiring the product or service.

**Perceived Product Quality:** is defined as the customer's judgment about the superiority or excellence of a product.

**Perceived Service Quality:** is defined as customer's judgment about the extent to which a Web site facilitates efficient and effective shopping, purchase, and delivery of products and services.

**Perceived Value:** is defined as cognition about attributes and benefits directly related to perceived needs or wants in the shopping experience.

**Satisfaction:** is defined as the extent to which customers perceive their prior expectations of a product or service to be confirmed during actual use.

**Trust:** is defined as a set of specific relationship intentions dealing primarily with integrity, benevolence, competence, and predictability of a retailer.

# Section 8
# Mobile Commerce

# Chapter 75
# Mobile Communications / Mobile Marketing

**Suzanne Altobello Nasco**
*Southern Illinois University Carbondale, USA*

## INTRODUCTION TO MOBILE COMMUNICATIONS

Mobile communications have become so widespread around the world that they are now ubiquitous, mostly due to the widespread availability, adoption, and affordability of mobile technologies. Today, there are almost 5 billion mobile phone subscriptions worldwide. Wireless services have grown at an annual rate of over 20% per annum over the past 8 years and mobile penetration has more than doubled every 4 years. Mobile penetration is now at over 60% worldwide (based on number of mobile subscriptions, not people); this growth is driven mostly by the Brazil, Russia, India, and China (BRIC) economies (Acharya, 2008). China is the largest wireless market, with over 600 million subscribers for mobile services. Reports by the mobile industry's trade association, Cellular Telecommunications and Internet Association (CTIA), state that the U.S. mobile phone market accounted for over 276 million wireless subscriptions in June 2009 and over 89% of the U.S. population has at least one wireless phone subscription (CTIA, 2009). As of early 2009, worldwide, there are over 1 billion more mobile phones than there are computers (Mandel, 2008).

Technological advancements in mobile devices have created new opportunities for multimedia communications through audio, visual, and combined audio-visual modalities (Nasco and Bruner 2007). Most mobile communications take the form of audio-only (voice) formats, such as the telephone call itself or the use of voice-messaging. Communications via mobile phones can also take a visual-only form, most commonly in the form of text messages, or short message service (SMS). These messages are limited to text-only, 160-character communications. SMS or "texting" has become

DOI: 10.4018/978-1-61520-611-7.ch075

an essential part of mobile communications. It is a more economical form of communication, as sending text messages is cheaper than making phone calls. CTIA (2009) reports than an average of 135 billion text messages were sent in the U.S. in June 2009 alone, marking an increase of 300% over the 28.8 billion messages reported in June 2007. More than 77% of all mobile subscribers in the U.S. have signed up for or purchased text-messaging services, 53% out of 77% send or receive text messages on a regular basis and by early 2008, the number of text messages sent by U.S. mobile subscribers outpaced the number of phone calls placed at a 1.75: 1 ratio (Covey, 2008). SMS leads all non-voice data and communication services worldwide and texting is even more common in other countries than in the U.S. In a Nielsen Telecom Practice Group survey (cited in Covey, 2008), almost 90% of mobile subscribers in Russia and 85% in Switzerland have used text messaging in the past month (compared to 53% of U.S. mobile users). Finally, with the emergence of third generation (3G and 3.5G) mobile phone technology, it is now possible to also send full video messages via multimedia message service (MMS), however, not all mobile handsets used presently can accept such sophisticated messages. In addition, not all consumers have experience with using sophisticated devices to obtain multimedia messages. Another limitation to widespread use of MMS is the network speed, which affects the consumer's ability to download large files and a company's ability to present large images and videos to be viewed on mobile devices. Finally, screen size can be a limitation to mobile communications. But, as mobile devices and technology improve, more interactive and innovative mobile communication forms will become more common. In conjunction with broadband access, the mobile communications landscape is different from traditional marketing communication mediums because, as Mandel (2008) states, a person's mobile device is always on, always with the user, and knows the location of the user.

## MOBILE MARKETING

Such widespread use of mobile communications presents opportunities for marketers to reach consumers through this alternative medium with a variety of marketing messages. Most of these types of communications have come in the form of text-only messaging. SMS has been used to market and promote everything from cars to toothpaste to university athletic events to President Obama's choice of Senator Joe Biden as his vice-presidential choice in the 2008 U.S. Presidential race. These messages can be in the form of a one-way communication, with a branded message being sent via SMS to consumers who have opted-in or signed up to receive such messages. These mobile marketing messages can take the form of text messages that inform the customer about the product/service, text messages that direct readers to a website, coupons sent to the mobile phone that can be exchanged for a rebate or financial discount, or a simple brand awareness message or new product launch message. These one-way mobile messages can also be in the form of audio advertisements that can take the form of a commercialized jingle that the user hears before proceeding to check voicemail messages or an audio recording played while the consumer interacts with a telephone-based service, such as when the mobile user calls directory assistance or a movie ticketing service and must listen to a paid advertisement before getting the information he/she desires.

Mobile marketing can also take the form of a two-way dialogue, encouraging the consumer to communicate back to the company. Examples of this type of mobile marketing include participation in company-sponsored mobile surveys, downloading branded content to mobile devices, and entering mobile contests or text-to-vote campaigns. Many popular television reality shows, such as *American Idol* and *Dancing with the Stars* (along with their international counterparts), encourage viewers to text in their vote for their favorite competitor and count those texts as votes in the tally to determine the winner of the show. In most cases, to initiate these two-way dialogues with a company, a customer is required to send an SMS message to a short code to participate in the contest or to retrieve an offer. Short codes are special telephone numbers that are significantly shorter than full telephone numbers that are used to address SMS and MMS messages from mobile phones. For example, instructions can be to "text YOUR NAME to 313131 to enter our mobile contest." Companies can buy their own short codes, contract with mobile marketing firms and use those firms' short codes, or mobile service providers can provide short codes to users for specific efforts. Each country has their own format for mobile short codes, but they usually range from three to eight digits, with five or six digits being a common length. In the U.S., short codes are administered by the CTIA.

Although most mobile marketing communications takes a "push" approach to advertising, whereby an identifiable corporate sponsor sends a branded message to consumers via the mobile device, the growth of smartphones, such as the Apple iPhone introduced in 2007, has created a new "pull" approach to mobile marketing efforts. Namely, via the use of "apps" (short for "applications"), customers can download branded applications that can help them to find nearby restaurants, check the status of an airline flight, or learn foreign language phrases. Large corporations are finding success by creating mobile applications that extend their brand presence into the (literal) hands of their customers, merging "pull" from customers who seek the application with "push" from the company regarding products or services. An excellent example of the future of branded smartphone applications is the Kraft Food iFood assistant. For a $.99 fee, users download the iFood application to their mobile smartphones and use the information to create shopping lists or find recipes based on ingredients or prep time. While using the application, consumers will see traditional advertisements for Kraft Food products and Kraft will collect valuable, target demographic and behavioral data from consumers who use the application (York, 2009).

Mobile video is still in its infancy stage, but also offers big potential for branded messages in the future. When users opt to watch video using their mobile devices, for instance, by logging onto a network website directly from the mobile browser, they may be presented with interstitial ads that are presented between content pages. For instance, before watching the newest episode of *Lost* by logging on to www.abc.com from their mobile phone, viewers must first watch a 30-second video advertisement prior to seeing the episode. Mandel (2008) highlights made-for-mobile videos on mobile TV, video-on-demand, or sponsorship of network mobisodes (mobile television episodes) as additional avenues for future mobile branding opportunities.

## MOBILE ADVERTISING STRATEGY

Currently, the majority of mobile commercial messaging is coming directly from the mobile service providers, alerting mobile users to new services or upgrades available from the provider. However, many consumer goods and services companies are also exploring mobile advertising as a new medium to communicate directly with their consumers, especially as mobile users begin to use more sophisticated devices to access the internet using their mobile devices. Major brands are beginning to invest heavily in mobile marketing: marketing budgets devoted to mobile marketing are predicted to increase 150% by 2013 (Wissinger, 2008) and worldwide mobile advertising (including display ads shown on websites accessed by mobile devices, text messages sent to consumers, and mobile search ads presented to customers who use mobile devices to do an internet search) is expected to grow from $2.7 billion in 2007 to $19 billion by 2012 (eMarketer, 2008).

Regionally, the projected $19 billion is split fairly evenly between U.S., Asia-Pacific, and Western European countries.

The ability to use mobile advertising to target the customer via specific demographic and even behavioral attributes is especially appealing to companies who want a more direct, immediate, and personal relationship with customers. Nielsen (2008) states that "mobile advertising is present on less than two-thirds of website homepage page views across leading mobile websites, and roughly half of that is unpaid house advertising (p. 3). Yet, over 57 percent of mobile internet users recall seeing a mobile advertisement, suggesting that these mobile display ads are a great way to drive brand awareness.

In a survey of mobile phone subscribers across Western Europe (France, Germany, Italy, Spain, and the United Kingdom) and the United States, M:Metrics reports the steady increase in business-to-consumer text-based marketing. The number of mobile phone users who have received an ad via SMS grew at a rate of 27% in the U.S. and 15% in Western Europe from May 2007 to January 2008. In early 2008, 31% of U.S. mobile subscribers recalled seeing or hearing a mobile advertisement (Gfk/NOP Research, 2008). Nielsen (2008) reported that 58 percent of teen mobile data users recalled seeing a mobile advertisement in mid-2008, up from 46 percent in late 2007. Advertising via SMS also leads to high recall, with estimates at over 50 percent recall (Nielsen, 2008). Important for mobile advertisers, M:Metrics found that mobile subscribers who actually have responded to an SMS ad has grown as well; redemption rates for mobile commercial messages were 1.9% in Germany, 2.4% in the U.S., 3.6% in Spain, 3.7% in the UK, 4.6% in France and 8.1% in Italy. Similarly, other research reports that two-thirds of business owners believe that mobile advertising campaigns generate a higher response rate than traditional methods due to the highly targeted nature of a mobile campaign (Cellular-news, 2008).

Of all mobile marketing solutions, SMS marketing is proving to be the most popular with almost a third of businesses surveyed by Cellular-news (2008) reporting using text messages to reach their existing or potential customers. Mobile marketing efforts are a cost-effective and targeted way "for businesses to interact with exactly the people they want, from sending a text reminder to alert a customer to an overdrawn bank account to confirming a delivery via SMS" (Cellular-news, 2008). Real-world discounts or coupons are the most popular types of incentives that companies can send to consumers via SMS or MMS (Berliant, 2008). Juniper Research (2008) predicts that mobile coupon growth and use worldwide will increase fourfold from 50 million to almost 200 million by 2013. Several recent practitioner and academic articles have discussed customers' willingness to accept mobile coupons and the frequency and types of messages they want to receive (c.f., ABIResearch, 2008; Belic, 2008; Coker & Nasco, 2009; Ransford, 2007).

## THE FUTURE OF MOBILE MARKETING

The future of mobile marketing (and mobile advertising, in particular) may lie in the ability of consumers to customize their ad experiences. When a customer has to opt-in to receive a branded mobile message, he/she is ultimately customizing the experience. However, companies can go further by allowing customers to limit when and how many mobile messages are received in a given time period. Often, this requires the need for a third-party mobile marketing internet-based solution provider (e.g., Clickatell.com, Air2web.com) that creates an interface for consumers to state their mobile preferences and designs computer-based programs that ensure the company's mobile messages are within the consumer's parameters. In addition, customers want customizability in their viewed ad experiences. For instance, most customers, mobile users included, understand that in order to provide viewers with free content, some websites sell advertising or obtain paid sponsors to subsidize the free content. Internet users have tolerated banner ads, pop-up ads, and website sponsorship advertising for years and there is no reason to expect that mobile users won't also tolerate branded communications on their mobile devices. Companies may do well, nonetheless, to consider that, because the mobile device is so personal, the consumer may also want to personalize the mobile ads that they receive. Hulu.com is an internet site that is allowing customers to choose which type of ads they would like to see. Before presenting free episodes of current and past television series, Hulu viewers can watch traditional 30-second ads aired during the longer video (like traditional TV advertising), but they can also choose to watch a 2 ½ minute branded-entertainment segment instead of normal commercial breaks before watching uninterrupted videos (Steinberg, 2009). It is this author's belief that companies and service providers integrating a mobile advertising strategy with their current marketing plan would do well to follow Hulu's example of allowing customers to choose ad experiences that "complement the viewing experience instead of taking away from it" (Steinberg, 2009, p. 8).

Another emerging trend in mobile marketing is the use of two dimensional (2D) barcodes, also called "Quick Response" (QR) codes. These codes store web addresses and URLs and companies can create unique barcodes that can be printed on outdoor or in-store signage, placed in magazine or newspaper print ads, or placed directly on product packaging. Viewers of the code who are interested in learning more about a product can "scan" the code by taking a picture of it with a web-enabled mobile phone with a camera and barcode reader software. The consumer's mobile internet browser is immediately launched and the user is taken directly to the product's website for more information on the product or to a mobile commerce website that will allow the user to buy the product directly. In the U.S., most mobile users have never seen QR barcodes, but in Japan, an estimated 70% of all mobile users take photos of 2D barcodes and currently, several large consumer goods manufacturers are joining together to promote the use of these codes in North America (Mobile Marketing Watch, 2009). Of course, consumers who are unfamiliar with the use of 2D barcodes will have to be educated on their use and value. Current models of consumer acceptance of technology (e.g., Nasco et al., 2008) can be used to inform organizations of the factors that lead to consumer intentions, use, and adoption of advanced mobile marketing tools, such as QR codes and MMS trends noted above.

Mobile advertising should no longer be considered a unique type of online advertising; rather, companies should start to consider how best to engage the mobile consumer and to enlarge or deepen the relationships between the consumer and the brand. Above all, a company should not integrate mobile marketing into their existing promotional strategy simply because they are able to; rather, companies should focus on delivering true value to their target market via mobile marketing. This effort requires more market research into the specific needs and desires of a company's target mobile audience regarding mobile communications. It is also necessary to examine how mobile marketing is used differently among large and small to medium-sized enterprises (SMEs). Large, global brands will have more marketing dollars to spend on mobile marketing activities, however, many SMEs may also benefit from the personal, two-way dialogue that can be achieved with mobile communications. These emerging mobile trends for large and small companies can complement, and in some cases may begin to supplant, other traditional modes of advertising in the 21st century.

## REFERENCES


ABIresearch.com. (2008). *Putting coupons in mobile users' hands*. Retrieved March 31, 2009, from http://www.emarketer.com/Article.aspx?id=1006522

Acharya, S. (2008). *Worldwide mobile cellular subscribers to reach 4 billion mark late 2008.* Retrieved December 15, 2008, from http://www.itu.int/newsroom/press_releases/2008/29.html

Belic, D. (2008). *Nielsen Mobile: 58 million U.S. mobile subscribers have seen advertising on their phones*. Retrieved March 30, 2009, from http://www.intomobile.com/2008/03/08/nielsen-mobile-58-million-us-mobile-subscribers-have-seen-advertising-on-their-phones.html

Berliant, S. (2008). *Are US consumers ready for mobile marketing?* Retrieved January 6, 2009, from http://insight.eyetraffic.com/public/item/212657

Cellular-news. (2008). *Brands set to treble spend on mobile marketing by 2013*. Retrieved January 6, 2009, from http://www.cellular-news.com/story/34048.php

Coker, K., & Nasco, S. A. (2009). *Consumer likelihood of using mobile devices to obtain commercial messages*. Manuscript submitted for publication.

Covey, N. (2008). *Flying Fingers: Text-messaging overtakes monthly phone calls.* Retrieved November 3, 2008 from http://en-us.nielsen.com/main/insights/consumer_insight/issue_12/flying_fingers

CTIA. (2009). *Wireless quick facts*. Retrieved January 25, 2010, from http://www.ctia.org/advocacy/research/index.cfm/AID/10323

eMarketer (2008). *Mobile advertising spending worldwide by format 2007-2012*. Retrieved January 7, 2009, from http://totalaccess.emarketer.com/Chart.aspx?N=0&Nr=P_ID:73703&xsrc=chart_articlex

Gfk/NOP Research. (2008). *Three in ten US mobile users recall seeing mobile ads.* Retrieved January 7, 2009, from http://www.marketingcharts.com/interactive/three-in-ten-us-mobile-users-recall-seeing-mobile-ads-3016/limbo-mobile-ad-recall-by-service-typejpg/

Juniper Research. (2008). *Mobile advertising – Because I'm worth it.* Retrieved August 18, 2008, from http://www.juniperresearch.com/shop/view-whitepaper.php?whitepaper=62

Mandel, M. (2008). Mobile marketing: From simple to complex. *Marketing Science Institute,* 08-1204pmm.

Mobile Marketing Association. (2008). *Mobile marketing industry glossary*. Retrieved December 15, 2008, from http://www.mmaglobal.com/glossary.pdf

Mobile Marketing Watch. (2009). *Five companies joining together for 2D barcode push*. Retrieved July 15, 2009, from http://www.mobilemarketingwatch.com/category/mobile-partners/

Nasco, S. A., & Bruner, G. C. (2007). Perceptions and recall of advertising content presented on mobile handheld devices. *Journal of Interactive Advertising*, *7*(2), 1–22.

Nasco, S. A., Kulviwat, S., Bruner, G. C., & Kumar, A. (2008). The CAT model: Extensions and moderators of dominance in technology acceptance. *Psychology and Marketing*, *25*(10), 987–1005. doi:10.1002/mar.20249

Nielsen. (2008). *Realizing potential: Overcoming barriers to the U.S. mobile advertising market*.

Ransford, M. (2007). *Ball State study finds collegians more receptive to getting advertising via cell phones.* Retrieved November 8, 2008, from http://www.bsu.edu/news/article/0,1370,7273-850-53637,00.html

Reardon, M. (2008). *U.S. text usage hits record despite price increases*. Retrieved February 28, 2009, from http://reviews.cnet.com/8301-12261_7-10038634-51.html?tag=mncol;txt

Shankar, V., & Hollinger, M. (2007). Online and mobile advertising: Current scenario, emerging trends, and future directions. *Marketing Science Institute Report*, 07-206.

Steinberg, B. (2009). Top-notch content makes site a success. *Advertising Age*, *80*(11), 8.

Wissinger, C. (2008). *Mobile advertising: 18-24 year olds lead the parade*. Retrieved November 7, 2008, from http://www.marketwire.com/press-release/Bigresearch-866741.html

York, E. B. (2009). Kraft hits on killer app for iPhone marketing. *Advertising Age*. Retrieved March 31, 2009, from http://adage.com/digital/article?article_id=133869.

## KEY TERMS AND DEFINITIONS

**MMS:** Multimedia messaging; mobile messages that can incorporate text, audio, and streaming video.

**Mobile Advertising:** branded messages paid for by an identified sponsor sent or displayed via mobile devices.

**Mobile Commerce:** trade that occurs via the use of a web-enabled mobile phone; products/services can be bought or sold using the mobile device as an interface.

**Mobile Coupons:** SMS messages that are sent directly to consumers' mobile devices; consumers show the mobile message at the point of sale for redemption or the coupon contains a unique code that can be entered at the point of purchase for redemption.

**QR Code:** Quick response code; a two dimensional barcode that, when scanned with a mobile phone, take the mobile user to a specific website or URL embedded in the code.

**Short Code (or Common Short Code (CSC) in the U.S.):** special telephone numbers, significantly shorter than full telephone numbers, which can also be used to address SMS and MMS messages from mobile phones.

**SMS:** short messaging service; mobile messages that are limited to 160 characters (including spaces).

# Chapter 76
# C2C Mobile Commerce:
## Acceptance Factors

**Lori N. K. Leonard**
*University of Tulsa, USA*

## ABSTRACT

*C2C e-commerce is being changed by the acceptance of mobile commerce devices. However, the extent of the use of mobile devices for C2C e-commerce is affected by many factors. A model of an individual's intention to make use of mobile devices for C2C e-commerce is presented. That model includes usefulness, ease of use, convenience, trust, and security. Propositions are developed for future research endeavors.*

## INTRODUCTION

Consumer-to-consumer (C2C) e-commerce has not been studied as much as other areas of e-commerce (Jones & Leonard, 2007), but C2C e-commerce is one of the fastest growing segments in e-commerce, heavily due to the increase in popularity of online auctions. However, C2C e-commerce includes more than the use of online auctions. C2C e-commerce can be seen in places such as web forums, chat rooms, and third party consumer listings. With this increase in C2C e-commerce popularity, there is still very little known about the acceptance of mobile devices for C2C e-commerce transactions. Mobile devices provide users the ability to conduct transactions anywhere, at anytime.

Mobile devices offer a unique opportunity to conduct C2C e-commerce. Many individuals are conducting C2C e-commerce as a means to acquire products at a more reasonable price, to acquire products that are considered scarce, or to sell items as another source of income, to name a few. However, these same individuals have jobs and other activities that may otherwise limit one's ability to utilize C2C e-commerce frequently, especially when online auctions end during the work day hours. Therefore, mobile devices offer the ability to monitor online items at any time. Mobile devices offer the opportunity for users to conduct transactions at their convenience, raising the question, "What

DOI: 10.4018/978-1-61520-611-7.ch076

factors impact the acceptance of mobile devices for conducting C2C e-commerce?"

This chapter addresses that question by exploring the mobile commerce research regarding intention to use. From that research, a model is proposed, utilizing previously studied factors, for an individual's intention to utilize mobile devices for C2C e-commerce. Propositions are provided for future research as well.

## BACKGROUND

Mobile devices open a range of opportunities for conducting C2C e-commerce. However, determining the acceptance of mobile devices for C2C e-commerce transactions is yet to be determined. Many researchers have examined mobile commerce in terms of adoption, intent to use, and success. In this section, a few of those studies will be explored.

The intention to use and the acceptance of mobile devices has been examined. Wang, Lin, and Luarn (2006) explored the behavioral intention of users with regards to mobile commerce. Using the technology acceptance model (TAM), the theory of planned behavior (TPB), and the mobile banking acceptance model, they collected data from 258 users in Taiwan and found self efficacy, perceived financial resources, perceived usefulness, perceived ease of use, and perceived credibility to impact a users intent to use mobile services. Wu and Wang (2005) studied users' acceptance of mobile commerce in terms of behavioral intent. Surveying users who were invoked in online banking, shopping, investing and or online services, they found perceived risk, cost, compatibility, and perceived usefulness to impact a user's intent. Bhatti (2007) also studied mobile commerce's acceptance by looking at behavioral intent. Collecting data from a survey of mobile commerce users, he found perceived behavioral control, perceived ease of use, and subjective norms to impact intent.

Xu and Gutierrez (2006) examined critical success factors in mobile commerce. Utilizing a Delphi panel of experts in mobile commerce and wireless communications, they found four factors to be important in mobile commerce success – convenience, ease of use, trust, and ubiquity. Jih (2007) also found convenience to be vital in shopping intention via mobile commerce.

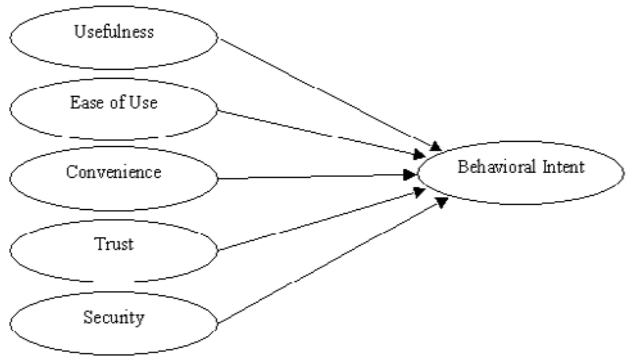
Finally, Fang, Chan, Brzezinski, and Xu (2005-6) examined acceptance of mobile commerce with regards to intended use. They took a different approach than the previous studies by looking at task type – general, gaming, and transactional. Therefore, they developed and tested a model for each. For general tasks, perceived usefulness and perceived ease of use influenced the user's intention to use mobile commerce. For gaming tasks, perceived playfulness influenced the user's intention to use mobile commerce. For transactional tasks, perceived usefulness and perceived security influenced the user's intention to use mobile commerce.

From these studies it is evident that many factors can play a role in influencing mobile commerce's use. The next section will take the results of the previously mentioned studies and apply them to C2C e-commerce, therefore, resulting in a model to determine mobile device use in C2C e-commerce.

## MODEL FORMULATION

Given the above studies' findings, a model for the intent to use mobile devices for C2C e-commerce is presented. The model incorporates variables from the mobile commerce studies as they apply to C2C e-commerce. The model proposes that perceived ease of use, usefulness, convenience, trust, and security impact the intention for users to utilize mobile devices for C2C e-commerce. Figure 1 presents the proposed model.

*Figure 1. Determinants of an individual's intent to use mobile devices for C2C e-commerce*




## Usefulness and Ease of Use

Perceived usefulness is an individual's expectation that the information technology (i.e. mobile device) will result in improved performance (Davis, Bagozzi, & Warshaw, 1989, 1992). Usefulness has been found to determine system usage (Adams, Nelson, & Todd, 1992; Davis, Bagozzi, & Warshaw, 1989, 1992), to contribute to an individual's intent to reuse a Web site (Lin, Wu, & Tsai, 2005), to be important in forming consumer attitudes and satisfaction with an electronic commerce channel (Davis, 1993; Devaraj, Fan, & Kohli, 2002), and to predict frequency of Web usage (Page-Thomas, 2006).

Perceived ease of use is the degree to which an individual expects the information system (i.e. mobile device) to be free of effort (Davis, Bagozzi, & Warshaw, 1989). Ease of use has been found to determine Web usage (Atkinson & Kydd, 1997; Davis, Bagozzi, & Warshaw, 1989; Davis, 1993; Pearson & Pearson, 2008), predict Web use for entertainment purposes (Atkinson & Kydd, 1997), and predict frequency of Web usage (Page-Thomas, 2006).

Devaraj, Fan, & Kohli (2002) studied online shoppers by surveying undergraduate and graduate students. They found both perceived usefulness and perceived ease of use to be significantly related to satisfaction with the e-commerce channel. Gefen, Karahanna, & Straub (2003) also found perceived usefulness of a given website to play an important role in determining a repeat customer's intention to purchase from that website. Pavlou (2003) conducted a study of perceived usefulness and perceived ease of use and an individual's intention to transact on a web site. The study found perceived usefulness and perceived ease of use to be significant predictors of intention to transact. Additionally, Vijayasarathy (2004) used perceived ease of use and perceived usefulness, among other constructs, to examine consumer intention to use online shopping. Using a mail survey, both factors were found to predict attitude towards online shopping. Grandon & Pearson (2004) studied small and medium-sized organizations in the U.S. to establish factors affecting the e-commerce adoption. They found perceived ease of use and perceived usefulness to be determinants of e-commerce adoption.

Therefore, we propose:

**Proposition 1:** The intention to utilize mobile devices for C2C e-commerce is influenced by usefulness.

**Proposition 2:** The intention to utilize mobile devices for C2C e-commerce is influenced by ease of use.

## Convenience

It is obvious that e-commerce creates convenience. However, the extent of that convenience is perceived by the user. With a mobile device, C2C e-commerce transactions should become more convenient. Convenience is defined as the extent the individual believes the mobile device will improve the simplicity of C2C e-commerce. A significant relationship has been found between perceived convenience and shopping intention and a positive effect of perceived convenience on shopping intention (Jih, 2007). Convenience has also been identified as one of the most important factors in mobile commerce success (Xu & Gutierrez, 2006).

In a study of home Internet banking and mobile banking, Laukkanen (2007) studied efficiency, convenience, and safety. He found all three factors to be important in determining differences in use (Gefen, Karahanna, & Straub, 2003). Trust can influence the overall transaction outcome (Mayer et al., 1995) and a consumer's value perceptions between home Internet banking and mobile banking. More specifically, mobile banking was found to eliminate needless trips home to utilize the online banking service. Laukkanen also found a relationship between efficiency and convenience, with a time saving being equated with efficiency.

Therefore, we propose:

**Proposition 3:** The intention to utilize mobile devices for C2C e-commerce is influenced by convenience.

## Trust

Trust is traditionally defined as the expectation that others, one chooses to trust, will not behave opportunistically by taking advantage of the situation (Gefen, Karahanna, & Straub, 2003); they will behave in a dependable, ethical, and socially appropriate manner. Trust helps online consumers in overcoming perceptions of uncertainty and risk with online transactions (McKnight, Choudhury, & Kacmar, 2002). However, in mobile commerce, it is not only the trust in the other individual but it is the trust also in the medium of the transaction (i.e., the mobile device) (Siau & Shen, 2003). Gaining trust in mobile commerce is precarious given the unique nature of mobile devices. Mobile devices can be limited in their screen size and resolution displays, as well as computational power and memory (Siau & Shen, 2003). Wireless networks can also be limited in bandwidth, and connection speed and reliability (Siau & Shen, 2003). Therefore, trust must be established for the other consumer (given the C2C relationship) and for the mobile device.

Trust has been found to impact perceived usefulness, and trust and perceived usefulness to impact intent to purchase online (Gefen, Karahanna, & Straub, 2003). Siau and Shen (2003) also indicate that mobile devices can be more difficult to trust given that data transmission is more vulnerable to eavesdropping.

Therefore, we propose:

**Proposition 4:** The intention to utilize mobile devices for C2C e-commerce is influenced by trust.

## Security

With any new technology, security is always a concern. The same applies to mobile commerce. Perceived security is defined as the extent an individual believes mobile commerce will be free of risk to conduct C2C e-commerce. Fang, Chan, Brzezinski, and Xu (2005-06) studied the acceptance of mobile commerce. They found perceived security to impact intended use for transactional tasks, but not for general or gaming tasks. Given that C2C e-commerce is a transactional task, perceived security will play a part. Security is also important given that mobile devices can be perceived to be less secure than traditional Internet connection devices (Siau & Shen, 2003).

Therefore, we propose:

**Proposition 5:** The intention to utilize mobile devices for C2C e-commerce is influenced by security.

## FUTURE RESEARCH DIRECTIONS

Given the proposed model of the determinants of an individual's intent to use mobile devices in C2C e-commerce, future research should be aimed at testing the propositions set forth. The use of mobile devices is extensive with the rise in wireless technology. However, there has not been made a distinction between business-to-business (B2B) e-commerce transactions, business-to-consumer (B2C) e-commerce transactions, C2C e-commerce transactions, and so forth. There are clearly differences in these types of transactions. The nature of C2C e-commerce makes it a unique entity. C2C e-commerce has a distinctive user demographic, with younger individuals utilizing it more extensively than other demographic groups; the products being exchanged can be more scarce than in the other venues; and the communication mechanisms utilized go beyond web sites and email (such as discussion rooms). Also, mobile devices are often needed in C2C e-commerce transactions when the individuals decide a face-to-face meeting is needed. Therefore, testing the proposed model will determine the factors that affect the intention to use mobile devices for such transactions. This is a first step in examining the acceptance of mobile devices in C2C e-commerce transactions.

## CONCLUSION

Mobile devices are changing every day. For example, cell phone capabilities are virtually limitless. Therefore, by understanding acceptance factors for using mobile devices in C2C e-commerce, cell phones can be designed with those factors in mind. This is clearly different than B2C e-commerce transactions and B2B e-commerce transactions. These types of transactions involve businesses, and in particular for B2B, mobile devices would be provided by the employer. In many cases, the employee would be expected to use the mobile device to conduct the B2B e-commerce transaction. There is still an acceptance factor but there is also the requirement to use the device which trumps the acceptance. For B2C, there is more freedom to make a choice to use the mobile device; however, there is also the choice to visit the physical store. This is definitely different from C2C.

Mobile devices and C2C e-commerce should go hand-in-hand. However, current research has not examined their combination. This chapter provides a model of one's intention to utilize mobile devices in C2C e-commerce. By determining the factors of importance when using a mobile device for C2C e-commerce, researchers will be able to ultimately determine how to make mobile devices more applicable for such types of transactions.

## REFERENCES

Adams, D. A., Nelson, R. R., & Todd, P. A. (1992). Perceived usefulness, ease of use, and usage of information technology: a replication. *MIS Quarterly*, 227–247. doi:10.2307/249577

Atkinson, M., & Kydd, C. (1997). Individual characteristics associated with World Wide Web use: an empirical study of playfulness and motivation. *The Data Base for Advances in Information Systems*, *28*(2), 53–62.

Bhatti, T. (2007). Exploring factors influencing the adoption of mobile commerce. *Journal of Internet Banking & Commerce*, *12*(3), 1–13.

Davis, F. D. (1993). User acceptance of information technology: system characteristics, user perceptions and behavioral impacts. *International Journal of Man-Machine Studies*, *38*, 475–487. doi:10.1006/imms.1993.1022

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: a comparison of two theoretical models. *Management Science*, *35*(8), 982–1003. doi:10.1287/mnsc.35.8.982

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1992). Extrinsic and intrinsic motivation to use computers in the workplace. *Journal of Applied Social Psychology*, *22*(14), 1111–1132. doi:10.1111/j.1559-1816.1992.tb00945.x

Devaraj, S., Fan, M., & Kohli, R. (2002). Antecedents of B2C channel satisfaction and preference: validating e-commerce metrics. *Information Systems Research*, *12*(3), 316–333. doi:10.1287/isre.13.3.316.77

Fang, X., Chan, S., Brzezinski, J., & Xu, S.(2005-6). Moderating effects of task type on wireless technology acceptance. *Journal of Management Information Systems*, *22*(3), 123–157. doi:10.2753/MIS0742-1222220305

Gefen, D., Karahanna, E., & Straub, D. W. (2003). Trust and TAM in online shopping: An integrated model. *MIS Quarterly*, *27*, 51–90.

Grandon, E. E., & Pearson, J. M. (2004). Electronic commerce adoption: an empirical study of small and medium US businesses. *Information & Management*, *42*(1), 197–216.

Jih, W. (2007). Effects of consumer-perceived convenience on shopping intention in mobile commerce: an empirical study. *International Journal of E-Business Research*, *3*(4), 33–46.

Jones, K., & Leonard, L. N. K. (2007). Consumer-to-consumer electronic commerce: a distinct research stream. *Journal of Electronic Commerce in Organizations*, *5*(4), 39–54.

Laukkanen, T. (2007). Internet vs mobile banking: comparing customer value perceptions. *Business Process Management Journal*, *13*(6), 788–797. doi:10.1108/14637150710834550

Lin, C. S., Wu, S., & Tsai, R. J. (2005). Integrating perceived playfulness into expectation-confirmation model for web portal context. *Information & Management*, *42*(5), 683–693. doi:10.1016/j.im.2004.04.003

Mayer, R. C., Davis, J. H., & Schoorman, F. D. (1995). An integrative model of organizational trust. *Academy of Management Review*, *20*, 709–734. doi:10.2307/258792

McKnight, D. H., Choudhury, V., & Kacmar, C. (2002). Developing and validating trust measures for e-commerce: an integrative typology. *Information Systems Research*, *13*, 334–359. doi:10.1287/isre.13.3.334.81

Page-Thomas, K. (2006). Measuring task-specific perceptions of the world wide web. *Behaviour & Information Technology*, *25*, 469–477. doi:10.1080/01449290500347962

Pavlou, P. A. (2003). Consumer acceptance of electronic commerce: integrating trust and risk with the technology acceptance model. *International Journal of Electronic Commerce*, *7*(3), 101–134.

Pearson, J. M., & Pearson, A. M. (2008). An exploratory study into determining the relative importance of key criteria in web usability: a multi-criteria approach. *Journal of Computer Information Systems*, *48*(4), 115–127.

Siau, K., & Shen, Z. (2003). Building customer trust in mobile commerce. *Communications of the ACM*, *46*(4), 91–94. doi:10.1145/641205.641211

Vijayasarathy, L. R. (2004). Predicting consumer intentions to use on-line shopping: the case for an augmented technology acceptance model. *Information & Management*, *41*(6), 747–762. doi:10.1016/j.im.2003.08.011

Wang, Y., Lin, H., & Luarn, P. (2006). Predicting consumer intention to use mobile service. *Information Systems Journal*, *16*, 157–179. doi:10.1111/j.1365-2575.2006.00213.x

Wu, J., & Wang, S. (2005). What drives mobile commerce? An empirical evaluation of the revised technology acceptance model. *Information & Management*, *42*, 719–729. doi:10.1016/j.im.2004.07.001

Xu, G., & Gutierrez, J. A. (2006). An exploratory study of killer applications and critical success factors in m-commerce. *Journal of Electronic Commerce in Organizations*, *4*(3), 63–79.

## ADDITIONAL READING

Ba, S., & Pavlou, P. A. (2002). Evidence of the effect of trust building technology in electronic markets: price premiums and buyer behavior. *MIS Quarterly*, *26*, 243–268. doi:10.2307/4132332

Backhouse, J., Hsu, C., Tseng, J. C., & Baptista, J. (2005). A question of trust. *Communications of the ACM*, *48*, 87–91. doi:10.1145/1081992.1081994

Barnes, S. J. (2002). The mobile commerce value chain: analysis and future developments. *International Journal of Information Management*, *22*, 91–108. doi:10.1016/S0268-4012(01)00047-0

Bruner, G. C., & Kumar, A. (2005). Explaining consumer acceptance of handheld Internet devices. *Journal of Business Research*, *58*, 553–558. doi:10.1016/j.jbusres.2003.08.002

Cheung, C. M. K., & Lee, M. K. O. (2006). Understanding consumer trust in internet shopping: a multidisciplinary approach. *Journal of the American Society for Information Science and Technology*, *57*, 479–492. doi:10.1002/asi.20312

Choi, J., Seol, H., Lee, S., Cho, H., & Park, Y. (2008). Customer satisfaction factors of mobile commerce in Korea. *Internet Research*, *18*(3), 313–335. doi:10.1108/10662240810883335

Dahlberg, T., Mallat, N., Ondrus, J., & Zmijewska, A. (2008). Past, present and future of mobile payments research: a literature review. *Electronic Commerce Research and Applications*, *7*, 165–181. doi:10.1016/j.elerap.2007.02.001

DeLone, W. H., & McLean, E. R. (1992). Information systems success: the quest for the dependent variable. *Information Systems Research*, *3*(1), 60–95. doi:10.1287/isre.3.1.60

DeLone, W. H., & McLean, E. R. (2003). The DeLone and McLean model of information systems success: a ten-year update. *Journal of Management Information Systems*, *19*(4), 9–30.

DeLone, W. H., & McLean, E. R. (2004). Measuring e-commerce success: applying the DeLone & McLean information systems success model. *International Journal of Electronic Commerce*, *9*(1), 31–47.

Everard, D. F., & Galletta, A. (2006). How presentation flaws affect perceived site quality, trust, and intention to purchase from an online store. *Journal of Management Information Systems*, *22*, 55–95. doi:10.2753/MIS0742-1222220303

Gebauer, J., Tang, Y., & Baimai, C. (2008). User requirements of mobile technology: results from a content analysis of user reviews. *Information System E-Business Management*, *6*, 361–384. doi:10.1007/s10257-007-0074-9

Gruen, T. W., Osmonbekov, T., & Czaplewski, A. J. (2006). eWOM: the impact of customer-to-customer online know-how exchange on customer value and loyalty. *Journal of Business Research*, *59*, 449–456. doi:10.1016/j.jbusres.2005.10.004

Jarvenpaa, S. L., Lang, K. R., Takeda, Y., & Tuunainen, V. K. (2003). Mobile commerce at crossroads. *Communications of the ACM*, *46*(12), 41–44. doi:10.1145/953460.953485

Jones, K., & Leonard, L. N. K. (2008). Trust in consumer-to-consumer electronic commerce. *Information & Management*, (45): 88–95. doi:10.1016/j.im.2007.12.002

Kim, H., Chan, H. C., & Gupta, S. (2007). Value-based adoption of mobile Internet: an empirical investigation. *Decision Support Systems*, *43*, 111–126. doi:10.1016/j.dss.2005.05.009

Lax, G., & Sarne, G. M. L. (2008). CellTrust: a reputation model for C2C commerce. *Electronic Commerce Research*, *8*, 193–216. doi:10.1007/s10660-008-9019-8

Leonard, L. N. K., & Jones, K. (2009). (forthcoming). The role of self-efficacy, trust, and experience and the mediating effects of satisfaction in the choice of C2C e-commerce among young adults. *Journal of Electronic Commerce in Organizations*.

Leonard, L. N. K., & Riemenschneider, C. K. (2008). What factors influence the individual impact of the web? An initial model. *Electronic Markets*, *18*(1), 75–90. doi:10.1080/10196780701797698

McCloskey, D. W. (2006). The importance of ease of use, usefulness, and trust in online consumers: an examination of the technology acceptance model with older consumers. *Journal of Organizational and End User Computing*, *18*, 47–65.

Molla, A., & Licker, P. S. (2001). E-commerce systems success: An attempt to extend and re-specify the DeLone and McLean model of IS success. *Journal of Electronic Commerce Research*, *2*, 1–11.

Ramus, K., & Nielsen, N. A. (2005). Online grocery retailing: what do consumers think? *Internet Research*, *15*(3), 335–352. doi:10.1108/10662240510602726

Riemenschneider, C. K., Jones, K., & Leonard, L. N. K. (2009). (forthcoming). Web trust – a moderator of the web's perceived individual impact. *Journal of Computer Information Systems*.

Salam, A., Rao, H., & Pegels, C. (2003). Consumer-perceived risk in e-commerce transactions. *Communications of the ACM*, *46*, 325–331. doi:10.1145/953460.953517

Salam, A. F., Iyer, L., Palvia, P., & Singh, R. (2005). Trust in e-commerce. *Communications of the ACM*, *48*, 73–77. doi:10.1145/1042091.1042093

Strader, T. J., & Ramaswami, S. N. (2002). The value of seller trustworthiness in C2C online markets. *Communications of the ACM*, *45*(12), 45–49. doi:10.1145/585597.585600

Tan, Y., & Thoen, W. (2001). Toward a generic model of trust for electronic commerce . *International Journal of Electronic Commerce*, *5*, 61–74.

Tan, Y., & Thoen, W. (2002). Formal aspects of a generic model of trust for electronic commerce . *Decision Support Systems*, *33*, 233–246. doi:10.1016/S0167-9236(02)00014-3

Wareham, J., Zheng, J. G., & Straub, D. (2005). Critical themes in electronic commerce research: a meta-analysis. *Journal of Information Technology*, *20*, 1–19. doi:10.1057/palgrave.jit.2000034

## KEY TERMS AND DEFINITIONS

**Consumer-to-Consumer (C2C):** e-commerce includes the use of online auctions, web forums, chat rooms, and third party consumer listings to conduct commerce transactions.

**Mobile Commerce:** provides users the ability to conduct transactions anywhere, at anytime using a wireless technology device.

**Perceived Convenience:** is the extent the individual believes a mobile device will improve the simplicity of C2C e-commerce.

**Perceived Ease of Use:** is the degree to which an individual expects the information system (i.e. mobile device) to be free of effort.

**Perceived Security:** is the extent an individual believes a mobile device will be free of risk to conduct C2C e-commerce.

**Perceived Trust:** is defined as the confidence the user has in the mobile device being used to conduct the online transaction.

**Perceived Usefulness:** is an individual's expectation that the information technology (i.e. mobile device) will result in improved performance.

# Chapter 77
# Exploring the Mobile Consumer

**Kaan Varnali**
*Bogazici University, Turkey*

**Cengiz Yilmaz**
*Bogazici University, Turkey*

## ABSTRACT

*The article provides insights into consumers' experience with mobile marketing by presenting a review of the mobile consumer behavior literature in an organized framework. An important contribution of this study is that it compiles a list of prominent predictor variables that come into play in the process of consumer adoption and acceptance of mobile marketing. The resulting list is purported to be beneficial to both academics by providing a state-of-the-art and practitioners by providing a powerful item battery to be used in setting up effective mobile marketing campaigns.*

## INTRODUCTION

The use of personal mobile and wireless devices as a medium for communicating with and delivering value to consumers, a new marketing venue often labeled "mobile marketing," has recently become a rapidly growing practice. Many industry analysts agree that the notion of one-to-one marketing is now a more realistic vision due to the rise of mobile marketing (hereafter, m-marketing). Accordingly, several global brands including Coca-Cola, Disney, BMW, McDonald's, Adidas, Nestle, Visa, and MTV are currently implementing m-marketing programs in order to benefit from its unique features. M-advertising revenue has reached to US$4,957 million in 2008, and is projected to exceed US$16 billion within the next 3-4 years (eMarketer, 2007).

DOI: 10.4018/978-1-61520-611-7.ch077

The present chapter focuses on consumer responses to m-marketing applications. Extant research on the consumer side of m-marketing appears to be highly scattered and fragmented. One of the purposes of the chapter is to present this literature in an organized framework. The consumer behavior discipline has a well established body of knowledge which includes a pool of cognitive and affective constructs that influence behavioral outcomes. Prior research about mobile consumers has focused primarily on these frameworks in exploring the behavioral and attitudinal responses to m-marketing practices. In reviewing this literature, we first focus on consumer perceptions of the value created through m-marketing. We then focus on the processes through which consumers adopt and accept m-marketing practices. Finally, we discuss post-usage constructs such as m-satisfaction and m-loyalty.

## PERCEIVED VALUE IN THE MOBILE CONTEXT

Since customer value is what every business entity ultimately seeks, there is a need to understand which elements and unique features of mobile medium provides value from the consumers' perspective. The most frequently noted value proposition of m-marketing is "ubiquity," that is, the omnipresence of information and continual access to commerce (Clarke, 2001). Ubiquity creates value to consumers by fulfilling time-critical needs and arrangements regardless of time and place (Anckar and D'Incau, 2002). Indeed, a large proportion of mobile service value is derived from time savings (Kleijnen, Ruyter and Wetzels, 2007).

Next, "convenience," the agility and accessibility provided by mobile devices (Clarke, 2001), is another key advantage of mobile medium for consumers. Anckar and D'Incau (2002) suggest that "convenience" creates value to consumers by fulfilling efficiency needs and ambitions, such as the need to increase productivity during dead spots of the day as the consumer is unable to access PC-based Internet. In fact, mobile services are used primarily for convenience (Kim, Chan and Gupta, 2007). Spontaneity, flexibility, immediacy, accessibility, time-criticality and instant connectivity are other terms used to refer to forms of ubiquity and convenience. None of these value propositions are mutually exclusive, but each provides important insights into the drivers of m-marketing adoption.

A distinctive feature of m-marketing is that it allows precise identification of the location of the consumer through the use of GPS technology. Leveraging this technology, m-marketers are able to send location-specific messages capturing contextuality. Applications involving this "localization" value proposition include time- and location-sensitive discount offers, roadside assistance, services allowing identification of nearby buyers and sellers, route guidance, road pricing, weather or traffic updates, accessibility information for disabled users, and speech-based guidance for visually impaired.

Another value proposition of the mobile medium is "personalization." The fact that mobile devices are typically used individually makes it an ideal tool for one-to-one marketing. Indeed, personalization is one of the most important factors affecting consumer attitudes toward m-advertising. Personalization makes marketing messages increasingly relevant to the target consumer. People who find m-marketing campaigns relevant are more likely to take actions such as visiting a web site, visiting a shop, replying to the message, supplying email address, or buying the product (Rettie, Grandcolas and Deakins, 2005).

Finally, studies indicate that both utilitarian and hedonic value perceptions contribute to consumers' adoption of m-marketing. In fact, the influence of hedonic value perceptions in building attitudes towards m-marketing appears to be stronger than that of utilitarian value especially among users with limited internet experience and low trust of mobile technology (Park and SuJin, 2006). Utilitarian value assessments correlate positively with importance given to service costs and connection stability, whereas hedonic value appears to correlate negatively with importance of service costs and positively with use convenience and information quality (Park, 2006). In addition, a hedonic tendency is found to be associated positively with perceptions of service quality, whereas a utilitarian tendency relates negatively to perceptions of service quality (Kim and Hwang, 2006).

## THE ROLE OF PERMISSION

The literature unanimously agrees on the significance of explicit consumer permission for the acceptance and success of m-marketing practices. Prior explicit permission is so critical that, without it, m-marketing messages could even reduce brand equity by causing resentment and irritation (Barwise and Strong, 2002). Empirical studies provide support that user control has a significant effect on consumers' attitudes toward m-marketing. Three types of user control are particularly important in the m-marketing domain: timing, frequency and content. Consumers should not only give permission to receive messages but also choose the timing they wish to receive them, the number of messages they shall receive, and the content of the messages (Carroll et al., 2007).

The concept of intrusiveness, which refers to feelings of resentment and irritation as a result of unexpected exposure to advertisements (Godin, 1999) is highly relevant to m-marketing due to the personal and "always on" nature of mobile devices. Factors that may mitigate intrusiveness include permission, message relevance, and monetary benefits (Krishnamurthy, 2000). The situational context, particularly time and location in which a mobile ad is received by a consumer, is of crucial importance to how he/she reacts to it (Barnes and Scornavacca, 2004). Therefore, the delivery of the message at the most appropriate time and location (role/situation congruence) is another factor that should mitigate intrusiveness. Supporting this view, Wehmeyer (2007) provide evidence that in high activity situations mobile ads are perceived more intrusive than during lower levels of activity.

## THE ROLE OF TRUST

Trust in the context of mobile services refers to a set of specific beliefs dealing primarily with the integrity, benevolence, competence, and predictability of a particular service provider. Trust is usually regarded as a catalyst in consumer-marketer relationships because it provides expectations of successful transactions and facilitates willingness to become vulnerable to a mobile Internet site after having taken the Internet site's characteristics into consideration (Lee, 2005). Prior research provides empirical support for the positive influence of trust on attitudes toward m-advertising and intentions to receive messages (Karjaluoto et al., 2008). In addition to its direct effects, trust also seems to increase positive dispositions toward m-marketing indirectly through increasing perceived usefulness of m-advertising (Zhang and Mao, 2008). Trust and value perceptions are also found to improve customer loyalty through their positive impacts on satisfaction (Lin and Wang, 2006).

## THE ROLE OF ATTITUDES AND PERSONAL VARIABLES

Attitudes are among the prime determinants of m-marketing adoption. Prior research seems to have focused primarily on message characteristics as antecedents of m-marketing attitudes. Findings indicate that informativeness, entertainment, credibility, and interactivity of the advertising message have the greatest impacts on consumer attitudes towards m-advertising (Haghirian and Inoue, 2007; Okazaki, 2004). The effects of prior knowledge and general attitude toward advertising, while being significant, seem to be of secondary importance (Bauer et al., 2005). Lee and Jun (2007) further reveal that the prime motivation for which an individual uses mobile media also relates to attitudes toward m-advertising. Consumers using mobile media for the purpose of mobility/convenience (functional benefits) have more favorable attitudes toward m-advertising in comparison to those who use mobile media for symbolic means. One of the few studies that focus on source characteristics indicate that promotional messages are perceived more positively if they come from another person rather than from a company (Wais and Clemons, 2008).

In their attempts to understand m-marketing acceptance and adoption, researchers have successfully validated extended versions of well established frameworks in marketing and consumer behavior literatures, including the Theory of Reasoned Action, the Theory of Planned Behavior, Technology Acceptance Model, Innovation Diffusion Theory, and uses and gratifications theories. These arch-theories were extended to include several innovation-based perceptions and personality traits as antecedents to consumer attitudes and intentions to accept m-marketing. A comprehensive list of these factors is provided in Table 1. Collectively, these works provide valuable insights into the adoption process of mobile services and the relative effects of predictor variables.

Consumer demographics such as gender, household income, age, education, social class, and student-status are generally posited as moderating the relationships between adoption determinants and attitudinal/behavioral responses. Likewise, several other individual characteristics such as average volume of advertising messages received, prior non-store shopping experience, prior usage of mobile services, and prior usage of the Internet are among the most commonly examined moderators describing differences among respondent groups in terms of adoption behavior. For instance, Nysveen, Pedersen and Thorbjørnsen (2005) reveal that social norms and intrinsic motives such as enjoyment are important determinants of intention to use mobile chat services among female users, whereas extrinsic motives such as usefulness and expressiveness are the key drivers among men. Karjaluoto et al. (2008) show that the strength of the relationship between intentions to receive messages and intentions to visit the advertised shop is greater for women than for men. It is also important to note that a few studies indicate nonsignificant effects of gender, education, and income on m-commerce frequency or future m-commerce intention (e.g., Bigné, Ruiz and Sanz, 2007).

Regarding the role of culture, cross-cultural investigations suggest that adoption and usage of mobile services and the process of attitude formation towards m-marketing are strongly influenced by cultural and structural factors. For example, Muk (2007) examine whether cultural differences have a significant impact on consumers' adoption of SMS advertising. Findings indicate that American consumers' decisions on accepting SMS ads are based solely on attitudinal considerations, whereas Taiwanese consumers are influenced by both social norms and attitudinal factors. Likewise, Harris, Rettie, and Kwan (2005) reveal significant differences between the UK and Hong Kong in usage of and attitudes to m-commerce services. They attribute these differences to disparities in levels of collectivism, power distance, and structural aspects of the two markets. Hence, the search for a single, global m-marketing strategy may be misguided.

A closer investigation of the aforementioned works indicates two critical issues. First, it appears that, due to the inherent characteristics of the mobile medium, a comprehensive understanding of mobile consumer behavior requires an integrative approach that views the end-user not only as a technology user but also as a service consumer and a network member (Pedersen, Methlie and Thorbjørnsen, 2002). Second, extant theories in the consumer behavior discipline should be adapted and utilized in the mobile context to capture a broader set of emotional, cognitive, social, and cultural influences. In fact, the list of elements and factors that are in interplay in shaping behaviors of mobile consumers is extremely long. A review of the accumulated literature on m-marketing adoption has revealed 70 determinants classified under 5 broader categories (see Table 1).

*Table 1. M-marketing adoption determinants*

| Determinants | Definition |
|---|---|
| **Consumer-based** | |
| **Demographics** | |
| Age | |
| Gender | |
| Household income | |
| Education | |
| Occupation | |
| Social class | |
| Student-status | High school, college, and non-student adults |
| Average volume of ad messages received | |
| Prior non-store shopping experience | Mail, catalogue, television, mobile and Internet |
| Existing knowledge | Prior usage of the mobile medium |
| Prior usage of the Internet | Users of a technology are thought to gain the ability to predict outcomes of using a similar technology |
| Frequency of mobile use | |
| Length of mobile use | How long the user is subscribed? |
| Mobile affinity | Individual's relationship with mobile medium |
| **Consumer Traits** | |
| Innovativeness | Willingness to try out any new information technology |
| Opinion leadership | The extent to which a person is held in high esteem by those that accept his or her opinions |
| Concern for privacy | The anxious sense of interest that a person has because of various types of threats to the person's state of being free from intrusion |
| Optimum stimulation level | Individual's general response to environmental stimuli |
| Susceptibility to social influence | The degree to which an individual is influenced by personal recommendations, actions, and adoption of products by significant others |
| Optimism | Overall feeling toward technological development |
| General attitude towards advertising | Degree of like or dislike for advertising |
| General attitude towards mobile | Degree of like or dislike for the mobile medium |
| Critical mass | Minimum amount of people who have already adopted the innovation necessary for adoption |
| Mobile technology readiness | Individual's propensity to use or embrace new mobile technologies |
| Self efficacy | Beliefs in one's capabilities to mobilize the motivation, cognitive resources, and courses of action needed to meet given situational demands |
| Love of shopping | The degree to which an individual receives emotional gratification from shopping |
| Time consciousness | Proneness to recognize the scarcity of time as a resource |
| Personal attachment | The extent to which the mobile phone represents an integral part of a person's self-concept, and defines his/her role in a cultural sub-group |
| Playfulness | Tendency to interact spontaneously, inventively, and imaginatively with microcomputers |

*continued on the following page*

*Table 1. continued*

| | |
|---|---|
| Perceived financial resources | Subjective assessments of one's own economic resources |
| Information seeking behavior | Tendency for seeking external information |
| Price-consciousness | Being interested in getting the lowest price in shopping |
| Involvement level | Intensity of interest that a buyer shows for a certain service in a specific purchase decision |
| Cultural background | Culture-based values, beliefs and tendencies |
| **Innovation-based (Perceived)** | |
| Relative advantage | Relative benefits of using the service when compared to its alternatives |
| Complexity/Cognitive effort | The extent to which an innovation is perceived as difficult to understand or use |
| Trialability | The extent to which potential adopters can try out components, but decide to return to their prior conditions without great cost |
| Compatibility | The degree to which an innovation is perceived to be consistent with consumers' previous experiences, values and needs |
| Observability | The extent to which potential adopters can observe or find out about the properties and benefits of an innovation |
| Visibility/Communicability | The degree to which the use of innovation is visible to others |
| Enjoyment | The extent to which the activity of using a product is perceived to be enjoyable in its own right, apart from any performance consequences |
| Navigation ergonomics/Interaction quality | Perceived quality of interaction |
| Connection quality/reliability | The degree to which users perceive that the connection between the mobile device and the internet is satisfying in terms of speed and reliability |
| Cost | Perceived expensiveness of the service fee |
| Privacy | The extent to which users perceive having control over sharing personal information with others |
| Time convenience | Perceptions regarding the benefit of time convenience |
| Security | Perceptions regarding the safety of the exchanged information |
| Permission/User control | Perceived user control over message delivery and the timing, content, and frequency of message delivery |
| Content credibility/reliability | The extent to which a consumer perceives claims made about the brand in the ad to be truthful and believable |
| Trust | Belief that allows consumers to willingly become vulnerable to the mobile service |
| Risk | Subjective expectation of suffering a loss in pursuit of the desired outcome of using a mobile service |
| Usefulness | The degree to which a person believes that engaging with a mobile service would enhance his or her performance or satisfy a concrete need |
| Ease of use | The degree to which a person believes that engaging with a mobile service would be free of effort |
| Novelty | The degree to which the mobile service is perceived as novel |
| Relevance of the content/Content quality | Relevance of the content of the m-marketing message to the target consumer |
| Technicality | The degree to which the mobile service is perceived as being technically excellent in the process of providing services |
| Information value/utility | The extent to which the message is perceived as an opportunity to gratify consumer's need for information |
| Entertainment value/utility | The extent to which the message is perceived as an opportunity to gratify consumer's need for entertainment |

*continued on the following page*

*Table 1. continued*

| | |
|---|---|
| Social value/utility | The extent to which the message is perceived as an opportunity to gratify consumer's need for social acceptance |
| Intrusiveness | Utility and expectedness of an interruption |
| Design aesthetics | Balance, emotional appeal, or aesthetic of the user interface |
| **Context-based** | |
| Peer/Social influence | |
| Task type | The objective of the user when engaging in a mobile service |
| Contextual quality | Delivery of the message at the most appropriate time and location |
| Usage characteristics/Motivational uses | A variety of usage situations are characterized by changing levels of utilitarian and hedonic motives. |
| **Strategy-based** | |
| Incentives | Clarity and type of incentives (e.g., free offers, coupons, discounts, lottery) |
| Ease of opt-out | Ease of getting out of the service |
| Information communication source | Media, opinion leader, less active members of the society |
| Frequency of message sending | |
| Variety of payment options | Availability of more than one payment method |

## M-SATISFACTION AND M-LOYALTY

Satisfaction is traditionally defined as an overall affective and cognitive evaluation of the product or service experience (Oliver, 1980). As a direct outcome of a customer's perception of value received, satisfaction is a strong predictor of re-purchase intentions, complaining, product usage, word-of-mouth recommendations, and loyalty. Loyalty is defined as "a deeply held commitment to re-buy or re-patronize a preferred product/service consistently in the future" (Oliver, 1999, p.34), and is seen as the key factor in developing a sustainable competitive advantage in competitive markets.

Pura (2005) analyze the direct effects of four value dimensions (conditional, emotional, monetary, and social) on commitment to and behavioral intentions towards using location-based mobile services. Findings of this study indicate that behavioral intentions are most strongly influenced by conditional value, i.e., the extent to which a mobile service offers entertaining service experiences in the right context, commitment, and monetary value. Commitment is further found to relate positively to emotional value and conditional value. Social value perceptions are found to be unrelated to the outcome variables. In another study, Pihlström (2007) finds that intentions to re-use the same service provider are directly influenced by commitment to the provider and indirectly by emotional and social value perceptions of the MMS content. The equivocal nature of these findings calls for future research attention on m-loyalty.

Another study investigates the role of information quality in increasing m-satisfaction and m-loyalty (Chae et al., 2002). Dimensions of information quality are identified as connection quality, content quality, interaction quality, and contextual quality (see Table 1). All four constructs are found to have significant effects on user satisfaction, which, in turn, relates to customer loyalty. In terms of relative effects, interaction quality and connection quality appear to have stronger impacts on user satisfaction than content quality and contextual quality. Choi et al. (2008) find perceived credibility of the advertiser/advertising as the most important driver of m-satisfaction and m-loyalty, which was followed by perceived connection quality. These finding indicate that provision of content and contextual quality is insufficient if the information is not easily accessible because of connection failures or interaction difficulties.

Regarding the effects of design aesthetics of mobile services on consumer satisfaction or loyalty, Bruner and Kumar (2005) show that visually oriented consumers are more likely to adopt mobile handheld devices than other consumers. This finding implicitly suggests that visual design is an important factor, at least for a segment of mobile device users. Drawing upon research on visual aesthetics in a variety of situations, Cyr, Head and Ivanov (2006) show design aesthetics having significant effects on perceived usefulness, ease of use, and enjoyment from mobile services (all of which are further shown to affect consumer loyalty). Nonetheless, there exist contradictory findings as well. For instance, Magura (2003) finds that site design has little relevance to mobile commerce acceptance. Obviously, further research in this area would be of great value.

## FUTURE RESEARCH DIRECTIONS

The current state of research in consumer responses to m-marketing seems to have approached the issue from an innovation-adoption perspective, focusing primarily on initial adoption requirements rather than on post-usage constructs such as satisfaction, repeat buying, loyalty, and switching behavior. This is to some extent reasonable, because mobile services are radical technological innovations and m-marketing is still in its initial phases. However, considering the fact that mobile devices have infiltrated almost every aspect of life, we now need excessive research effort to understand more about post-usage constructs. Likewise, cross-cultural studies in the domain of m-marketing are still quite scarce.

Perhaps more important, the concept of mobile social networking, which involves making and sharing content through mobile Internet, is on the rise. Therefore, research should also focus on types of mobile social networks, drivers and inhibitors of mobile social networking, and consumer needs that drive this new trend.

Overall, although there has been substantial progress in the consumer side of m-marketing, the field still offers fertile research avenues.

## CONCLUSION

As shown in Table 1, consumer intentions to receive and engage in m-marketing depends upon a multitude of antecedent factors, including personal variables such as personality traits, predispositions, demographics, and cultural background, as well as upon several perceptual variables. All these factors are important in terms of driving consumer attitudes and behavioral intentions, hence excessive focus on any group of factors in isolation is unlikely to result in desired responses.

## REFERENCES

Anckar, B., & D'Incau, D. (2002). Value creation in mobile commerce: Findings from a consumer survey. *JITTA: Journal of Information Technology Theory & Application*, *4*(1), 43–65.

Barnes, S. J., & Scornavacca, E. (2004). Mobile marketing: the role of permission and acceptance. *International Journal of Mobile Communications*, *2*(2), 128–139. doi:10.1504/IJMC.2004.004663

Barwise, P., & Strong, C. (2002). Permission-based mobile advertising. *Journal of Interactive Marketing*, *16*(1), 14. doi:10.1002/dir.10000

Bauer, H. H., Reichardt, T., Barnes, S. J., & Neumann, M. M. (2005). Driving consumer acceptance of mobile marketing: a theoretical framework and empirical study. *Journal of Electronic Commerce Research*, *6*(3), 181–192.

Bigné, E., Ruiz, C., & Sanz, S. (2007). Key drivers of mobile commerce adoption: an exploratory study of Spanish mobile users. *Journal of Theoretical & Applied Electronic Commerce Research*, *2*(2), 48–61.

Bruner, G. C., & Kumar, A. (2005). Explaining consumer acceptance of handheld Internet devices. *Journal of Business Research*, *58*(5), 553–558. doi:10.1016/j.jbusres.2003.08.002

Carroll, A., Barnes, S. J., Scornavacca, E., & Fletcher, K. (2007). Consumer perceptions and attitudes towards SMS advertising: recent evidence from New Zealand. *International Journal of Advertising*, *26*(1), 79–98.

Chae, M., Kim, J., Kim, H., & Ryu, H. (2002). Information quality for mobile Internet services: a theoretical model with empirical validation. *Electronic Markets*, *12*(1), 38–46. doi:10.1080/101967802753433254

Choi, J., Seol, H., Lee, S., Cho, H., & Park, Y. (2008). Customer satisfaction factors of mobile commerce in Korea. *Internet Research*, *18*(3), 313–335. doi:10.1108/10662240810883335

Clarke, I. (2001). Emerging value propositions for M-commerce. *The Journal of Business Strategy*, *18*(2), 133–149.

Cyr, D., Head, M., & Ivanov, A. (2006). Design aesthetics leading to m-loyalty in mobile commerce. *Information & Management*, *43*, 950–963. doi:10.1016/j.im.2006.08.009

eMarketer. (2007, October). *Mobile Brand Advertising*.

Godin, S. (1999). *Permission Marketing: Turning Strangers into Friends, and Friends into Customers*. New York: Simon & Schuster.

Haghirian, P., & Inoue, A. (2007). An advanced model of consumer attitudes toward advertising on the mobile Internet. *International Journal of Mobile Communications*, *5*(1), 48–67. doi:10.1504/IJMC.2007.011489

Harris, P., Rettie, R., & Kwan, C. C. (2005). Adoption and usage of m-commerce: a cross-cultural comparison of Hong Kong and the United Kingdom. *Journal of Electronic Commerce Research*, *6*(3), 210–225.

Karjaluoto, H., Standing, C., Becker, M., & Leppaniemi, M. (2008). Factors affecting Finnish consumers' intention to receive SMS marketing: a conceptual model and an empirical study. *International Journal of Electronic Business*, *6*(3), 298–318. doi:10.1504/IJEB.2008.019109

Kim, D. J., & Hwang, Y. (2006). A study of mobile Internet usage from utilitarian and hedonic user tendency perspectives. In *Proceedings of the Twelfth Americas Conference on Information Systems*.

Kim, H., Chan, H. C., & Gupta, S. (2007). Value-based adoption of mobile Internet: an empirical investigation. *Decision Support Systems*, *43*(1), 111–126. doi:10.1016/j.dss.2005.05.009

Kleijnen, M., Ruyter, K., & Wetzels, M. (2007). An assessment of value creation in mobile service delivery and the moderating role of time consciousness. *Journal of Retailing*, *83*(1), 33–46. doi:10.1016/j.jretai.2006.10.004

Krishnamurthy, S. (2000). A comprehensive analysis of permission marketing. *Journal of Computer-Mediated Communication*, *6*(2).

Lee, T. (2005). The impact of perceptions of interactivity on customer trust and transaction intentions in mobile commerce. *Journal of Electronic Commerce Research*, *6*(3), 165–181.

Lee, T., & Jun, J. (2007). The role of contextual marketing offer in Mobile Commerce acceptance: comparison between Mobile Commerce users & nonusers. *International Journal of Mobile Communications*, *5*(3), 339–356. doi:10.1504/IJMC.2007.012398

Lin, H.-H., & Wang, Y.-S. (2006). An examination of the determinants of customer loyalty in mobile commerce contexts. *Information & Management*, *43*(3), 271–282. doi:10.1016/j.im.2005.08.001

Magura, B. (2003). What hooks m-commerce customers? *MIT Sloan Management Review*, *44*(3), 9.

Muk, A. (2007). Cultural influences on adoption of SMS advertising: a study of American and Taiwanese consumers. *Journal of Targeting . Measurement & Analysis for Marketing*, *16*, 39–47. doi:10.1057/palgrave.jt.5750062

Nysveen, H., Pedersen, P. E., & Thorbjørnsen, H. (2005). Explaining intention to use mobile chat services: moderating effects of gender. *Journal of Consumer Marketing*, *22*(4/5), 247–257. doi:10.1108/07363760510611671

Okazaki, S. (2004). How do Japanese consumers perceive wireless ads? A multivariate analysis. *International Journal of Advertising*, *23*(4), 429–454.

Oliver, R. L. (1980). A cognitive model of the antecedents and consequences of satisfaction decisions. *JMR, Journal of Marketing Research*, *17*(4), 460–469. doi:10.2307/3150499

Oliver, R. L. (1999). Whence consumer loyalty. *Journal of Marketing*, *63*, 33–44. doi:10.2307/1252099

Park, C. (2006). Hedonic and utilitarian values of mobile internet in Korea. *International Journal of Mobile Communications*, *4*(5), 497–508.

Park, J. & SuJin Y. (2006). The moderating role of consumer trust and experiences: value driven usage of mobile technology. *International Journal of Mobile Marketing*, *1*(2), 24–32.

Pedersen, P. E., Methlie, L. B., & Thorbjørnsen, H. (2002) Understanding mobile commerce end-user adoption: a triangulation perspective and suggestion for an exploratory service evaluation framework. *Proceedings of the 35th Hawaii International Conference on System Sciences.*

Pihlström, M. (2007). Committed to content provider or mobile channel? Determinants of continuous mobile multimedia service use. *JITTA: Journal of Information Technology Theory & Application*, *9*(1), 1–24.

Pura, M. (2005). Linking perceived value and loyalty in location-based mobile services. *Managing Service Quality*, *15*(6), 509–539. doi:10.1108/09604520510634005

Rettie, R., Grandcolas, U., & Deakins, B. (2005). Text message advertising: response rates and branding effects. *Journal of Targeting . Measurement & Analysis for Marketing*, *13*(4), 304–313. doi:10.1057/palgrave.jt.5740158

Wais, J. S., & Clemons, E. K. (2008). Understanding and implementing mobile social advertising. *International Journal of Mobile Marketing*, *3*(1), 12–18.

Wehmeyer, K. (2007) Mobile Ad Intrusiveness – The effects of message type and situation. In *Proceedings of the 20th Bled eConference*.

Zhang, J., & Mao, E. (2008). Understanding the acceptance of mobile SMS advertising among young Chinese consumers. *Psychology and Marketing*, *25*(8), 787–805. doi:10.1002/mar.20239

## ADDITIONAL READING

Balasubramanian, S., Peterson, R. A., & Jarvenpaa, S. L. (2002). Exploring the implications of m-commerce for markets and marketing. *Journal of the Academy of Marketing Science*, *30*(4), 348–361. doi:10.1177/009207002236910

Michael, A., & Salter, B. (2006) *Mobile Marketing*, UK: Butterworth-Heineman.

Sugai, P. (2005). Mapping the mind of the mobile consumer across borders: an application of the Zaltman metaphor elicitation technique. *International Marketing Review*, *22*(6), 641–657. doi:10.1108/02651330510630267

## KEY TERMS AND DEFINITIONS

**Customer Value:** Overall assessment of the utility of a market offering based on what is received and what is given.

**M-Loyalty:** A deeply held commitment to reuse a preferred mobile service or service/network provider consistently in the future.

**Mobile Marketing:** The use of personal mobile and wireless devices as a medium for creation, communication and delivery of customer value.

**M-Satisfaction:** Overall affective and cognitive evaluation of the mobile service experience

**Permission Marketing:** Type of marketing campaign that requires consumers to 'opt in' before they receive marketing messages of any kind and have the option to 'opt out' at any stage.

**Personalization:** The degree to which a service/message is tailored to meet the needs and wants of the individual consumer.

# Chapter 78
# The Personalization Privacy Paradox:
## Mobile Customers' Perceptions of Push-Based vs. Pull-Based Location Commerce

**Heng Xu**
*Pennsylvania State University, USA*

**John M. Carroll**
*Pennsylvania State University, USA*

**Mary Beth Rosson**
*Pennsylvania State University, USA*

## INTRODUCTION

Recent advances in positioning technologies, such as global positioning systems and cellular triangulation techniques, have not only provided consumers with unprecedented accessibility to network services while on the move, but also enabled the localization of services (Bellavista, Kupper, & Helal, 2008). Locatability, that is, the ability of mobile hosts to determine the current physical location of wireless devices, is thus the key enabler of an alluring mobile business operation (Junglas & Watson, 2003). In the literature, commercial location-sensitive applications and services that utilize geographical positioning information to provide value-added services are generally termed location-based services (LBS), marketed under terms like 'Location-Commerce' or 'L-Commerce' (Barnes, 2003).

Despite the growing attention given to LBS, little is understood about the differential effects of alternative protocols for locating client devices on the mobile consumer perceptions and behaviors. To offer personalized services that are tailored to mobile consumers' activity contexts, LBS providers deliver information content through mobile communication and positioning systems in two ways – push and pull mechanisms. In the pull mechanism (i.e., reactive LBS), individuals request information and services based on their locations, e.g., a user might request a list of nearby points of interest. In the push mechanism (i.e., proactive LBS), location-sensitive content is automatically sent to individuals based on tracking their locations. From the consumer perspective, the pull-based L-Commerce entails a higher

DOI: 10.4018/978-1-61520-611-7.ch078

level of control, but consequent time and cognitive investment to manage personal information are relatively high. The push-based L-Commerce, on the other hand, allows for the regular canvassing of information sources for updated information and automatic delivery (Edmunds & Morris, 2000): less control but also less effort. Although the push-based L-Commerce may reduce consumers' information processing and retrieval efforts, it increases the amount of potentially irrelevant information that consumers have to deal with as well as the amount of personal location information that they have to disclose to service providers (Eppler & Mengis, 2004).

Will the push-based L-Commerce be experienced as more intrusive to individual privacy and/or as interruptive to the mobile consumer's activity? How will mobile consumers make the tradeoff between privacy concerns and instrumental values of L-Commerce? In this chapter, we attempt to respond to these questions by discussing the differences between push and pull mechanisms and discussing how these differences may lead to different mobile consumers' perceptions of push-based and pull-based L-Commerce. In what follows, we present the conceptual analysis, describing the personalization privacy paradox, and discussing the different impacts of pull and push mechanisms on the privacy personalization paradox. This is followed by a discussion of the key results, directions for future research, and theoretical implications.

## CONCEPTUAL ANALYSIS

### The Personalization Privacy Paradox

Information privacy refers to the ability of the individual to control the terms under which personal information is acquired and used (Westin, 1967). Within the robust body of research that attempts to understand the nature of consumer privacy, it has been found that the *calculus* perspective of privacy is "the most useful framework for analyzing contemporary consumer privacy concerns" (Culnan & Bies, 2003, p.326). This perspective reflects an implicit understanding that privacy is not absolute (Klopfer & Rubenstein, 1977); rather, the individual's privacy interests can be interpreted based on a "calculus of behavior" (Laufer & Wolfe, 1977, p.36). That is to say, individuals can be expected to behave as if they are performing a risk-benefit analysis (i.e., privacy calculus) in assessing the outcomes they will receive as a result of providing personal information to corporations (Culnan & Bies, 2003). Applying the notion of privacy calculus to the understanding of the tradeoff between personalization and privacy, we may interpret the usage of personalized information or service as an exchange where consumers disclose their personal information in return for the customized information or services. Prior studies have confirmed that users are more likely to provide personal information when they perceive higher value in the personalization services offered (White, 2004).

Labeled as one type of context-awareness applications, L-Commerce can provide a user with the value of contextualization by sending the user with relevant promotional information based on the user's location, identity, activity and time (Barnes, 2003). Personalization has been generally defined as "the ability to provide content and services that are tailored to individuals based on knowledge about their preferences and behaviors" (Adomavicius & Tuzhilin, 2005, p.84). In the context of L-Commerce, personalization with the emphasis on individualized utility has been acknowledged as one key value that adds to the user experiences and smoothness of interactions (Zimmermann, Specht, & Lorenz, 2005). Consumers may be motivated to disclose their personal information in exchange for personalized services and/or information access. L-Commerce can obviously be personalized as the services are invariably tied to a mobile device (e.g., a mobile phone). To the extent that a mobile device could be uniquely identified (e.g., via the SIM card in the case of a mobile phone) and is always handy and available, the device is ideal for marketers to channel their marketing and advertising opportunities into tailoring wireless content delivery for mobile consumers. Indeed, personalization, as one important antecedent of perceived benefits identified by prior studies (Junglas & Watson, 2003; Zimmermann et al., 2005), is gained when L-Commerce applications are tailored to individual customers' interests, locations, and the time of the day. Therefore, we propose that *the value of personalization increases consumers' perceived benefits of information disclosure in L-Commerce*.

It has been suggested by prior studies that personalized information and services have significant privacy implications because of large amounts of personal information collected for performing personalization (Kobsa, 2007). Consumers are vulnerable to at least two kinds of risks if their personal information is not used fairly or responsibly (Culnan and Armstrong 1999). First, a consumer may perceive that her privacy is invaded if unauthorized access is made to her personal information as a result of a security breach or in the absence of appropriate internal controls (Culnan and Armstrong 1999). Second, as computerized information may be readily duplicated and shared, a consumer is vulnerable to the risk that the personal information provided is being put to secondary use for unrelated purposes without prior knowledge or consent (Culnan and Armstrong 1999).

In the L-Commerce context, the concerns center on the confidentiality of the dynamic location data, accumulated location data and other personal information, and the potential risks that consumers experience over the possible breach of confidentiality (Shiels, 2008). Improper handling of personal information could result in the discovery of consumer identity and behavior, which may be used for unsolicited marketing, price discrimination or unauthorized access (Kobsa, 2007). In the context of mobile commerce, it has been shown that consumers' privacy concerns were triggered when they were presented with a personalized shopping list that was derived from an analysis of their purchasing history (Kourouthanassis & Roussos, 2003; Roussos et al., 2002). Despite the benefits or added value provided by personalized information and services, consumers are concerned about their personal information collected and used to perform personalization (Awad & Krishnan, 2006). Therefore, we propose that *the value of personalization increases consumers' perceived risks of information disclosure in L-Commerce*.

## Influences of Information Delivery Mechanisms – Push vs. Pull

To offer personalized services that are tailored to mobile consumers' activity contexts, marketers and advertisers deliver information content through mobile communication and positioning systems in two ways – push and pull mechanisms. In the push-based L-Commerce, service providers send relevant information or content to consumers by background observation of their behaviors through tracking physical locations of their mobile devices. With these data, personalization systems tailor the services based on the user's known proximity to a store or merchant. Haag et al. (2005) describes an application that pushes video rental information to customers: whenever appearing in the vicinity of a participating video store, the customer's mobile phone triggers a system within the video store that evaluates that customer's rental history against store inventory. If the system indicates an available video will be of interest, it sends a text message to the customer's mobile phone with the rental details on the film.

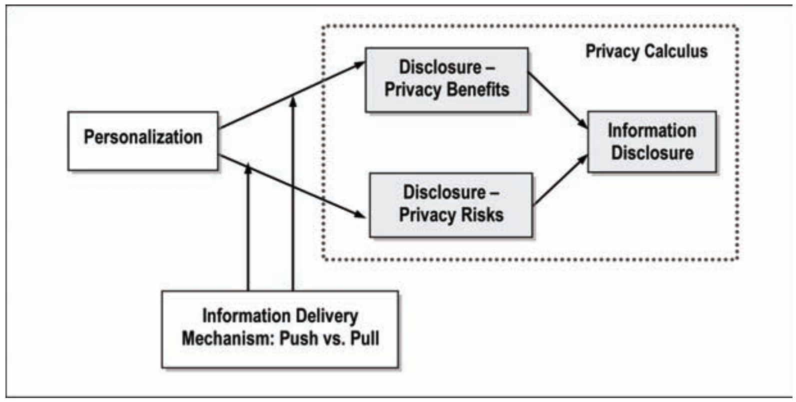
In contrast to the push-based mechanism, the pull-based mechanism only locates users' mobile devices when the users initiate specific requests. Such pull-based L-Commerce may be seen in some 'on demand' services where the user dials or signals a service provider for specific information / service such as the nearest Starbucks store. In this approach, location information is ephemeral and useful only to complete the transaction requested (e.g., informing the user of the Starbucks store). One of the first examples was a service launched by ZagMe in the United Kingdom (Buckley, 2007). By calling a number or sending a text message to activate location tracking, customers could receive promotional information and coupons through text messages based on their geographical location in a designated mall.

As discussed earlier, higher level of personalization leads to higher level of perceived benefits of information disclosure. However, this relationship is likely to be contingent on the type of information delivery mechanisms (push/pull). Comparing to pull mechanism, push-based L-Commerce should increase the level of timeliness and locatability of information access as push approach enables users to obtain their needed information as soon as it is available (Kendall & Kendall, 1999; 2000). Hence, the benefits of push system are that it allows for the regular canvassing of selected information sources for updated information and having that information sent to users seamlessly (Herther, 1998). Comparing to pull-based LBS, push may result in a substantial reduction in the amount of consumers' information search as the subscribed content is being delivered, rather than retrieved (Kendall & Kendall, 1999; 2000). Due to the limited information-processing capacity of the human mind (Alba et al., 1997), consumers tend to reduce the amount of efforts on information search and decision making through the push system (Kendall & Kendall, 1999; 2000). Hence, for push-based L-Commerce, a user may perceive higher level of personalization value when the service content adapts itself automatically based on the user's profile without the user's involvement. Therefore, we propose that *the positive association between personalization and perceived benefits of information disclosure will be stronger when the information delivery mechanism is push than when it is pull*.

The negative effect of perceived privacy risks on intention to disclose personal information, however, is likely to be moderated by the level of *control* inherent in the type of information delivery mechanism (i.e., push/pull). Empirical evidence shows that the ability of the consumer to control the disclosure of personal information could offset the risk of possible negative consequences (Eddy, Stone, & Stone-Romero, 1999). L-Commerce applications in different information delivery mechanisms offer different levels of *control* over the disclosure of personal information (Gidari, 2000; Levijoki, 2001). In pull-based L-Commerce, the consumer exercises greater control over the interaction: the decision to initiate contact with the marketer is volitional, and location information is provided only to complete the transaction requested. In contrast, in push-based L-Commerce, the consumer's location is tracked all the time and location-based information / services are automatically sent to a consumer's mobile device based on that consumer's location and previously stated preferences. Although pushing selected information to users reduces their information processing and retrieval needs, it increases the amount of potentially irrelevant information that users have to deal with and the amount of location information that they have to disclose to service providers (Eppler & Mengis, 2004). Since consumers have less control over their interactions with service providers, push-based L-Commerce would be potentially more intrusive to individual privacy and tend to interrupt the consumer (Unni & Harmon, 2007). This would amplify the impacts of privacy risk perceptions. Therefore, we propose that *the predicted positive association between personalization and perceived risks of information disclosure will be stronger when the information delivery mechanism is push than when it is pull*.

Figure 1 depicts the conceptual framework.

*Figure 1. The conceptual framework*




In addition, it seems reasonable to argue that the conceptual structure of personalization privacy paradox is context-dependent. For example, the usage of the location-based buddy-finder servicers such as tracking friends and sending restaurant coupons based on friends' locations may lead to a positive outcome of the privacy calculus and hence higher willingness to disclose location information. Thus it is important to explore the contextual nature of privacy theory—knowing what "more" or "less" privacy might mean for different individuals in the specific context. Thus, Waldo et al. (2007) called for more research on the contextual nature of privacy, as they believe that research along this direction will make it clear that questions about privacy necessarily imply specifying privacy "from whom," "about what," "for what reasons," and "under what conditions." Because of such context-specific nature of privacy calculus, we propose that *parameter estimates in the conceptual framework (e.g., factor mean levels, path coefficients) may not be the same among different contexts or applications*.

## FUTURE RESEARCH DIRECTIONS

Research on L-Commerce is in the early stages and our exploratory efforts represent one of the first attempts to examine how the information delivery mechanism (push/pull) may influence the personalization privacy paradox. This chapter represents the early attempts at exploring the relative effectiveness of push and pull mechanisms with privacy considerations as a focal point. Further research should be directed to empirically test the conceptual framework (Figure 1). A field experiment in which participants can gain more realistic experiences of using LBS is recommended to test the framework because this approach allows us to manipulate key variables and exercise control over extraneous variables. This study could be designed as a one-factorial experiment manipulating information delivery mechanism (push and pull) with participants randomly assigned to one of the two groups. One specific push-based application and one pull-based application could be adapted from present applications described in Haag et al. (2005) and Buckley (2007) to have two balanced experiment scenarios. At the final stage of the experiment, participants will be asked to complete a questionnaire regarding the major research constructs – *perceived benefits of information disclosure* (Unni & Harmon, 2007), *perceived risks of information disclosure* (Dinev & Hart, 2006), *personalization* (Zeithaml, Parasuraman, & Malhotra, 2000), and *information disclosure* (Culnan & Armstrong, 1999). Upon collecting the data, the multi-group analyses (push and pull subgroups) through structural equation modeling techniques (e.g., Partial Least Squares) can be conducted to test the research model.

The challenge is to design the manipulations for both pull and push mechanisms in a balanced and realistic manner. Particularly, it would be challenging to mimic user behaviors for the pull-based LBS in an experimental setting. Because in pull-based LBS (e.g., "where is the nearest Japanese restaurant offering discounts right now?"), a consumer's decision to initiate contact with the service provider is volitional. Therefore, triggering consumers' natural motives of initiating the use of pull-based LBS in an experimental setting remains a challenge.

The notion of privacy calculus interprets the individual's privacy interests as an exchange where individuals disclose their personal information in return for certain benefits. Such calculus perspective of privacy has been found in many studies to be one of the major frameworks analyzing consumer privacy concerns (Culnan & Bies, 2003; Dinev & Hart, 2006). This chapter suggested that the conventional understanding of privacy as a calculus can be applied to explain to the personalization privacy paradox in the new L-Commerce context. Privacy concerns in such new context of surveillance-based technologies become particularly salient as merchants and service providers may have access to a large volume of potentially sensitive consumer information. This research is an initial examination of issues relating to the moderating roles of push versus pull information delivery mechanism in the personalization and privacy paradox.

## CONCLUSION

Location-based technologies that are aware of the circumstances of users can deliver relevant services or information in a productive, personalized and context-relevant way, deepening customer relationships. The convergence between marketing, customer relationship management and mobile commerce represents a potentially powerful platform for L-Commerce. This chapter has provided preliminary analysis about how consumers strike a balance between value and risk. The current research contributed to existing literature by theoretically investigating the personalization privacy paradox through a privacy calculus lens, for information delivery mechanism (push vs. pull), in an understudied L-Commerce environment. Our initial analysis that the influence of personalization on the privacy calculus model depends on the type of information delivery mechanisms suggest the need for future studies to understand these effects more fully. Using the groundwork laid in this study, future research along various possible directions could contribute to extending our theoretical understanding and practical ability to foster the acceptance of L-Commerce.

## REFERENCES

Adomavicius, G., & Tuzhilin, A. (2005). Personalization technologies: a process-oriented perspective. *Communications of the ACM*, *48*(10), 83–90. doi:10.1145/1089107.1089109

Alba, J., Lynch, J. G., Weitz, B., Janiszewski, C., Lutz, R., Sawyer, A., & Wood, S. (1997). Interactive Home Shopping: Consumer, Retailer, and Manufacturer Incentives to Participate in Electronic Marketplaces. *Journal of Marketing*, *61*(July), 38–53. doi:10.2307/1251788

Awad, N. F., & Krishnan, M. S. (2006). The personalization privacy paradox: An empirical evaluation of information transparency and the willingness to be profiled online for personalization. *MIS Quarterly*, *30*(1), 13–28.

Barnes, J. S. (2003). Known by the Network: The Emergence of Location-Based Mobile Commerce. In E.-P. Lim & K. Siau (Eds.), *Advances in Mobile Commerce Technologies*, (pp. 171-189). Hershey, PA: Idea Group Publishing.

Bellavista, P., Kupper, A., & Helal, S. (2008). Location-Based Services: Back to the Future. *IEEE Pervasive Computing / IEEE Computer Society [and] IEEE Communications Society*, *7*(2), 85–89. doi:10.1109/MPRV.2008.34

Buckley, R. (2007). *Location Based Advertising - Theory and Practice*. Available online http://www.mobiadnews.com/documents/lbs_buckley.pdf

Culnan, M. J., & Armstrong, P. K. (1999). Information Privacy Concerns, Procedural Fairness and Impersonal Trust: An Empirical Investigation. *Organization Science*, *10*(1), 104–115. doi:10.1287/orsc.10.1.104

Culnan, M. J., & Bies, R. J. (2003). Consumer Privacy: Balancing Economic and Justice Considerations. *The Journal of Social Issues*, *59*(2), 323–342. doi:10.1111/1540-4560.00067

Dinev, T., & Hart, P. (2006). An Extended Privacy Calculus Model for E-Commerce Transactions. *Information Systems Research*, *17*(1), 61–80. doi:10.1287/isre.1060.0080

Eddy, R. E., Stone, L. D., & Stone-Romero, F. E. (1999). The Effects of Information Management Polices on Reactions to Human Resource Information Systems: An Integration of Privacy and Procedural Justice Perspectives. *Personnel Psychology*, *52*, 335–358. doi:10.1111/j.1744-6570.1999.tb00164.x

Edmunds, A., & Morris, A. (2000). The Problem of Information Overload in Business Organisations: A Review of the Literature. *International Journal of Information Management*, *20*, 17–28. doi:10.1016/S0268-4012(99)00051-1

Eppler, M. J., & Mengis, J. (2004). The concept of information overload: A review of literature from organization science, marketing, accounting, MIS, and related disciplines. *The Information Society*, *20*, 325–344. doi:10.1080/01972240490507974

Gidari, A. (2000). *No 'L-Commerce' Without 'L-Privacy': Fair Location Information Practices for Mobile Commerce*. Paper presented at the L-Commerce 2000-the Location Services & GPS Technology Summit. Available online: http://www.airbiquity.com/downloads/Privacy-Airbiquity.PDF

Haag, S., Cummings, M., & Phillips, A. (2005). *Management Information Systems for the Information Age* (6 ed.). New York: Irwin/McGraw-Hill Higher Education.

Herther, N. K. (1998). Push and the Politics of the Internet. *The Electronic Library*, *16*(2), 455–461. doi:10.1108/eb045624

Junglas, I. A., & Watson, R. T. (2003). *U-Commerce: An Experimental Investigation of Ubiquity and Uniqueness.* Paper presented at the Proceedings of 24th Annual International Conferences on Information Systems (ICIS 2003), Seattle, USA.

Kendall, E. J., & Kendall, E. K. (1999). Information delivery systems: an exploration of Web pull and push technologies. *Communications of the AIS*, *1*(1), 2–42.

Kendall, E. J., & Kendall, E. K. (2000). Individual, Organizational, and Societal Perspectives on Information Delivery Systems: Bright and Dark Sides to Push and Pull Technologies. In R. Baskerville, J. Stage & J. I. DeGross (Eds.), *Organizational and Social Perspectives on Information Technology* (pp. 179-194). Amsterdam: Kluwer Academic Publishers.

Klopfer, P. H., & Rubenstein, D. L. (1977). The concept privacy and its biological basis. *The Journal of Social Issues*, *33*, 52–65.

Kobsa, A. (2007). Privacy-Enhanced Personalization. *Communications of the ACM*, *50*(8), 24–33. doi:10.1145/1278201.1278202

Kourouthanassis, P., & Roussos, G. (2003). Developing consumer-friendly pervasive retail systems. *IEEE Pervasive Computing / IEEE Computer Society [and] IEEE Communications Society*, *2*(2), 32–39. doi:10.1109/MPRV.2003.1203751

Laufer, R. S., & Wolfe, M. (1977). Privacy as a concept and a social issue: A multidimensional developmental theory. *The Journal of Social Issues*, *33*, 22–41.

Levijoki, S. (2001). *Privacy vs Location Awareness*. Helsinki University of Technology.

Roussos, G., Tuominen, J., Koukara, L., Seppala, O., Kourouthanasis, P., Giaglis, G., et al. (2002). *A case study in pervasive retail.* Paper presented at the Proceedings of the 2nd international workshop on Mobile commerce, Atlanta, GA.

Shiels, M. (2008). Privacy worry over location data. *BBC News.* Retrieved Aug 28, 2008, 2008, from http://news.bbc.co.uk/1/hi/technology/7559731.stm

Unni, R., & Harmon, R. (2007). *Perceived Effectiveness of Push vs. Pull Mobile Location-Based Advertising*. Retrieved from http://www.jiad.org/article91

Waldo, J., Lin, H., & Millett, L. I. (2007). *Engaging Privacy and Information Technology in a Digital Age*: National Academies Press.

Westin, A. F. (1967). *Privacy and Freedom*. New York: Atheneum.

White, T. B. (2004). Consumer Disclosure and Disclosure Avoidance: A Motivational Framework. *Journal of Consumer Psychology*, *14*(1 & 2), 41–51. doi:10.1207/s15327663jcp1401&2_6

Zeithaml, A. V., Parasuraman, A., & Malhotra, A. (2000). *A Conceptual Framework for Understanding e-Service Quality: Implications for Future Research and Managerial Practice,* Report No. 00-115, Marketing Science Instituteo.

Zimmermann, A., Specht, M., & Lorenz, A. (2005). Personalization and Context Management. *User Modeling and User-Adapted Interaction*, *15*(3), 275–302. doi:10.1007/s11257-005-1092-2

## ADDITIONAL READING

Ackerman, M. S. (2004). Privacy in pervasive environments: next generation labeling protocols. *Personal and Ubiquitous Computing*, *8*(6), 430–439. doi:10.1007/s00779-004-0305-8

Barkhuus, L., & Dey, A. (2003). *Location-Based Services for Mobile Telephony: A Study of User's Privacy Concerns.* Proceedings of the INTERACT, 9th IFIP TC13 International Conference on Human-Computer Interaction, Zurich, Switzerland.

Beresford, R. A., & Stajano, F. (2003). Location Privacy in Pervasive Computing. *IEEE Pervasive Computing / IEEE Computer Society [and] IEEE Communications Society*, *1*, 46–55. doi:10.1109/MPRV.2003.1186725

Bruner, C. G. II, & Kumar, A. (2007). Attitude toward Location-Based Advertising. *Journal of Interactive Advertising*, *7*(2). http://www.jiad.org/article89.

Clarke, R. (2001). Person location and person tracking: Technologies, risks and policy implications. *Information Technology & People*, *14*(2), 206–231. doi:10.1108/09593840110695767

Easton, J. (2002). Going Wireless: Transform Your Business with Mobile Technology. New York: HarperBusiness.

Galanxhi-Janaqi, H., & Nah, F. (2004). U-Commerce: Emerging Trends and Research Issues. *Industrial Management & Data Systems*, *104*(9), 744–755. doi:10.1108/02635570410567739

Galanxhi-Janaqi, H., & Nah, F. (2006). Privacy Issues in the Era of Ubiquitous Commerce. *Electronic Markets*, *16*(3), 222–232. doi:10.1080/10196780600841894

Hoadley, M. C., Xu, H., Lee, J. J., & Rosson, M. B. (2010). (forthcoming). Privacy as Information Access and Illusory Control: The Case of the Facebook News Feed Privacy Outcry. *Electronic Commerce Research and Applications*.

Junglas, I., & Watson, R. T. (2006). The U-Constructs: Four Information Drives. *Communications of AIS*, *17*, 569–592.

Junglas, I. A., & Watson, R. T. (2008). Location-Based Services: Evaluating User Perceptions of Location-Tracking and Location-Awareness Services. *Communications of the ACM*, *51*(3), 65–69. doi:10.1145/1325555.1325568

Kaasinen, E. (2005). User acceptance of location-aware mobile guides based on seven field studies. *Behaviour & Information Technology*, *24*(1), 37–49. doi:10.1080/01449290512331319049

Lederer, S., Mankoff, J., & Dey, K. A. (2003, April). *Who Wants to Know What When? Privacy Preference Determinants in Ubiquitous Computing.* Proceedings of Conferences on Human Factors in Computing Systems (CHI), Fort Lauderdale, Florida, USA.

Lyytinen, K., & Yoo, Y. (2002). Research Commentary: The Next Wave of Nomadic Computing. *Information Systems Research*, *13*(4), 377–388. doi:10.1287/isre.13.4.377.75

Miller, A. I. (2002). Einstein, Picasso: Space, Time, And the Beauty That Causes Havoc. New York: Basic Books.

Rao, B., & Minakakis, L. (2003). Evolution of Mobile Location-Based Services. *Communications of the ACM*, *46*(12), 61–65. doi:10.1145/953460.953490

Rittenbruch, M. (2002). Atmosphere: A Framework for Contextual Awareness. *International Journal of Human-Computer Interaction*, *14*(2), 159–180. doi:10.1207/S15327590IJHC1402_3

Sheng, H., Nah, F., & Siau, K. (2008). An Experimental Study on Ubiquitous Commerce Adoption: Impact of Personalization and Privacy Concerns. *Journal of the Association for Information Systems*, *9*(6), 344–376.

Wallace, P., Hoffmann, A., Scuka, D., Blut, Z., & Barrow, K. (2002). *i-Mode Developer's Guide*. Boston, Mass: Addison-Wesley.

Watson, R. T., Pitt, L. F., Berthon, P., & Zinkhan, G. M. (2002). U-Commerce: Extending the Universe of Marketing. *Journal of the Academy of Marketing Science*, *30*(4), 329–343. doi:10.1177/009207002236909

Xu, H., Oh, L. B., & Teo, H. H. (2009). Perceived Effectiveness of Text versus Multimedia Location-Based Advertising Messaging. *International Journal of Mobile Communications*, *7*(2), 154–177. doi:10.1504/IJMC.2009.022440

Xu, H., Rosson, M. B., & Carroll, J. M. (2008). *Mobile Users' Privacy Decision Making: Integrating Economic Exchange and Social Justice Perspectives*. Proceedings of 14th Annual Americas Conference on Information Systems (AMCIS 2008), Toronto, Canada.

Xu, H., & Teo, H. H. (2005). Privacy Considerations in Location-Based Advertising, In C. Sorensen, Y. Yoo, K. Lyytinen, and J. I. DeGross (Ed.), *Designing Ubiquitous Information Environments: Socio-Technical Issues and Challenges*, Springer, 71-90.

Xu, H., Teo, H. H., & Tan, B. C. Y. (2005). *Predicting the Adoption of Location-Based Services: The Roles of Trust and Privacy Risk*. Proceedings of 26th Annual International Conference on Information Systems (ICIS 2005), Las Vegas, Nevada, 897-910.

Xu, H., Zhang, C., Shi, P., & Song, P. (2009). *Exploring the Role of Overt vs. Covert Personalization Strategy in Privacy Calculus,* Best Paper Proceedings of 69th Annual Meeting of the Academy of Management (AOM 2009), Chicago, Illinois, 2009.

## KEY TERMS AND DEFINITIONS

**Information Privacy:** refers to the ability of the individuals to control over how their personal information is collected and used.

**Locatability:** refers to the ability of mobile hosts to determine the current physical location of wireless devices.

**Location Commerce (L-Commerce):** refers to commercial location-based services that utilize geographical positioning information to provide value-added services to mobile consumers.

**Location-Based Service (LBS):** refer to the network-based services that utilize the ability to make use of the geographical position of the wireless devices so as to be accessible with wireless devices through the mobile network.

**Personalization:** refers to the ability to provide content and services that are tailored to individuals based on the knowledge about their preferences and contexts.

**Pull-based LBS (reactive LBS):** is the location-sensitive content sent to the wireless subscriber's mobile device only when the subscriber explicitly requests for. Such pull-based LBS may be seen in some 'on demand' services where the user dials or signals a service provider for specific information / service such as the nearby points of interest. In this approach, location information is ephemeral and useful only to complete the transaction requested.

**Push-based LBS (proactive LBS):** is the location-sensitive content sent by or on behalf of service providers to a wireless mobile device at a time other than when the subscriber requests it. In the push-based LBS, service providers send relevant information or content to users based on users' previously stated product preferences, and by background observation of their behaviors through tracking physical locations of their mobile devices.

# Chapter 79
# Mobile Gaming:
## Perspectives and Issues

**Krassie Petrova**
*Auckland University of Technology, New Zealand*

## INTRODUCTION

Mobile gaming (mGaming) belongs to the category of mobile entertainment applications. It is widely adopted in some countries –for example in Japan (Baldi & Thaung, 2002; Chan, 2008) and is fast becoming a popular and profitable mobile commerce service (Kleijnen, de Ruyter, & Wetzels, 2003; Paavilainen, 2004, p. 133). In 2006, the revenue from phone games in Europe alone reached US$6 billion (Fritsch, Ritter, & Schiller, 2006). It is predicted that worldwide mGaming revenues will continue to grow with Asia-Pacific markets contributing significantly to the growth (Paul, Jensen, Wong, & Khong, 2008).

Past research results indicate that both customer perceptions and attitudes, and mGaming supply chain factors may play a critical role as determinants of mGaming business model success and mGaming adoption (Barnes, 2003; Carlsson, Hyvonen, Repo, & Walden, 2005; Kuo & Yu, 2006; Macinnes, Moneta, Caraballo, & Sarni, 2002; Peppard & Rylander, 2006; Petrova, 2007; Siau, Lim, & Shen, 2001; Soh & Tan, 2008). Following up on prior findings the study presented here develops further the proposition that customer adoption of mobile gaming services and products is linked to:

i) User perceptions about the value of playing a mobile game in the context of their lifestyle, and
ii) User expectations about the quality of the mGaming service in the context of the environment.

The main objective of this chapter is to identify the determinants of mGaming success, to highlight the most important issues related to mGaming adoption, and to suggest recommendations for mobile game design and mGaming service pro-

DOI: 10.4018/978-1-61520-611-7.ch079

visioning. The chapter is organized as follows: First, definitions and background information are provided, and mobile gaming demand and supply are discussed. The sections following introduce mGaming adoption drivers and factors derived from studies using adoption models. mGaming determinants are proposed and discussed. The chapter concludes with an overview of future trends and research directions.

## BACKGROUND

A mobile game is a video game played on a hand-held device such as a mobile phone, by a player with a connection to a mobile data network. A game may require a permanent connection, or may be a standalone one ('download once'). Actively connected players may be moving and frequently changing their geographic location. Mobile games may involve groups of competing and/or collaborating participants. Using location-awareness features, mobile games may superimpose features of the real world into the game space and create an augmented reality environment (Bell et al., 2006; Broll, et al., 2008; Finn, 2005; Koivisto, 2006; Maitland, van de Kar, de Montalvo, & Bouwman, 2005; Rashid, Mullins, Coulton, & Edwards, 2006). Pervasive mobile games involve players in interaction with another and with the physical environment, and may be played by geographically dispersed groups of players (Segatto, Herzer, Mazzotti, Bittencourt, & Barbosa, 2008).

As a service, mGaming uses the communication channel provided by the private mobile data network, which may also connect to the public Internet (the 'mobile Internet'). Only mobile network subscribers or prepaid customers may play mobile games which require a permanent connection. However some games may be played within an ad-hoc network formed by the players implementing a short range connection technology such as Bluetooth.

Most mobile games are designed and offered to be played for entertainment, with NTT DoCoMo (Japan) the best known case of a mobile entertainment provider. DoCoMo users access the mobile Internet via iMode – the DoCoMo access platform. Mobile entertainment activities and specifically mGaming are seen by DoCoMo as a key growth driver (Barnes, 2003; Chan, 2008). However mGaming is also deployed in other contexts as a motivational strategy, or as a knowledge building facilitator. Examples include testing student knowledge (Wang, Øfsdahl, & Morch-Størstein, 2008), or encouraging 'sedate' players to exercise and thus improve their wellness (Bell et al., 2006; de Freitas & Griffiths, 2008; Wylie & Coulton, 2008). There is a current rise in the number of projects exploring location-based educational mobile games (Cogoi, Sangiorgi, & Shahin; 2006; Schwabbe & Goth, 2005), games involving 'sightseeing' or 'touring' (Spikol & Milrad, 2008), and virtual reality games (Doswell & Harmeyer, 2007) – all of them designed to be played by players actively moving in the physical space.

## MOBILE GAMING: SUPPLY AND DEMAND PERSPECTIVES

Prior results in the area of user adoption of mGaming indicate that customer demand could be uncertain (e.g. Maitland et al., 2005) and therefore the business models deployed could be unstable. However even back in 2002 Anckar and D'Incau considered interactive mGaming as one of the top applications consumers were likely to adopt. Confirming this earlier prediction in the last five years the mGaming market has shown significant growth with an increasing supply of new games including multiplayer environments and situation-aware scenarios (Soh & Tan, 2008). In order to uncover the issues related to the future development of mGaming and the potential for

*Table 1. Mgaming supply: A reference model. (Adapted from Petrova & Qu, 2006)*

| Mobile Industry Players | |
|---|---|
| ***Service Supply*** | |
| **Mobile Business Service Provision** | Content aggregators |
| **Mobile Service Aggregation** | Mobile portal providers |
| **Mobile Data Service Provision** | Mobile network operators; second tier providers |
| ***Application Supply*** | |
| **Mobile Application Development** | Mobile application developers; mobile content developers |
| **Mobile Platform / Middleware Development.** | Platform / middleware developers and vendors |
| ***Infrastructure Supply*** | |
| **Mobile Device Supply** | Mobile equipment vendors and retailers |
| **Mobile Network Supply** | Technology platform and infrastructure vendors, mobile network operators |

its wider adoption, in this section mGaming is investigated from two general perspectives: Supply (the service provision perspective) and demand (the customer perspective).

## A Reference Model for Mobile Gaming Supply

Adapting the reference model proposed in (Petrova & Qu, 2006), the key players in the mGaming supply chain are classified in Table 1 according to their operational areas: infrastructure (networks and devices), application (platforms and applications), and service (business and data services, and service aggregation).

Network operators occupy the key position in the infrastructure supply area as access enablers; they also ensure the quality of the mGaming service when a permanent network connection is maintained, e.g. in real-time interactive games which may need greater bandwidth, connectivity across operators, and location information (De Souza e Silva, 2008; Paavilainen, 2002; 2004, p. 65). On their part device manufacturers provide devices with functionality and configuration supporting game playing such as 3G/4G and Java capability, a color screen able to display 3D imagery, large memory, and a fast processor (Leavitt, 2003).

The major players in the application supply area include game and platform developers. Currently used game development middleware platforms are iMode, SMS, WAP, J2ME, BREW. Windows CE and Symbian OS are examples of mobile operating systems. Technologies deployed to provide location information for location-aware games are typically Cell ID (where location information is supplied by the mobile network), and GPS or A-GPS (the mobile handheld device needs the ability to process data provided by the global Geo Positioning System, maintained by the USA Department of Defense). At present, game developers encounter challenges when trying to ensure game compatibility across technologies, platforms and contexts including language (Baldi & Thaung, 2002; Bhatia, 2005; Buellingen & Woerter, 2004; Finn, 2005; Paavilainen, 2004, p.68; Rashid et al., 2006).

Finally the service supply layers of the reference model comprise content aggregators such as I-play (http://www.iplay.com/) and eamobile (http://www.eamobile.com/Web/). The business model deployed may involve subscription-based payment (e.g. VodafoneLive!, at http://games.vodafone.co.nz/), or a third party payment gateway (e.g. In-Fusio, at http://www.in-fusio.com/start.php).

Industry players tend to operate across areas: For example the global telecommunications company Vodafone acts as a mobile network operator, as a mobile data service provider, and as a game portal. The decisions a company makes about their business model may also depend on the legislative environment which differs between the European and the Japanese, or the European and the American markets (Henten, Olesen, Saugstrrup, & Tan, 2004; Maitland et. al, 2005). A detailed profiling of market players and description of their roles can be found in (Kuo & Yu, 2006).

## Mobile Gaming Adoption and Demand Drivers

Mobile entertainment application and services including mGaming have been studied using existing information technology adoption models (e.g. Carlsson et al., 2005; Pagani & Schipani, 2003). Other studies focus on social factors (e.g. Barnes & Huff, 2003; Pedersen, 2005), and on user role preferences (Pedersen, Methlie, & Thorbjornsen, 2002). Key influences derived both from prior work and from empirical studies were reported in (Baldi & Thaung, 2002) and in (Moore & Rutter, 2004). Kleijnen et al. (2003) studied specifically mGaming adoption by applying the diffusion of innovations theory and considered complexity, compatibility, relative advantage, and communicability as factors influencing user decision. Further, Kleijnen, de Ruyter and Wetzels (2004) found that game players perceived navigation, communicability, risk, and payment options as the most important adoption factors. More recently Soh and Tan (2008) classified adoption and use factors into three main groups: mobile device penetration, mobile device enhancement, and mobile network enhancement. A list the potential drivers of mGaming adoption from a mobile entertainment services perspective derived from the studies selected for this literature review and extending the summary found in (Petrova & Qu, 2006) is presented in Table 2.

## Linking mGaming Supply and Demand

While separate investigations of the mobile gaming industry and the consumer market allow identification of industry roles and relationships, and drawing conclusions about customer attitudes and intentions, it is not always clear how findings about adoption factors may be used to influence the design of mobile games and mGaming services, and to link mGaming demand and supply.

Analyzing further the approaches to modeling adoption deployed in the empirical studies reviewed it can be seen that the potential drivers identified above underpin some of the independent variables used in the empirical models. These variable have been subsequently found to be factors influencing positively intention to use and / or adoption (Table 3, last two columns).

Mapping the factors onto the mGaming reference model as shown in the first column of Table 3 may help address the gap identified above and create a framework linking mGaming supply and demand. It is proposed that there are two important determinants of mobile gaming supply and demand, each related to the role of the mobile gamer as a customer in the business and interface/infrastructure supply areas:

i) Requirements related to customer personal, professional and social lifestyle as the demand is not only for a useful mGaming service but for games and a related service which are lifestyle compatible and may enhance its quality (‘Lifestyle’).
ii) Expectations for the quality of the service as customers are already sufficiently experienced in the use of the new technology, and demand not just easy to use, but more adaptable, transparent and personalized services (‘Quality of Service’).

It is proposed that mGaming supply chain players may need to consider customer lifestyle

*Table 2. Potential drivers of mGaming adoption. Sources: a) Baldi & Thaung, 2002; b)Pedersen et al., 2002; c) Barnes & Huff, 2003; d. Kleijnen et al.,2003; e) Pagani & Schipani, 2003; f) Moore & Rutter, 2004; g) Carlsson et al., 2005; h) Pedersen, 2005; i) Soh & Tan, 2008.(Adapted from Petrova & Qu, 2006)*

| Driver | | a | b | c | d | e | f | g | h | i |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Fun / "killing time" application | a | | | a | a | a | a | | |
| 2 | Usefulness | a | a | a | a | a | a | a | a | a |
| 3 | Economic environment | a | | a | | | | | a | |
| 4 | Technical environment | a | a | a | a | | | | a | a |
| 5 | Cost | a | | a | a | a | a | a | a | |
| 6 | Social status | a | a | a | a | a | a | a | a | |
| 7 | Personalization | a | a | | | a | | | | |
| 8 | Owners' identity | a | a | a | a | | a | a | | |
| 9 | Culture | a | | a | | | | | | |
| 10 | Subjective norms | | a | a | a | a | | | a | |
| 11 | Attitude to new technology | | a | a | a | a | | a | a | |
| 12 | Age, gender | a | | a | | a | a | | | |
| 13 | Simplicity of use | a | a | a | a | a | a | a | a | |
| 14 | Privacy risk | | | | a | a | a | | | |
| 15 | Security risk | | | a | a | a | a | | a | |
| 16 | Accessibility, mobility | a | | a | a | | a | a | | a |
| 17 | Saving time | a | | | | | | a | a | |
| 18 | Interactive innovation | a | | a | a | | | | | a |

requirements and quality of service expectations as decision making factors influencing the design of their respective business models. While mGaming service providers need to focus predominantly on lifestyle requirements, network operators need to consider expectations about the quality of service. On the other hand intermediary industry players such as game developers and publishers may need to consider both determinants in decisions about mGaming application design and development.

## Player Requirements and Game Design

Some recent empirical studies have investigated the lifestyle and quality of service perspectives of mGaming, including their social, demographic and technical aspects. This section provides a brief commentary and suggests recommendations for mobile game and mGaming service design.

## Socializability

Petrova and Qu's (2007) study of attitudes towards mobile gaming among tertiary students (New Zealand) showed that the attitude to mobile gaming was closely related to the social lifestyle of players. 'Expressiveness' was perceived as the most significant motivator in playing. Being observed to play was construed as a way to communicate to others the player's identity. The authors suggested that player motivation could be enhanced by games designed to create societies of players.

*Table 3. Mobile gaming demand and supply determinants. (Adapted from Petrova, 2007)*

| Determinant | Factor | Value Proposition |
|---|---|---|
| **Business:** Requirements related to lifestyle suitability and enhancement ('Lifestyle') | **Compatibility** (drivers 1, 2) | Playing a mobile game as an activity may meet the needs of a specific consumer group – for example commuters with time to spare. |
| | **Facilitating conditions** (drivers 3, 4) | Payment options, billing and support options may impact on users' willingness to adopt. Increased network capability supports adoption. |
| | **Trialability** (driver 5) | As playing games has generally a level of addictiveness, free trials may lead to "addiction" and subsequent adoption. |
| | **Observability/communicability** (driver 6) | Refers to the ability to communicate within a peer group and be observed playing which may be of social importance. |
| | **Image** (drivers 7,8) | The personalized use of a mobile phone may lend its owner status-related features.. |
| | **Normative beliefs** (drivers 9,10,11) | Playing the same game as one's friends may facilitate social acceptance; social pressures influence customer perceptions and decision making, and facilitate building a critical mass of customers. |
| **Infra-structure & interface:** Expectations for navigation, speed, imagery, reliability ('Quality of Service') | **Self-Efficacy** (driver 12) | Technical services need to match the requirements and needs of different customer segments For example a large group of relatively older potential gamers may not be able to play due to device limitations. |
| | **Complexity** (driver 13) | The ease of use of an entertainment application is important as an enjoyable experience is expected. In mGaming clear navigation and simplified game structure influence positively response time and may have implications for the decision to play. |
| | **Trust** (drivers 14, 15) | Perceived fear of privacy invasion (e.g. in location-based games) and/or lack of security may influence consumer choice. |
| | **Relative advantage** (drivers 16, 17, 18) | The ubiquity and accessibility of mobile entertainment may satisfy the demand for a "killing time" and relaxing "fun" service – for example interactive and multi-player games. |

Paul et al. (2008) studied the effect of social interactions on players of mobile games (Malaysia) and identified socialization factors in multiplayer online games including collaboration, competition, communication, and recommendation. The participants in the study were asked to design and then evaluate mobile games with enhanced socializing. The authors concluded that games which focused on social lifestyle (i.e. social status, peer acceptance, and sharing experiences) may enjoy a longer life-cycle and thus could be more profitable.

## Player Background

In the empirical studies already cited authors have indicated that a correlation may exist between the type of the game and the player background. For example, Paul et al. (2008) pointed out that socializing in the context of mobile games may make it necessary to design games fine tuned to meet the needs of the specific target group such as teenagers, or female players. Hashim, AbHamid and Wan Rozali (2007) established that both male and female students (Malaysia) were interested in playing while older students (at a higher level of education) were less likely to play an educational game. Petrova and Qu (2007) reported that male players were more likely to download games and play (and pay for) multiplayer games with contexts such as strategy, sports and action while female players were more likely to play simple games (e.g. puzzles and card games). Ha, Yoon and Choi (2007) found that gamers from different gender and age groups had different preferences with respect to enjoyment while playing, and that gamer behavior may have been was affected both by the attractiveness of the game played, and by demographics such as age and gender.

## Mobile Game Design

Ha et al. (2007) found that games needed to be simpler rather than more complex in order to be widely accepted. However once players were satisfied with their game choice they would expect the infrastructure to support gaming seamlessly. The findings by Duh, Chen and Tan (2008) were similar. Their study of mobile gamers' preferences (in Singapore) with respect to the relationship between mobile game design and mobile phone interface identified issues with mGaming provision related to a 'mobile lifestyle'. For example games requiring significant level of eye-hand coordination were not always convenient to be played while moving; games designed with a hierarchy of difficulty levels may last too long to be completed within the time limits of a journey. The authors suggested that rather than supplying more advanced features, both mobile game and mobile phone design needed to fit in with players' usual behavior. Other issues related to quality of service included the lack of mobile devices with better display screens and navigation pads, and games in need of better visual controls.

In summary there is a need for a higher level of cooperation between game designers and phone manufacturers as phone design needs to meet the usability requirements of different games while game design need to consider the mobile phone form factor. With respect to customer requirements for mobile games and the related services there is a need to target a well defined market segment or a group of customers, with a design that is compatible with the group's demographic parameters, social norms and usual behavior. The service provided needs to be perceived as valuable in its context (e.g. entertainment, education, tourism).

## FUTURE RESEARCH DIRECTIONS

The research reviewed earlier allows the creation of a picture of the future trends in mGaming supply and demand. Trends in mobile game development include games designed to be played on a smart phone with enhanced video and audio features, a smart navigation pad, intelligent game controls, and incorporating the use of the built-in camera. Future mobile games will facilitate communication within gaming groups and the building of social mobile networks. Massively multiplayer mobile online games utilizing high bandwidth (4G) technology, and location-aware augmented reality and pervasive games operating both in a virtual and the real world will be offered to socially connected mobile gamer communities. Mobile games are also likely to become very prominent in educational models.

The independent portal provider's role in the future is not certain as mobile network operators and mobile data service providers will continue to collaborate with game developers and offer both downloadable and online games as part of the overall service package. This may lead to changes in the mGaming value chain and may ultimately make mGaming more affordable. However content aggregators may start specializing in context-related games such as educational or tourism oriented ones and retain their position as publishers of specialized gaming software.

Directions for further research in the area include usability studies of mobile games, and empirical studies based on lifestyle and quality of service as independent variables influencing the adoption of next generation mobile games. Results from such studies may inform game and device design research by highlighting the specific requirements of mobile game players and the dynamics of their acceptance and user behavior.

## CONCLUSION

The chapter explores mobile gaming from supply and demand perspectives. A reference model is used to classify the key participants in the mGaming supply chain. mGaming adoption drivers and factors identified in prior work are used to construct the global determinants of mGaming demand: Customer life style requirements, and customer expectations about the quality of the service. It is suggested that mobile game life cycle and mobile gaming profitability would improve if mobile game design addresses the specific lifestyle needs of the targeted customer group, with mobile devices and networks seamlessly supporting game features and providing transparent but efficient services including location identification and connectivity. Further empirical research in the area may include in-depth studies of next generation mobile game adoption and spread from the perspectives of lifestyle and quality of service and involving both customers and industry players as participants.

## REFERENCES

Anckar, B., & D'Incau, D. (2002). Value-added services in mobile commerce: An analytical framework and empirical findings from a national consumer survey. In *Proceedings of the 35th Hawaii International Conference on System Sciences,* (pp. 1087-1096). New York: IEEE Press.

Baldi, S., & Thaung, H. P.-P. (2002). The entertaining way to m-commerce: Japan's approach to the mobile internet - a model for Europe? *Electronic Markets*, *12*(1), 6–13. doi:10.1080/101967802753433218

Barnes, S. J. (2003). The mobile commerce value chain in consumer markets. In *m-Business: The strategic implications of wireless technologies,* (pp. 13-37). Burlington, MA: Butterworth-Heinemann.

Barnes, S. J., & Huff, S. L. (2003). Rising sun: iMode and the wireless Internet. *Communications of the ACM*, *46*(11), 79–84. doi:10.1145/948383.948384

Bell, M., Chalmers, M., Barkhuus, L., Hall, M., Sherwood, S., Tennent, P., et al. (2006). Interweaving mobile games with everyday life. In *Proceedings of CHI 2006 - Games and Performances* (pp. 417-426). Perth, Australia: Murdock University Press.

Bhatia, S. (2005). Any port in a storm? Retrieved June 1, 2005, from http://mobenta.com/analysis/

Broll, W., Lindt, I., Herbst, I., Ohlenburg, J., Braun, A.-K., & Wetzel, R. (2008, July/August). Towards next-gen mobile AR games. *Computer Graphics and Applications*, *28*(4), 40–48. doi:10.1109/MCG.2008.85

Buellingen, F., & Woerter, M. (2004). Development perspectives, firm strategies and applications in mobile commerce. *Journal of Business Research*, *57*(12), 1402–1408. doi:10.1016/S0148-2963(02)00429-0

Carlsson, C., Hyvonen, K., Repo, P., & Walden, P. (2005). Asynchronous adoption patterns of mobile services. In *Proceedings of the 38th Annual Hawaii International Conference on Systems Sciences* (pp. 189a). New York: IEEE Press.

Chan, D. (2008). Convergence, connectivity, and the case of Japanese mobile gaming. *Games and Culture*, *3*(1), 13–25. doi:10.1177/1555412007309524

Cogoi, C., Sangiorgi, D., & Shahin; K. (2006, November). mGBL – mobile game-based learning: perspectives and usage in learning and career guidance topics. *eLearning Papers, 1.* Retrieved December 2008, from http://www.elearningpapers.eu

De Freitas, S., & Griffiths, M. (2008). The convergence of mobile gaming practices with other media forms: What potential for learning? A review of the literature. *Learning, Media and Technology*, *33*(1), 11–20. doi:10.1080/17439880701868796

De Souza e Silva, A. (2008, Spring). Alien revolt (2005-2007): A case study of the first location-based mobile game in Brazil. *IEEE Technology and Society Magazine*, 18–28. doi:10.1109/MTS.2008.918036

Doswell, J., & Harmeyer, K. (2007). Extending the 'serious game' boundary: Virtual instructors in mobile mixed reality learning games. In *Proceedings of the Digital Game Research Association (DiGRA 2007) Conference* (pp. 524-529). New York: ACM Press.

Duh, H. B.-L., Chen, V. H. H., & Tan, C. B. Y. (2008). Playing different games on different phones: An empirical study o mobile gaming. In *Proceedings of the 10th ACM International Conference on Mobile HCI*, (pp. 391-394). New York: ACM Press.

Finn, M. (2005). Gaming goes mobile: Issues and Implications. *Australian Journal of Emerging Technologies and Society*, *39*(1), 32–42.

Fritsch, T., Ritter, H., & Schiller, J. (2006). User case study and network evolution in the mobile phone sector (A study on current mobile phone applications). In *Proceedings of the 2006 ACM SIGCHI International Conference on Advances in Computer Entertainment Technology,* (Article No. 10). New York: ACM Press.

Ha, I., Yoon, Y., & Choi, M. (2007). Determinants of adoption of mobile games under mobile broadband wireless access environment. *Informational and management, 44*9(3), 276-286.

Hashim, H. A., Ab Hamid, S. H., & Wan Rozali, W. A. (2006). A Survey on mobile games usage among the institute of higher learning (IHL) students in Malaysia. In *Proceedings of the First IEEE International Symposium on Information Technologies and Applications in Education (ISITAE '07),* (pp. 40-44). New York: IEEE Press.

Henten, A., Olesen, H., Saugstrup, D., & Tan, S.-E. (2004). Mobile communications: Europe, Japan and South Korea in a comparative perspective. *Info*, *6*(3), 197–207. doi:10.1108/14636690410549534

Kleijnen, M. D., de Ruyter, K., & Wetzels, M. (2003). Factors influencing the adoption of mobile gaming services. In B. E. Mennecke & T. J. Strader (Eds.), *Mobile commerce: Technology, theory, and applications* (pp. 202-217). Hershey, PA: Idea Group Publishing.

Kleijnen, M., D., de Ruyter, K., & Wetzels, M. (2004). Consumer adoption of wireless services: Discovering the rules, while playing the game. *Journal of Interactive Marketing*, *18*(2), 51–61. doi:10.1002/dir.20002

Koivisto, E. M. I. (2006). Mobile Games 2010. *Proceedings of the 2006 International Conference on Game Research and Development* (pp. 1-2*).* New York: ACM Press.

Kuo, Y.-F., & Yu, C.-W. (2006). 3g telecommunication operators' challenges and roles: A perspective of mobile commerce value chain. *Technovation*, *26*, 1347–1356. doi:10.1016/j.technovation.2005.08.004

Leavitt, N. (2003). Will wireless gaming be a winner? *Computer*, *36*(1), 24–27. doi:10.1109/MC.2003.1160050

Macinnes, I., Moneta, J., Caraballo, J., & Sarni, D. (2002). Business models for mobile content: The case of m-games. *Electronic Markets*, *12*(4), 218–227. doi:10.1080/101967802762553477

Maintland, C. F., van de Kar, E. A. M., de Montalvo, U. W., & Bouwman, H. (2005). Mobile information and entertainment services; business models and service networks. *International Journal of Management and Decision Making*, *6*(1), 47–64. doi:10.1504/IJMDM.2005.005965

Moore, K., & Rutter, J. (2004).Understanding consumers' understanding of mobile entertainment. In K. Moore & J. Rutter (Eds.), *Mobile Entertainment: User-Centred Perspective,* (pp. 49-65). Manchester, UK: ESRC CRIC (University of Manchester).

Paavilainen, J. (2002). Consumer mobile commerce. In *Mobile business strategies*: *Understanding the technologies and opportunities* (pp. 69-121). London: IT Press.

Paavilainen, J. (2004). *Mobile games: Creating business with Nokia N-Gage*. Boston: New Riders.

Pagani, M., & Schipani, D. (2003). Motivations and barriers to the adoption of 3G mobile multimedia services: An end user perspective in the Italian market. In M. Khosrow-Pour (Ed.) *Innovations through InformationTtechnology; Proceedings of the 2003 Information Resources Management Association International Conference (IRMA'03) (*pp.957-960). Hershey, PA: IRMA.

Paul, S. A., Jensen, M., Wong, C. Y., & Khong, C. W. (2008). Socializing in mobile games. In *Proceedings of the 3rd International Conference on Digital Interactive Media in Entertainment and Arts* (pp. 2-9). New York: ACM Press.

Pedersen, P. E. (2005). Adoption of mobile Internet services: An exploratory study of mobile commerce early adopters. *Journal of Organizational Computing and Electronic Commerce*, *15*(3), 203–221. doi:10.1207/s15327744joce1503_2

Pedersen, P. E., Methlie, L. B., & Thorbjornsen, H. (2002). Understanding mobile commerce end-user adoption: a triangulation perspective and suggestions for an exploratory service evaluation framework. In *Proceedings of the 35th Annual Hawaii International Conference on System Science* (pp. 1079-1086).New York: IEEE Press.

Peppard, J., & Rylander, A. (2006). From value chain to value network: Insights for mobile operators. *European Management Journal*, *24*(2-3), 128–141. doi:10.1016/j.emj.2006.03.003

Petrova, K. (2007) Understanding the success factors of mobile gaming. In D. Taniar (Ed.), *Encyclopaedia of Mobile Computing & Commerce*", *Vol. 1, Part M-Entertainment*. Hershey, PA: IGI Global.

Petrova, K., & Qu, H. (2006). Mobile gaming: a reference model and critical success factors. In M. Khosrow-Pour (Ed.), *Emerging Trends and Challenges in Information Technology Management*: *Proceedings of the 2006 Information Resources Management Association Conference (IRMA 2006),*(pp. 228-231). Hershey, PA: IRMA.

Petrova, K., & Qu, H. (2007). Playing mobile games: consumer perceptions. In J. Filipe, D. A. Marca, B. Shishkov, & M. van Sinderen (Eds.), *Proceedings of the Second International Conference on e-Business(ICE-B)* (pp. 209-214). New York: IEEE Press.

Rashid, O., Mullins, I., Coulton, P., & Edwards, R. (2006, January). Extending cyberspace: Location based games using cellular phones. *ACM Computers in Entertainment, 4*(1), Article 3C.

Schwabe, G., & Goth, C. (2005). Mobile learning with a mobile game: design and motivational effects. *Journal of Computer Assisted Learning*, *21*, 204–216. doi:10.1111/j.1365-2729.2005.00128.x

Segatto, W., Herzer, E., Mazzotti, C. L., Bittencourt, J. R., & Barbosa, J. (2008). Mobio threat: A mobile game based on the integration of wireless technologies. *ACM Computers in Entertainment, 6*(3), No. 39.

Siau, K., Lim, E., & Shen, Z. (2001). Mobile commerce: Promises, challenges and research agenda. *Journal of Database Management*, *12*(3), 4–13.

Soh, J. O. B., & Tan, B. C. Y. (2008). Mobile gaming. *Communications of the ACM*, *51*(3), 35–39. doi:10.1145/1325555.1325563

Spikol, D., & Milrad, M. (2008). Combining physical activities and mobile games to promote novel learning practices. In *Proceedings of the Fifth IEEE International Conference on Wireless, Mobile, and Ubiquitous Technology in Education (WMUTE'08)* (pp. 31-38). New York: IEEE Press.

Wang, A. I., Øfsdahl, T., & Morch-Størstein, O. K. (2008). An evaluation of a mobile game concept for lectures. In *Proceedings of the 21st Conference on Software Engineering Education and Training* (pp. 197-204). New York: IEEE Press.

Wylie, C. G., & Coulton, P. (2006). Exergaming. In *Proceedings of the 2008 International Conference on Advances in Computer Entertainment Technology* (pp. 338-341), New York: ACM Press.

## ADDITIONAL READING

Dholakia, R. R., & Dholakia, N. (2004). Mobility and markets: emerging outlines of m-commerce. *Journal of Business Research*, *57*(12), 1391–1396. doi:10.1016/S0148-2963(02)00427-7

Funk, J. L. (2003). *Mobile Disruption: The technologies and applications driving the mobile Internet*. New Jersey: John Wiley & Sons.

Lee, C.-w., Hu, W.-C., & Yeh, J.-h. (2003). A system model for mobile commerce. *23rd International Conference on Distributed Computing Systems Workshops (CDCSW'03),* p. 634.

Natsuno, T. (2003). *I-Mode strategy*. Chichester, England: Wiley.

Nysveen, H., Pedersen, P. E., & Thorbjornsen, H. (2005). Intention to use mobile services: Antecedents and cross-service comparisons. *Journal of the Academy of Marketing Science*, *33*(3), 330–346. doi:10.1177/0092070305276149

Sarker, S., & Wells, J. D. (2003). Understanding mobile handheld device use and adoption. *Communications of the ACM*, *46*(12), 35–39. doi:10.1145/953460.953484

Shchiglik, C., Barnes, S., Scornavacca, E., & Tate, M. (2004). Mobile entertainment service in New Zealand: An examination of consumer perceptions towards games delivered via the wireless application protocol. *International Journal of Services and Standards*, *1*(2), 155–171. doi:10.1504/IJSS.2004.005694

Van de Kar, E., Maitland, C. F., de Montalvo, U. W., & Bouwan, H. (2003). Design guidelines for mobile information and entertainment services: Based on the Radio 538 ringtunes I-mode service case study. *Proceedings of the 5th International Conference on Electronic commerce (ICEC '03*), 413-417.

Varshney, U., & Vetter, R. (2002). Mobile commerce: Framework, applications and networking Support. *Mobile Networks and Applications*, *3*(7), 185–187. doi:10.1023/A:1014570512129

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MISQ*, *27*(3), 425–478.

## KEY TERMS AND DEFINITIONS

**4G (4th generation):** An advanced wireless communication technology offering high quality of service, to become a future standard gradually replacing the currently considered best 3G technology.

**Location Information:** Information about the geographical position of an active mobile device which can be obtained independently of the mobile network via technologies such as GPS (Global Positioning Service), or can be supplied by the mobile network itself (e.g. using the Cell ID technology).

**Location-Based Service (LBS):** A mobile data service which needs and relies on location information, and which customers can access via a mobile devoice connected to a mobile network.

**Mobile Application Development Platform:** Software (middleware) which enables the development of applications supporting mobile connectivity (e.g. BREW, J2ME, WAP).

**Mobile Commerce (mCommerce):** A term referring to commercial transactions conducted over mobile access networks, including transfer of ownership of goods and the provision of services.

**Mobile Game:** A video game played on a mobile phone.

**Mobile Gaming (mGaming):** Playing a mobile game by one or more players.

**Mobile Phone Form Factor:** refers to the size, style, and other features of the mobile phone as a hardware object.

**Mobile Platform:** An operating system designed for and installed in a mobile device (e.g. Symbian OS, Windows CE).

# Chapter 80
# Role of Personal Innovativeness in Intentions to Adopt Mobile Services:
## Cross-Service Approach

**Sanna Sintonen**
*Lappeenranta University of Technology, Finland*

**Sanna Sundqvist**
*Lappeenranta University of Technology, Finland*

## INTRODUCTION

Because only a fraction of new service ideas are successful, and due to the turbulence and dynamics in mobile business markets, a thorough understanding of factors underlying mobile service adoption decisions is necessary. Use of mobile communications has been increasing extensively (Watson et al., 2002). Today, an extensive selection of mobile services is available to consumers. However, consumers use mobile devices mainly for simple services, like text messaging (Nysveen et al., 2005a). In order to better understand the acceptance of mobile services, it is necessary to study behavioral intentions (i.e. antecedents of actual adoption behavior) of consumers adopting new mobile services.

DOI: 10.4018/978-1-61520-611-7.ch080

Consumer adoption behavior as a research topic has been given considerable notice, and several models have been provided to explain the behavioral intentions related to innovation adoption – also in the field of mobile communications. The background for these models exists in different fields of research and the theory base is rich: like the theory of planned behavior (TPB), technology acceptance model (TAM) and the diffusion of innovations (DOI) theory. Although these models have been useful in explaining behavioral intentions, several extensions have been proposed as it has been suggested that these basic models are too parsimonious. The present study follows this notion, and highlights the role of personal innovativeness in predicting consumers' adoption intentions. Personal innovativeness describes partly the personality of consumers, but is also attached to the technological domain. Personal innovativeness thus captures attitudinal influence toward adoption behavior, and may play a significant role in predicting adoption behavior.

The proposed model is based on TPB, TAM and DOI models as it investigates usage intentions via three overall influences: attitudinal influence (innovativeness), motivational influence (status image), and perceived control (willingness to pay). As mobile services differ in their characteristics (Hoffman & Novak, 1996), customers' intentions should be studied across service categories. Additionally, innovativeness should be seen as an individual characteristic which is invariant across different types of technology (Schillewaert et al., 2005). A cross service approach was chosen and the focus is on three sets of mobile services: mobile entertainment services, mobile services for everyday activities, and mobile notification services.

The purpose of this article is to contribute to the research on behavioral intentions to use mobile services. Key role is attributed to innovativeness in predicting mobile service adoption. The present study follows Nysveen et al.'s (2005a) proposition and integrates and updates TPB, TAM and DOI models. We hope to be able to provide a more nuanced understanding of consumers' motives for using mobile services by (1) studying motivational and attitudinal influences and consumers' perceived control, and (2) by studying the issue across three different mobile service categories. Additionally (3), we pay attention to the dual role of hardware (mobile phone) characteristics in adoption of related software (mobile services).

## BACKGROUND

The theory of planned behavior (Ajzen, 1985), technology acceptance model (Davis, 1985) and the innovation diffusion theory (Rogers, 1983) are perhaps the most often applied models in predicting adoption behavior, as they provide a good starting point in investigating individual-level factors affecting the adoption of last-mile technology (Oh et al., 2003). Comparison of these theories (Figure 1) reveals that TPB and TAM both focus on predicting behavioral intention and actual behavior, whereas DOI and TAM share in common innovation related perceptions that are formed by the individual, and which are critical for the innovation adoption. Thus, further focus is given on three sets of variables: attitudinal, motivational and behavioral.

### Attitudinal Influences: Personal Innovativeness

Literature in marketing suggests that a key success factor of new product introduction is identification of those people who are the first to buy the product or service launched into markets (Flynn & Goldsmith, 1993). It is necessary that the innovation is adopted by these first individuals who have a characteristic that has come to be known as innovativeness. Innovativeness can be seen as a psychographic characteristic of individuals. Midgley and Dowling (1978) define consumer innovativeness as the degree to which an individual is receptive to new ideas and makes innovation decisions independently of the communicated experience of others (p. 236). Yi et al. (2006) describe innovative adopters in their study as follows:

*You buy into a new product's concept very early in its life cycle. You find it easy to imagine, understand and appreciate the benefits of a new technology and base buying decisions on this belief. You do not base these buying decisions on well established references, preferring instead to rely on intuition and vision.* (Yi et al., p. 403)

Innovativeness thus reflects the consumers' openness toward new ideas and their willingness to be among the first ones to adopt innovations. Innovativeness is considered to be domain specific

*Figure 1. The main concepts in the ground models*

| Theory base | Main concepts and their definitions |
|---|---|
| ***Theory of planned behaviour (TPB)*** | *Attitude toward the behaviour*<br>The degree to which a person has a favourable or unfavourable evaluation or appraisal of the behaviour in question |
| | *Subjective norm*<br>The perceived social pressure to perform or not to perform behaviour |
| | *Perceived behavioural control*<br>The perception of the ease or difficulty of performing the behaviour of interest |
| ***Technology acceptance model (TAM)*** | *Perceived usefulness*<br>The degree to which a technology is perceived as providing benefits in performing certain activities |
| | *Perceived ease of use*<br>The extent to which a technology is perceived as being easy to understand and use |
| | *Attitude*<br>The degree of evaluative affect that an individual associates with using the target system in his or her job |
| ***Diffusion of innovation (DOI)*** | *Relative advantage*<br>The degree to which an innovation is perceived better than the idea it supersedes |
| | *Observability*<br>The degree to which results of an innovation are visible to others |
| | *Compatibility*<br>The degree to which an innovation is perceived as being consistent with existing values, past experiences, and needs of potential adopters |
| | *Complexity*<br>The degree to which an innovation is perceived as difficult to understand and use |
| | *Trialability*<br>The degree to which an innovation may be experimented with on a limited basis |

(Agarwal & Prasad, 1998). Domain-specific innovativeness has been successfully used for detecting innovation adopter categories (Goldsmith, 2001; Goldsmith et al., 1998). Prior research (Yi et al., 2006) has shown that domain specific personal innovativeness predicts well innovation adoption behavior. As domain specific constructs (both at product and product category level) are highly associated with concrete behaviors (Goldsmith et al., 1995), it is hypothesized that:

**H1:** Personal innovativeness is positively related to the adoption of mobile services.

Rogers' (1983) original definition of innovativeness which was based on time of adoption view, offers a possibility to approach the adopter categories. In this view innovativeness was seen as the degree to which an individual is relatively earlier in adopting new ideas than other members of a system. According to Rogers' (1983), the compelling reason to buy for innovators and early adopters is either technological novelty or the real benefits. Price is not critical to them and they are often said to be willing to pay more. In a recent empirical study, Hsu and Shiue (2008) found that in computer software industry novelty seeking behaviors, i.e. innovativeness is positively related to consumers' willingness to pay. Thus, we can also propose an indirect influence through willingness to pay:

**H2:** The higher the personal innovativeness the higher the willingness to pay more for new mobile services.

## Motivational Influences: Image

The role of mobile phone has changed as the penetration rates have risen. The phone is no more acquired just for phone calls, instead it provides multiple purposes for use. The mobile phone is a highly personal medium (Barwise & Strong, 2002), and is a kind of status symbol that represents one type of motivational influence (see Nysvenn et al., 2005a). Innovation literature very often discusses perceived innovation characteristics, and several concepts related to perceived innovation characteristics have been introduced over the time. For example, Moore and Benbasat (1991) extended the work of Rogers and added image construct. Perceived image represents the degree to which an individual believes that an innovation will bestow them with added prestige or status in their relevant community (Plouffe et al., 2001, p.68). Considering the nature of mobile communications and the stage of its diffusion, the spectrum of mobile phone models turns our focus on the image status that the mobile phone brings. It is not uncommon that new mobile phone models are launched in fashion shows together with new clothing designs. Lu et al. (2005) reported that in many Asian countries young people treat smart phones as new fashions items. However, innovation adoption studies have not paid much attention to the role of image. Few researchers have included the perception of image in their research models. For instance, image was found to be a positive determinant of perceived usefulness (Chan & Lu, 2004), and to increase the adoption intentions of internet banking. An indirect positive effect of image on virtual banking adoption has also been proposed by Liao et al. (1999). As image represents one type of relative advantage and thus reflects adopters' motivational state, it is proposed that

**H3:** The more important the innovation's motivational influence (i.e. image), the stronger the adoption intention.

Innovation adoption may follow belief-attitude-intention causal flow. Innovativeness represents consumers' attitudinal level toward adopting innovations, and in relation to this causal flow, it is assumed that image is one kind a 'belief' of an innovation. We thus follow the notion of Nysveen et al. (2005a), who suggested that motivational factors' effect on intention may be mediated by attitudinal factors, like innovativeness. Therefore we propose:

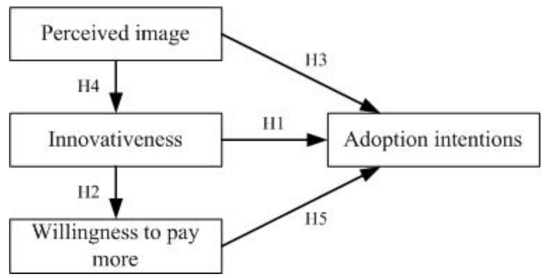
**H4:** Motivational influence has a positive effect on attitudinal factors (here consumer's personal innovativeness).

## Perceived Control: Willingness to Pay

Perceived behavioral control is related to the extent to which consumers believe that skills, resources, and opportunities are present to perform the required behavior (Mathieson, 1991). Nysveen et al. (2005a) have also highlighted the role of individual user's economy in perceived control issues. In technology-mediated environments, consumers are concerned about the amount of control that can be exerted (Kang et al., 2006). Consumers face different control issues when adopting mobile technology and new mobile services. These concerns are particularly fed by consumers' apprehension about financial costs of using such services. Besides ensuring that the phone model meets the needs for advanced mobile services, the individual must have necessary financial resources to prepare for increasing costs. Hence, perceived control is related to the general assessment of whether or not the entire costs of using mobile services can be controlled by the consumer.

Willingness to pay (WTP) has been utilized by economists, psychologists, and marketing researchers in evaluating the demand for innovations (Wertenbroch & Skiera, 2002). In recent studies, Kim et al. (2007) considered the financial aspect of the consumer perception of the costs related

*Figure 2. Research model*




to mobile internet, and Shih (2004) compared the user acceptance of physical and digital products and online services, and suggested that the access cost influenced negatively only in the case of on-line services. When it comes to mobile services, WTP concept is multifaceted as the necessary financial sacrifice is binary: the device related costs and the continuous costs depending on the service usage. Following the main studies in the field, we hypothesize:

**H5:** The more a consumer is willing to pay for the innovation, the more likely he/she is to adopt it.

The research model (Figure 2) examines motivational, attitudinal and behavioral factors and suggests that innovativeness has a central role in predicting the adoption behavior.

## UNDESTANDING INTENTIONS TO ADOPT MOBILE SERVICES

### Data and Measurement

The data was collected in Germany, and 1454 eligible responses were obtained (see descriptive information in Figure 3).

The statements that reflected innovativeness and image were measured with a six point Likert-scale ranging from 1="that is perfectly applicable to me" to 6="that does not apply to me at all". The willingness to pay more for services was reflected with two indicators. The first captures how much the customer is willing to pay for mobile phone usage including new services and the second measure captured the absolute upper limit of mobile phone usage costs. The target variables in the interest were future intentions to use different mobile services. A six point Likert-scale ranging from 1="very interested" to 6="not interested at all" measured individuals' intentions to use new services. Confirmatory factor analysis was

*Figure 3. Descriptive information of the respondents*

| Age | (%) | Level of education | (%) | Gender | (%) | Income | (%) |
|---|---|---|---|---|---|---|---|
| Under 20 years | 25.4 | Primary school | 24.2 | Male | 51.5 | < 2000 DM | 5.7 |
| 20 to 35 years | 31.4 | Further schooling | 38.0 | Female | 48.5 | 2001 – 3000 DM | 12.1 |
| 36 to 50 years | 31.2 | High-school diploma | 21.6 | | | 3001 – 4000 DM | 17.3 |
| Over 50 years | 18.0 | Study at a university | 15.7 | | | 4001 – 5000 DM | 19.3 |
| | | | | | | 5001 – 6000 DM | 14.9 |
| | | | | | | > 6001 DM | 30.6 |

*Figure 4. Scale statistics*

| | *Confirmatory factor analysis* | | | | *Summated scale statistics* | | |
|---|---|---|---|---|---|---|---|
| *Items** | *Loading* | *Error variance* | *CR* | *AVE* | *Mean** | *Std dev** | *Error variance* |
| *Intention: entertainment services* | | | | | | | |
| entertainment1 | .729 | .469 | .822 | .540 | 4.494 | 1.382 | .339 |
| entertainment2 | .762 | .420 | | | | | |
| entertainment3 | .589 | .653 | | | | | |
| entertainment4 | .838 | .298 | | | | | |
| *Intention: services for everyday activities* | | | | | | | |
| everyday1 | .653 | .574 | .803 | .404 | 3.759 | 1.427 | .309 |
| everyday2 | .630 | .603 | | | | | |
| everyday3 | .647 | .582 | | | | | |
| everyday4 | .63 | .603 | | | | | |
| everyday5 | .648 | .58 | | | | | |
| everyday6 | .607 | .632 | | | | | |
| *Intention: notification services* | | | | | | | |
| notification1 | .651 | .576 | .689 | .428 | 2.670 | 1.246 | .484 |
| notification2 | .750 | .438 | | | | | |
| notification3 | .546 | .702 | | | | | |
| *Innovativeness* | | | | | | | |
| innovativeness1 | .692 | .522 | .773 | .461 | 3.761 | 1.144 | .298 |
| innovativeness2 | .662 | .562 | | | | | |
| innovativeness3 | .607 | .631 | | | | | |
| innovativeness4 | .747 | .442 | | | | | |
| *Image* | | | | | | | |
| image1 | .661 | .562 | .570 | .400 | 4.165 | 1.458 | .914 |
| image2 | .601 | .639 | | | | | |
| *Willingness to pay more* | | | | | | | |
| paymore1 | .709 | .498 | .791 | .657 | 115.580 | 112.850 | .190 |
| paymore2 | .901 | .188 | | | | | |

*The full items are available from authors on request. *Computed from unstandardized values.

conducted to verify the measurement model (see Figure 4). Future services included three separate categories: entertainment services (e.g. music downloads), services related everyday activities (e.g. banking) and notification services (e.g. location based alerts). The suggested research model was tested with structural equation modeling. In order to simplify the modeling procedure, summated scale were computed for each latent variable from its indicators. The error term variance for each was retrieved from the summated scale variance and latent variable's construct reliability (Fisher & Price, 1992; Bagozzi & Heatherton, 1994; Childers et al., 2001).

## Path Analytic Assessment of Intention to Adopt Mobile Services

Figure 5 summarizes the results for the path coefficients and goodness of fit statistics for the models. The goodness of fit statistics were the same for all three model, and they suggested that the model had an excellent fit to the data ($\chi^2$=.6565, p=.418, df=1, NFI=.999, NNFI=1.003, GFI=1.00, AGFI=.998).

Based on the results, the hypothesized models succeeded rather well in explaining the intentions to adopt mobile services in the cases of entertainment and everyday activities. Considering the hypotheses, innovativeness was a significant predictor of intentions, thus H1 can be accepted. This relationship between innovativeness and adoption intentions is well established also in prior studies. For example, Mort and Drennan (2005) found statistically significant relationship in innovativeness and intentions to use mobile life enhancers. The second hypothesis discussed the willingness to pay more for mobile services and whether innovativeness has a positive influence on it. Based on the structural model, it can be said that higher innovativeness increases consumers' willingness to make higher financial sacrifices, thus supporting the hypothesis H2. The negative path coefficient between innovativeness and

*Figure 5. Path coefficients*

| Path | Intention: Notification services $R^2$=.168 | Intention: Entertainment services $R^2$=.302 | Intention: Services for everyday activities $R^2$=.339 |
|---|---|---|---|
| H1: innovativeness → intention | .370* | .221* | .459* |
| H2: innovativeness → willingness to pay more | -.271* | -.271* | -.271* |
| H3: image → intention | -.035 | .312* | .014 |
| H4: image → innovativeness | .646* | .646* | .646* |
| H5: willingness to pay more → intention | -.142* | -.168* | -.242* |
| * p<.001 | | | |

willingness to pay more is caused by the coding, i.e. lower values indicate higher innovativeness. Rogers (1983) proposed already in early 80's that innovativeness (namely innovators) and willingness to pay (personal income) are positively related. This view is supported in a review by Martinez and Polo (1996). Our results thus strongly support previous research findings from other fields. Our results indicate the hypothesis H3 holds only for the entertainment services, i.e. the higher social prestige coming along with the mobile phone is important only with entertainment services such as music downloads and games. This inclusion of diffusion related variables into TAM model was also supported by a recent study (see López-Nicolás et al., 2008). However, contrary to expectations prior research on adoption intentions of wireless Internet services via mobile technology (see Lu et al., 2005) has not found a direct effect of social prestige to adoption intentions. Lu et al. (2005) proposed that the effect of social influences on adoption intentions are mediated through perceived usefulness and perceived ease of use. The hypothesis H4 suggested that the motivational influence of image related to the mobile phone has a positive influence on domain-specific innovativeness, and based on the results this hypothesis can be accepted. This result is inline with Nysveen et al. (2005a), who originally proposed this relationship. Results reveal that consumers' willingness to pay more increased intentions to adopt all three types of services; the hypothesis H5 is thus accepted. The negative path coefficient between WTP and adoption intentions is here also caused by the coding of intention, i.e. lower values indicate higher intentions. Also this result is inline with existing studies. For example, Sultan (2002) found that consumers' willingness to pay for internet services was highest in the early phases of adoption life cycles.

## FUTURE RESEARCH DIRECTIONS

Limitations and future research are considered collectively because the limitations of any study may be the most efficient method for identifying future opportunities for research. The present study examined three service categories, but for instance, the adoption rates of mobile internet were not yet available, and therefore more research is needed to cover the diffusion of mobile internet and different services that come along with it. Additionally, the present model focused only on a set of variables under each main theoretical model (TPB, TAM, DOI). Thus, future studies should also pay more attention to concepts like role of normative pressure (e.g. Ajzen, 1991; Lu et al., 2005) in adopting mobile services and the interplay between service and hardware characteristics. For segmentation purposes, it would be fruitful to assess the demographic influences on the adoption of mobile services. For instance, age, gender and income could be relevant background variables and have significant effects across different types of services (e.g. Hung et al., 2003;

Nysveen et al., 2005b). Also including person's technological readiness (see e.g. Parasuraman, 2002) might offer interesting results.

## CONCLUSION

The business field related to mobile phones is currently turning from selling the subscriptions to the content site with a wide variety of mobile services. Thus, understanding the adoption intention of mobile services is crucial for companies operating in mobile communications industry. Our model assessed three set of factors: motivational, attitudinal and behavioral. They all are important predictors of the adoption of mobile services. However, when predicting the adoption of mobile entertainment services, motivational factors, like image, become crucial. Based on the empirical evidence, it can be seen that the phone model has a binary role in service adoption. First, it is a necessity as there is still divergence in their applicability for different purposes of use. Secondly, it might be that since mobile services might be invisible to others, the image characteristic of the hardware i.e. mobile phone becomes more important in reflecting certain lifestyles or other psychographics. Mobile telecommunication operators and service providers should take these findings into account if they want to distinguish themselves in a highly competitive market.

## REFERENCES

Agarwal, R., & Prasad, J. (1998). A Conceptual and Operational Definition of Personal Innovativeness in the Domain of Information Technology. *Information Systems Research*, *9*(2), 204–215. doi:10.1287/isre.9.2.204

Ajzen, I. (1985). From Intentions to Actions: A Theory of Planned Behavior. In J. Kuhl & J. Beckmann (Eds.), *Action Control: From Cognition to Behavior* (pp. 11-39). Heidelberg, Germany: Springer.

Ajzen, I. (1991). The Theory of Planned Behavior. *Organizational Behavior and Human Decision Processes*, *50*, 179. doi:10.1016/0749-5978(91)90020-T

Bagozzi, R. P., & Heatherton, T. F. (1994). A General Approach to Representing Multifaceted Personality Constructs: Application to State Self-Esteem. *Structural Equation Modeling*, *1*(1), 35–67. doi:10.1080/10705519409539961

Barwise, P., & Strong, C. (2002). Permission-based Mobile Advertising. *Journal of Interactive Marketing*, *16*, 14–24. doi:10.1002/dir.10000

Boccaletti, S., & Nardella, M. (2000). Consumer Willingness to Pay for Pesticide-free Fresh Fruit and Vegetable in Italy. *International Food and Agribusiness Management Review*, *3*, 297–310. doi:10.1016/S1096-7508(01)00049-0

Chan, S.-C., & Lu, M.-T. (2004). Understanding Internet Banking Adoption and Use Behavior: A Hong Kong Perspective. *Journal of Global Information Management*, *12*(3), 21–43.

Childers, T. L., Carr, C. L., Peck, J., & Carson, S. (2001). Hedonic and Utilitarian Motivations for Online Retail Shopping Behavior. *Journal of Retailing*, *77*, 511–535. doi:10.1016/S0022-4359(01)00056-2

Davis, F. D. (1985). *A Technology Acceptance Model for Empirically Testing New End-User Information Systems: Theory and Results*. Unpublished doctoral dissertation, Massachusetts Institute of Technology, Massachusetts.

Fisher, R. J., & Price, L. L. (1992). An Investigation into the Social Context of Early Adoption Behavior. *JMR, Journal of Marketing Research*, *19*(3), 477–486.

Flynn, L. R., & Goldsmith, R. E. (1993). Identifying Innovators in Consumer Service Markets. *The Service Industries Journal*, *13*(3), 97–106. doi:10.1080/02642069300000052

Fu, T.-T., Liu, J.-T., & Hammitt, J. K. (1999). Consumer Willingness to Pay for Low-pesticide Fresh Produce in Taiwan. *Journal of Agricultural Economics*, *50*, 220–233.

Goldsmith, R. E. (2001). Using the Domain Specific Innovativeness Scale to Identify Innovative Internet Consumers. *Internet Research*, *11*(2), 149–158. doi:10.1108/10662240110695098

Goldsmith, R. E. (2002). Explaining and Predicting Consumer Intention to Purchase over the Internet: An Exploratory Study. *Journal of Marketing Theory and Practice*, *10*(2), 22–28.

Goldsmith, R. E., d'Hauteville, F., & Flynn, L. R. (1998). Theory and Measurement of Consumer Innovativeness. *European Journal of Marketing*, *32*(3/4), 340–353. doi:10.1108/03090569810204634

Goldsmith, R. E., Freiden, J. B., & Eastman, J. K. (1995). The Generality/Specificity Issue in Consumer Innovativeness Research. *Technovation*, *15*(10), 601–612. doi:10.1016/0166-4972(95)99328-D

Hoffman, D. L., & Novak, T. P. (1996). Marketing in Hypermedia Computer-Mediated Environments: Conceptual Foundations. *Journal of Marketing*, *60*(July), 50–68. doi:10.2307/1251841

Hsu, J. L., & Shiue, C. W. (2008). Consumers' Willingness to Pay for Non-pirated Software. *Journal of Business Ethics*, *81*, 715–732. doi:10.1007/s10551-007-9543-9

Hung, S.-Y., Ku, C.-Y., & Chang, C.-M. (2003). Critical Factors of WAP Services Adoption: An Empirical Study. *Electronic Commerce Research and Applications*, *2*(1), 42–60. doi:10.1016/S1567-4223(03)00008-5

Kang, H., Hahn, M., Fortin, D. R., Hyun, Y. J., & Eom, Y. (2006). Effects of Perceived Behavioral Control on the Consumer Usage Intention of e-Coupons. *Psychology and Marketing*, *23*, 841–864. doi:10.1002/mar.20136

Kim, H.-W., Chan, H. C., & Gupta, S. (2007). Value-Based Adoption of Mobile Internet: An Empirical Investigation. *Decision Support Systems*, *43*, 111–126. doi:10.1016/j.dss.2005.05.009

Liao, S., Shao, Y. P., Wang, H., & Chen, A. (1999). The Adoption of Virtual Banking: An Empirical Study. *International Journal of Information Management*, *19*(1), 63–74. doi:10.1016/S0268-4012(98)00047-4

López-Nicolás, C., Molina-Castillo, F. J., & Bouwman, H. (2008). An Assessment of Advanced Mobile Services Acceptance: Contributions from TAM and Diffusion Theory Models. *Information & Management*, *45*(6), 359–364. doi:10.1016/j.im.2008.05.001

Lu, J., Yao, J. E., & Yu, C.-S. (2005). Personal Innovativeness, Social Influences and Adoption of Wireless Internet Services via Mobile Technology. *The Journal of Strategic Information Systems*, *14*, 245–268. doi:10.1016/j.jsis.2005.07.003

Martinez, E., & Polo, Y. (1996). Adopter Categories in the Acceptance Process for Consumer Durables. *Journal of Product and Brand Management*, *5*(3), 34–47. doi:10.1108/10610429610126560

Mathieson, K. (1991). Predicting User Intentions: Comparing the Technology Acceptance Model with the Theory of Planned Behavior. *Information Systems Research*, *2*, 173–191. doi:10.1287/isre.2.3.173

Midgley, D. F., & Dowling, G. R. (1978). Innovativeness: The Concept and Its Measurement. *The Journal of Consumer Research*, *4*(4), 229–242. doi:10.1086/208701

Moore, G. C., & Benbasat, I. (1991). Development of an Instrument to Measure the Perceptions of Adopting an Information Technology Innovation. *Information Systems Research*, *2*(3), 192–222. doi:10.1287/isre.2.3.192

Mort, G. S., & Drennan, J. (2005). Marketing m-services: Establishing a Usage Benefit Typology Related to Mobile User Characteristics. *Journal of Database Marketing & Customer Strategy Management*, *12*, 327–341. doi:10.1057/palgrave.dbm.3240269

Nysveen, H., Pedersen, P. E., & Thorbjørnsen, H. (2005a). Intentions to Use Mobile Services: Antecedents and Cross-Service Comparison. *Journal of the Academy of Marketing Science*, *33*(3), 330–346. doi:10.1177/0092070305276149

Nysveen, H., Pedersen, P. E., & Thorbjørnsen, H. (2005b). Explaining Intention to Use Mobile Chat Services: Moderating Effects of Gender. *Journal of Consumer Marketing*, *22*(4/5), 247–256. doi:10.1108/07363760510611671

Oh, S., Ahn, J., & Kim, B. (2003). Adoption of Broadband Internet in Korea: The Role of Experience in Building Attitudes. *Journal of Information Technology*, *18*, 267–280. doi:10.1080/0268396032000150807

Parasuraman, A. (2002). Technology Readiness Index (TRI): A Multiple-Item Scale to Measure Readiness to Embrace New Technologies. *Journal of Service Research*, *2*, 307–320. doi:10.1177/109467050024001

Plouffe, C. R., Vandenbosch, M., & Hulland, J. (2001). Intermediating Technologies and Multi-Group Adoption: A Comparison of Consumer and Merchant Intentions Toward a New Electronic Payment System. *Journal of Product Innovation Management*, *18*(2), 65–81. doi:10.1016/S0737-6782(00)00072-2

Rogers, E. M. (1983). *Diffusion of Innovations,* (3rd ed.). New York: Free Press.

Schillewaert, N., Ahearne, M. J., Frambach, R. T., & Moenaert, R. K. (2005). The Adoption of Information Technology in the Sales Force. *Journal of Marketing Management*, *34*, 323–336.

Shih, H.-P. (2004). An Empirical Study on Predicting User Acceptance of E-Shopping on the Web. *Information & Management*, *41*(3), 351–368. doi:10.1016/S0378-7206(03)00079-X

Sultan, F. (2002). Consumer Response to the Internet: An Exploratory Tracking Study of On-line Home Users. *Journal of Business Research*, *55*(8), 655–663. doi:10.1016/S0148-2963(00)00206-X

Watson, R. T., Leyland, F. P., Berthon, P., & Zinkhan, G. M. (2002). U-Commerce: Expanding the Universe of Marketing. *Journal of the Academy of Marketing Science*, *30*(4), 333–347. doi:10.1177/009207002236909

Wertenbroch, K., & Skiera, B. (2002). Measuring Consumers' Willingness to Pay at the Point of Purchase. *JMR, Journal of Marketing Research*, *39*, 228–241. doi:10.1509/jmkr.39.2.228.19086

Yi, M. Y., Fiedler, K. D., & Park, J. S. (2006). Understanding the Role of Individual Innovativeness in the Acceptance of IT-based Innovations: Comparative Analyses of Models and Measures. *Decision Sciences*, *37*(3), 393–426. doi:10.1111/j.1540-5414.2006.00132.x

## KEY TERMS AND DEFINITIONS

**Adoption Intention:** individual's readiness to perform a given behavior. Here readiness to buy mobile services.

**Attitudinal Influence:** consumer's attitudinal stage towards adopting innovations. Is illustrated here via personal domain specific innovativeness.

**Image:** a type of perceived innovation characteristic and consumer's motivational stage and is assumed to have positive relationship with adoption intentions.

**Innovation:** an object (service) which is perceived as new by an individual consumer. Here mobile services.

**Motivational Influence:** motivational influence composes of several elements like expressiveness and is believed to encourage adoption intentions.

**Perceived Control:** a belief that one has on influencing on a certain event. Here belief of consumer's financial resources effect on adopting new mobile services.

**Perceived Innovation Characteristics:** consumer's beliefs concerning important attributes of an innovation. Here perceived image that consumer gets by using new mobile services.

**Personal Domain Specific Innovativeness:** reflection of consumer's openness toward new ideas and willingness to be among the first ones to adopt mobile communications innovations.

**Willingness to Pay:** consumer's perceived control towards adoption of innovations, namely mobile services.

# Chapter 81
# Service Discovery Techniques in Mobile E-Commerce

**Nandini Sidnal**
*K.L.E.S. College of Engineering and Technology, India*

**Sunilkumar S. Manvi**
*Reva Institute of Technology and Management, India*

## ABSTRACT

*With the rising number of web services in mobile E-commerce, service discovery has become an important feature in the future of E-commerce for mobile users. A service in the network can be any software or hardware entity that a user might be interested to utilize. Service discovery is the action of finding appropriate service provider for a requested service. When the location of the demanded service (typically the address of the service provider catering services such as shopping, auctions, edutainment, etc.) is retrieved, the user may further access the service and use it. Service discovery is an emerging field in the area of ubiquitous and pervasive computing owing to its mobile devices with limited resources. There are various service discovery techniques and protocols (proposed or/and already implemented) particularly tailored to specific set of objectives. With service discovery, devices may automatically discover network services including their properties, and services may advertise their existence in a dynamic way. This chapter discusses various mobile E-commerce issues with major focus on service discovery issue. It elaborates on syntax and semantic based various service discovery mechanisms and concludes with future directions to service discovery mechanism.*

## MOBILE E-COMMERCE

**Mobile E-commerce** is trading of goods, services or information irrespective of location, using hand held devices for communication between all necessary parties to complete the necessary transactions in a wireless environment mostly through the Web. Today's technology has advanced to a state, that hand held devices not only register the names and numbers but also track the user location and are a substitute for wallets and credit cards, in future they are bound to replace and go further, that they may

DOI: 10.4018/978-1-61520-611-7.ch081

very well turn into intelligent assistants capable of anticipating many of the wishes and needs, such as automatically arranging for taxis to come and pick after business meetings or providing with summaries of relevant news and messages left by colleagues. But, for all these changes to happen, key issues of interoperability, usability, security, and privacy, one need to be continuously updated. **Mobile e-commerce** facilitates mobile application services like banking, payment, auctioning, ticketing etc.

The attributes of **mobile e-Commerce** as discussed in (Varshney, 2003) are ubiquity, convenience, connectivity, personalization, localization, automation and adaptation. Ubiquity: easier information access in real-time anywhere anytime since user devices are portable and mobile. Convenience: devices that store data and have Internet connections. Instant connectivity: easy and quick connection to Internet and other mobile devices and databases. Personalization: preparation of information for individual consumers as per their needs. Localization of products and services: knowing where the user is located at any given time and match service to them and provide quality services. Automation: Proactive services to be provided. Adaptation and intelligence: **Context** aware operations to be handled in the changing market environment.

Quality characteristics as defined (Nandini &Sunilkumar, 2009) that model attributes of **mobile E-commerce** system are as follows.

- Reliability: refers to a set of attributes that bear on the capability of the software to maintain its performance level under stated conditions for stated period of time.
- Functionality: refers to a set of functions and specified properties that satisfy stated or implied needs. It also refers to the existence of these functions and services that support end users interaction via the mobile system.
- Efficiency: capability of the system to provide appropriate performance relative to the amount of resources used under stated conditions.
- Scalability: the performance of the system should be the same even with the increase in network traffic.
- Flexibility: The system must be able to accommodate the dynamism in the E-market.

Following is the list of the **mobile e-commerce** applications (B2B, B2C) (Manvi, 2003) Mobile financial applications, Mobile advertising, Mobile inventory management / Product locating and shopping, Proactive service management, Wireless re-engineering, Mobile auction, Mobile entertainment services and games, Mobile office and Mobile distance education.

## ISSUES IN MOBILE E-COMMERCE

The major issues in **mobile E-Commerce** can be broadly classified with respect to mobile devices, Wireless middleware and communications infrastructure (Hawick & James, 2004; Peter et al., 2002). Some of the issues with respect to mobile devices (Samaras, 2002) are as follows:

- Ultimate (physical) form(s) of mobile client devices
- Personalization of information presented to the user on mobile device
- Design of user interfaces for mobile devices that convey better required information, get the feedback from the user, facilitate customization and personalization.
- Design of applications for use on different mobile devices
- Acceptance of protocols or systems for mobile device communication.
- Mobile device upgradeability.
- Reduce processing power with usage of better processors that have clock rates suitable for computing applications on mobile devices.

- Accommodate or adapt the applications to suit the memory requirements of mobile devices.
- Design of file systems in mobile devices with limited memory available in handheld portable mobile devices.
- Limited input/output interface (screens, keyboards, etc):
- Limited battery life.

Wireless middleware is extremely important for developing new mobile commerce applications. Wireless middleware should have ability to hide the underlying network details from applications while providing a uniform and easy-to-use interface. While developing the wireless middleware the following issues are to be considered (Evans & Sarkar, 2004; Lei, 2002; Kalevi, 2001).

- Atomic transactions and synchronization of data.
- Low memory and adaptable operating system.
- Low cost and low memory requirements of encoding of the m-Commerce transactions.
- Specially designed browsers for mobile devices with functionalities including secured m-Commerce transactions.
- Data management and retrieval for location dependent services.
- Identity verification for secured payments and amount transfers by using biometrics or any other suitable techniques.
- **Service discovery** mechanisms to facilitate mobile users and reduce latency.
- Data security from viruses and intruders especially the m-Commerce contents such as inventory control operations, trading data, customers list, financial transactions, etc.

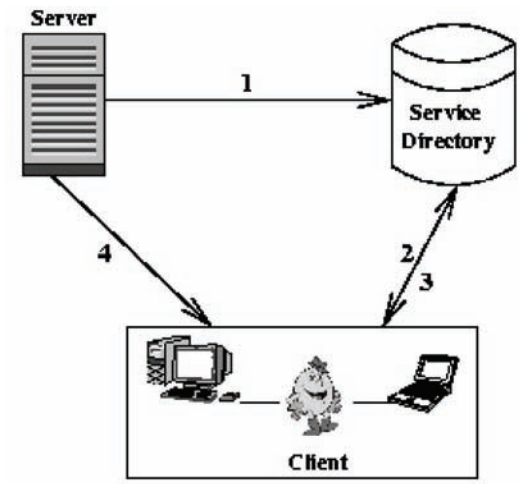
In **mobile E-Commerce**, service quality primarily depends on network resources and capabilities. The following are the communications infrastructure issues in **mobile E-Commerce**.

- Efficient usage of currently available limited bandwidth.
- Difficulties with mobile devices interfacing with multiple communications environments.
- Interoperability among communication technologies.
- Intelligent network routing to optimize the power and bandwidth resources.
- Frequent disconnections leads to discontinuous data transfer. Hence it is required to maintain continuous and seamless data transfer while moving from one network to another.
- Providing bounded end-to-end delays with minimum delay variations.
- Security for wireless transactions in wireless networks is important for maintaining data integrity and privacy.

## SERVICE DISCOVERY ISSUE IN MOBILE E-COMMERCE

The process of obtaining a set of services which can possibly fulfill a user request is called **service discovery**. The general architecture of any **service discovery** is as follows: A service advertises and registers itself to a service register that keeps track of networked services. Services can de-register at any point of time. Figure 1 describes the process of **service discovery** and the entities involved. Each **service discovery** protocol (Marin-Perianu et al., 2005) consists of at least two basic participating elements: Client (or user)- the entity that is interested in finding and using a service, and Server- the entity that offers the service. Protocols may use service repositories to facilitate service mappings. Therefore, it is common to find a third participating entity called as directory. Directory

*Figure 1. Generic service discovery process and entities*




(or server, broker, central, resolver) is a node in the network that maintains service description information either partially or totally.

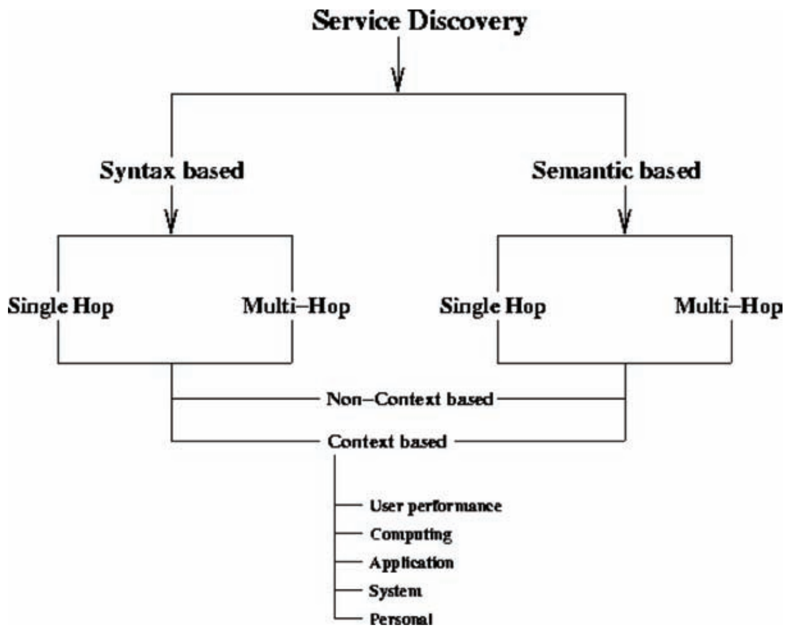
General **Service discovery** process can be explained in the following sequence:

1. The services are registered / deregistered in service directory.
2. The client requiring the service browses/ queries to discover the services.
3. The client obtains the required service information from the service directory.
4. The client accesses the service from the server.

Web Services, by definition (Al-Masri & Mahmoud, 2008) are self-contained, self-describing applications that can be published, located and invoked remotely in a dynamic fashion over the Internet. This loosely coupled remote-service invocation capability has proven to be a particularly attractive proposition for e-commerce and business integration models. The introduction of software development via Web Services has been the most significant web engineering paradigm, in the recent years. The widely acknowledged importance of the Web Services' concept lies in the fact that they provide a platform independent answer to the software component development question. The dependence on internet has increased as the number of internet enabled applications in **mobile E-commerce** is rising; proportionally the number of requests from the clients to access these services has also relatively increased. For any given **mobile E-commerce** application the requests from the clients are to be processed in shortest amount of time, with efficient use of available resources by the service provider, for which the web services need to be structured to reduce the service access time and increase the throughput of the system. **Service discovery** mechanisms are equally important as they have turned out as a challenging task in **mobile E-commerce**.

To access the web services through the mobile devices, services are to be mined in the network environment and placed in an appropriate database for flexible and adaptable accessibility. Mobile users are rarely aware of available web services that fulfill their current needs. Therefore, enhanced **service discovery** mechanisms are required, besides category or organization based search which are redundant in the mobile environment. **Service discovery** needs to find an appropriate service provider for every client request. Due to

*Figure 2. Taxonomy of service discovery mechanisms*




the limitations like processing and memory capabilities of the hand held devices, as the clients cannot keep the log of web services and requests, hence **service discovery** plays a vital role.

## SERVICE DISCOVERY MECHANISMS

**Service discovery** plays a major role in the development and deployment of **mobile E-commerce** applications as they are web enabled. The two closely related tasks involved in a web **service discovery** are web service descriptions and techniques that are used to match service descriptions against the user requirements. The process in which the tasks are carried out gives rise to various **service discovery** architectures. The **service discovery** architectures depend on types of network, as each network is based on the assumptions suitable to them, the most important being the mobility and rate of joining and leaving of devices from the network. In the wired network, both the servers and the clients do not move at all and hence are not suitable for **mobile E-commerce**. The classifications of the various **service discovery** mechanisms as per the taxonomy are as shown in Fig. 2.

One of the key objectives of the **service discovery** mechanisms in **mobile E-commerce** is to reduce the number of transmissions necessary to discover services in the users' devices so as to enhance the battery charge utility. This can be achieved by using aforesaid **context**s in matching process (Broens, 2004). In this section, first, **syntax** based **service discovery** mechanisms are elaborated and next the need and importance of **semantic service discovery** mechanism for **mobile E-commerce** are presented. Discussions on works or protocols for **service discovery** which are **context** aware for single hop networks, **semantic** based **service discovery** in non **context** based single hop networks and mechanisms under **Context** based single hop networks are not carried out as the contributions are not significant.

## Syntax Based Service Discovery Mechanisms

In **syntax** based **service discovery** mechanisms, string matching technique is used to match the keywords in the user's query with service descriptions. These mechanisms are used when the number of web services are limited and the discovery process is manual. When there is an explosion in number of web services, matching with only keywords will not be adequate to get the desired results.

## Non-Context Based Single Hop Networks

This section gives overview of some of the **syntax** based single hop **service discovery** mechanisms without considering the **context** in wireless networks. The DEAPspace group (Nidd, 2001) has proposed a solution to the problem of **service discovery** in pervasive systems without using a central server. A list of all known services called "world view" is present on all devices. Each device periodically broadcasts its "world view" to its neighbors, which update their "world view" accordingly.

Simple **service discovery** protocol (SSDP) (Goland, et al., 2009) is a lightweight discovery protocol for the Universal Plug and Play (UPnP) initiative, and it defines a minimal protocol for multicast-based discovery. SSDP can work with or without its central directory service, called the Service Directory. When a new service is to be added to the network, it has to multicast (one-to-many communications) an announcement message to notify its presence to the available devices including service directory. The service directory, if present, will record the announcement. Alternatively, the announcement may be sent through unicast (one-to-one communications) directly to the service directory. When a client wants to discover a service, it either searches in the service directory or sends a message through multicast.

## Non-Context Based Multi-Hop Networks

The multi hop (also called as ad hoc networks) wireless category of **service discovery** mechanisms are compiled from (Outay et al., 2007), the ones where the service providers and clients are both mobile.

Overviews of some of these mechanisms are described in this section. Lightweight Overlay for **Service Discovery** in MANET (Lanes) is application layer overlay to discover services offered in a mobile ad hoc network (Klein et al., 2003). They offer a fault-tolerant and efficient structure, which can be used for **semantic**s-based **service discovery**. Lanes are based on the Content Addressable Network (CAN). The basic concept of Lanes is a two-dimensional overlay structure, called lanes, where one dimension of the overlay propagates service advertisements; the other one distributes service requests.

Distributed **Service Discovery** Protocol (DSDP) is a distributed **service discovery** architecture which relies on a virtual backbone for locating and registering available services within a dynamic network topology (Kozat, 2003). Konark is a **service discovery** and delivery protocol designed specifically for mobile ad hoc networks and targeted towards device independent services (Helal, 2003). Konark assumes an IP level connectivity among devices in the network. To describe a wide range of services, Konark defines an XML-based description language, based on web **service discovery** language (WSDL), that allows services to be described in a tree based human and software understandable form. Service advertising and discovery can be done at any level of the tree, thus enables service matching at different stages of abstraction, from generic to very specific at the leaf of the tree. The service advertisements contain name and URL of the service, as well as time-to-live (TTL) information to help self-healing of the systems. The client peers can cache this service information to use it later so that they do not have to locate the services again. If no service information is cached for a desired service, a distributed pull method is used to retrieve the service location.

Secure **Service Discovery** Protocol is a dynamic **service discovery** infrastructure for small or medium size MANETs (Yuan & Arbaugh, 2003). The protocol allows finding, locating and evaluating services in vicinity required by client and fit for high dynamic environment without directory **agent** or central registry.

## Context Based Multihop Networks

**Context**-aware **service discovery** has been addressed lately by several research initiatives that have proposed following enhanced discovery mechanisms. The work of (Robinson, 2005) describes a novel **context**-sensitive approach to **service discovery**, whereby queries and advertisements can be issued in a **context**-sensitive manner by using techniques such as query completion, query relaxation, preferences and query persistence.

Geography-based Content Location Protocol (GCLP) is a protocol for efficient content location in location-aware ad hoc networks (Tchakarov & Vaidya, 2004). The Protocol makes use of location information to lower proactive traffic, minimizing query cost and achieve scalability. GCLP assumes that all devices in the network know their own location. It makes use of this information to periodically advertise content to nodes along several geographical directions. Nodes that attempt to locate content need only contact one of these nodes to become aware of the presence of the desired content. A node can advertise its services by sending periodically update messages that follow a predefined trajectory through the network. This significantly decreases the amount of proactive traffic as it is limited to nodes along the trajectories. Nodes along these trajectories cache the information received from the update messages. A client that wants to locate a service on the network sends out a query message that similarly propagates along predefined trajectories.

Alliance-based **Service Discovery** for mobile ad-hoc networks (MANET) is a peer-to-peer caching based and policy driven **service discovery** frame-work to facilitate **service discovery** in MANET (Ratsimor et al., 2002). The approach adopts structured compound formation of **agent** (a software **agent** is an autonomous program which is embedded with proactive decision making, adaptation, and intelligence) communities to the mobile environment and achieves high degree of flexibility in adapting itself to the changes of the ad-hoc environment. An alliance helps in **service discovery** and the alliance formation does not have the overhead of explicit leader election.

**Context** based **service discovery** as described in (Nandini & Sunilkumar, 2009) is a distributed system that provides the user with the ability to obtain services and information according to the **context** (location, time, situation, users, etc.). **Context** plays the role of a filtering mechanism, allowing only transmission of relevant data and services back to the device, thus saving bandwidth and reducing processing costs. The approach adopted here is the combination of **context**-aware computing and **agent** oriented computing, in order to provide better user tailored services in pervasive environments. **Agent**s have the advantage of being able to assist users, to discover and compose services. This helps with fast and autonomous adaptation to **context** changes.

The Cooltown project (Broens, 2004), focuses on expanding the view of physical entities to a virtual world of web content, in which people, places and things are web-present. The bottom layer of the architecture consists of mechanisms for obtaining points of interest (i.e. people, places, things) via discovery mechanisms. Discovery can take place by sensing the location of the points of interest (i.e. URL or ID from which a URL can be derived) via beacons. Cooltown's **service discovery** is location aware.

The discovery mechanism used in the **Context** Toolkit is centralized and facilitates development and deployment of **context**-aware applications. It uses only a single discoverer (i.e. central registry). When started, all components register with the discoverer at a known network address and port. The discoverer "pings" each registered component at a pre-specified frequency to ensure that each component is functioning correctly. Applications can discover services by using yellow and white page lookup mechanisms (Dey, 2001).

CB-Sec is an architecture developed to allow **service discovery** and its composition to derive the benefits from available **context** (Most´efaoui et al., 2003). It is based on mobile devices that not only consume web services, but also publish their data through web services. **Service discovery** is done by the **Context**-Based **Service Discovery** module (CSD). The request of the client is decomposed into basic services using UCMs (ubiquitous coordination model) social laws. Then the broker **agent** (i.e. another part of the CSD) retrieves **context** information from the **context** database. This information is used to discover the requested basic services closer to the user location.

## Semantic Based Service Discovery

The syntactic discovery mechanisms (keyword-based) do not consider the **semantic**s of the requester's goals and service. They retrieve objects with descriptions that contain particular keywords from the user's request. In most of the cases, this leads to low recall and precision. In **semantic** based approach classification of the objects are based on their properties. This enables retrieval based on object types rather than keywords. Furthermore, they can specify the interrelations among **context** entities and ensure common, unambiguous representation of these entities.

## Non Context Based Multihop Networks

The work in (Chakraborty et al., 2002) explains a group-based distributed **service discovery** protocol for mobile ad hoc networks. It is based on the concept of peer-to-peer caching of service advertisements and group-based intelligent forwarding of service requests to reduce the broadcast storm problem. It does not require a service to register to a lookup server. For service description the **semantic** capabilities offered by the DARPA **Agent** Markup Language (DAML) are used to effectively describe services and resources present in the network. The services present on the nodes are classified into hierarchical groups. Each node advertises its services to its neighbors within a defined number of hops. An advertisement also includes a list of the several service groups that the sender node has seen in its vicinity. This group information is used to intelligently select and forward a service request to other nodes in the network where there are chances of service availability. Thus, the **semantic** features present in DAML are used to reduce network flooding.

The project work DReggie as discussed in (Chakraborty et al., 2001) is an attempt to enhance the matching mechanisms in Jini and other **service discovery** systems. The key idea in DReggie is to enable these **service discovery** systems to perform matching based on **semantic** information associated with the services. In the DReggie system, a **service discovery** request contains the description of an "ideal" service - one whose capabilities match exactly with the requirements. Thus, matching involves comparison of requirements specified with the capabilities of existing services. Depending on the requirements, a match may occur even if one or more capabilities do not match exactly. Service descriptions in the DReggie system are marked up in DAML. The **semantic** matching process that uses these descriptions is performed by a reasoning engine.

**Service discovery** mechanism as described by (Gu et al., 2005) announces the presence of services by which mobile users can locate these services whenever required. **Service discovery** in dynamic mobile environments poses many challenges such as service providers may create and delete services or servers anytime; mobile services may be deployed in various forms, etc. In this paper, a design is proposed for a Service Locating Service (SLS), which addresses some of these issues to provide a flexible **service discovery** mechanism for **mobile E-commerce** applications. The architecture adopts a dynamic tree structure for organizing SLS servers to meet the dynamic requirements of services and servers; introduces service aggregation for fast locating; and also proposes multiple service matching mechanisms, which contain an attribute matching engine and a **semantic** matching engine for different service interfaces.

The protocol presented in (Zhang et al., 2007) is based on the concepts of peer-to-peer caching of service advertisements and group-based intelligent forwarding of service requests. It does not require a service to be registered with a registry or lookup server. Services are described using the Web Ontology Language (OWL) that enables increased flexibility in service matching.

OWL-S recognizes that not only content but also services are offered by Web resources. Users should be able to discover, invoke, compose and monitor these services. OWL-S develops an ontology for services that makes this functionality possible. One of the big tasks OWL-S tries to enable is automatic **service discovery**. This involves the automatic location of web services that provide a particular service that adheres to requested constraints.

The Web Architecture for Services Platform (WASP) project creates a supporting platform for mobile **context**-aware applications (Ebben, 2002). It indicates why the platform provides a good opportunity to apply a **context**-aware, ontology based, **semantic service discovery** mechanism. One of the characteristics of the WASP platform is that it should intelligently search (i.e. **service discovery**) for relevant services from a broad and dynamic range of services.

Chakraborty et al. (2002) have come out with Bluetooth **semantic Service Discovery** Protocol (SDP) that enables a client application on a device to discover information about services on other Bluetooth devices. Every service is represented by a profile that is identified by a 128-bit Universally Unique Identifier (UUID). Attributes associated with a particular service are also identified by UUIDs. **Service discovery** requests, sent by the client, must contain one or more UUIDs. A match occurs on a peer device if and only if at least one UUID specified by the client is contained in one or more service records. UUID-based matching ensures that the protocol is lightweight, both in terms of discovery time and memory, and makes it well suited to resource constrained devices.

## Context Based Multihop Networks

The **context** based **service discovery** protocol (CBSDP) (Khedr, 2002) is a **service discovery** protocol developed to overcome the issues with **service discovery** in highly dynamic ad hoc communications. It tries to solve the problems with current **service discovery** mechanism that are not capable of enabling services in a spontaneous networking environment It provides mechanisms that supply initial service configuration and it enables service composition. CBSDP provides users with the possibility to obtain services and information according to its **context**. The services are automatically detected by sensors. CBSDP uses a common ontology for the different services that behave as a basic communication between the **agent**s existing in the environment. The ontology is used to interpret the data of the service into meaningful information for the lookup service that is invoked when a user requests a service.

A **context** aware, ontology based **semantic service discovery** as proposed by Chakraborty et al. (2001) focuses on the advantages of using **context** awareness with **semantic service discovery** resulting in an intelligent web **service discovery** mechanism.

## CONCLUSION

There is a requirement for efficient web service discovery mechanisms in near future, as there would be an exponential increase in the number of web services especially with regards to mobile E-commerce. Due to this explosion, manual discovery of mobile E-commerce services becomes impossible and one needs to adapt to automation of discovery process. This automation has to be efficient with respect to search time and accuracy. The discovery mechanism should operate as an human brain, for which cognitive agent based belief desire intention (BDI) architecture is to be adapted. Better search results can be obtained by using semantic matching rather than syntax matching. As mobile E-commerce clients use hand held devices which have computing, memory and battery limitations, the discovery mechanisms should use intelligent agent technologies which will overcome the aforesaid limitations to a certain extent.

## REFERENCES

Al-Masri, E., & Mahmoud, Q. H. (2007). Investigating Web Services on the World Wide Web. In *Proceedings of the 16th International Conference on World Wide Web,* (pp. 1257-1258). New York: ACM.

Broens, T. (2004). *Context-aware, Ontology based, Semantic Service Discovery*. Thesis for a Master of Science degree in Telematics from the University of Twente, Enschede, the Netherlands.

Chakraborty, D., Joshi, A., Finin, T., & Yesha, Y. (2002). GSD: A novel group-based service discovery protocol for MANETS. In *proceedings of 4th IEEE Conference on Mobile and Wireless Communications Networks*, (pp. 140-144).

Chakraborty, D., Perich, F., Avancha, S., & Joshi, A. (2001). DReggie: Semantic Service Discovery for M-Commerce Applications. In *Proceedings of Workshop on Reliable and Secure Applications in Mobile Environment, 20th Symposium on Reliable Distributed Systems*. Retrieved December 2001 from http://ebiquity.umbc.edu/get/a/publication/9.pdf

Dey, A. K. (2000). *Providing Architectural Support for Context-Aware applications*. Unpublished doctoral thesis, College of Computing, Georgia Institute of Technology.

Ebben, P. (2002). Blueprint and design of the WASP application platform. *Web Architecture for services platform /D2.2*. Retrieved December 2002 from https://doc.novay.nl/dsweb/Get/Document-55283/Context-aware,%20Ontology%20 based,%20Semantic%20Service%20Discovery

Evans, E., & Sarkar, N. (2004). Mobile Commerce Implementation in the Hospital Environment: Issues, Challenges and Future Trends. *Bulletin of Applied Computing and Information Technology*, *2*(1).

Gu, T., Pung, H. K., & Yao, J. K. (2005). Towards a flexible service discovery. *Journal of Network and Computer Applications*, *28*(3), 233–248. doi:10.1016/j.jnca.2004.06.001

Hawick, K., & James, H. (2002). Middleware Issues for Mobile Business and Commerce. In *proceedings of world scientific and engineering academy and society International Conference on E-Activities,* (pp- 44-48).

Helal, Desai, Verma, Lee, & Konark. (2003). A service discovery and delivery protocol for ad-hoc networks. In *Proceedings of the Third IEEE Conference on Wireless Communication Networks*. (Vol. 3 pp. 2107-2113)

Kalevi, K. (2001). Mobile electronic commerce challenges for global cooperation. In *the proceedings of 9th European Conference on Information Systems*. Retrieved October 2001 from http://is2.lse.ac.uk/asp/aspecis/20010060.pdf

Khedr, M. (2002). Agent-Based Context-Aware Ad Hoc Communication. *Lecture notes in computer science*, (pp. 105-118). Retrieved from http://www.springerlink.com/index/90548ATLK0P248RQ.pdf

Klein, M., Konig-Ries, B., & Obreiter. P. Lanes a lightweight overlay for service discovery in mobile ad hoc networks. In *Proceedings of 3rd Workshop Applications and Services in Wireless Networks* (ASWN 03). Retrieved July, 2003, from http://hnsp.inf-bb.uni-jena.de/DIANE/docsASWN2003.pdf

Kozat and Tassiulas. (2003). Network layer support for service discovery in mobile ad hoc networks. In *proceedings IEEE INFOCOM, USA,* (pp. 1965-1975). Washington, DC: IEEE Press.

Lei, H. (2002). Mobile Commerce: Vision and Challenges. In *Symposium on Applications and the Internet,* (pp.36)

Manvi, S. & Venkatraman. (2003). Agent Based Electronic Trading. *Institution of Electronics and Communication Engineers Technical review, 20*(4), 349-359.

Marin-Perianu, R., Hartel, P., & Scholten, H. (2005). *A Classification of Service Discovery Protocols.* technical report series 05-25, Centre for Telematics and Information Technology. Retrieved from http://de.scientificcommons.org/raluca_marin-perianu

Most'efaoui, S. K., Tafat-Bouzid, A., & Hirsbrunner, B. B. (2003).Using Context Information for Service Discovery and Composition. In *the Proceedings of the fifth conference on information integration and web-based applications and services*, (pp 129-138).

Nandini, S., & Sunilkumar, M. (2009). *Auction Service Discovery Model - An Agent Based Approach.* Paper presented at Fifth international workshop on Mobile Commerce and services (WMCS), Qingdao, China, (pp. 399-406). Washington, DC: IEEE computer society press.

Nidd, M. (2001). Service Discovery in DEAPspace. *IEEE Personal Communications, 8*(44), 39-45. Retrieved from http://www.springerlink.com/index/NRM5C9M93DV43Q5X.pdf

Outay, F., Vèque, V., & Bouallègue, R. (2007). Survey of Service Discovery Protocols and Benefits of Combining Service and Route Discovery . *International Journal of Computer Science and Network Security*, *7*(11), 85–92.

Peter, T., Robert, N., & Merrill, W. (2002). Issues in Mobile e-commerce. *Communications of the Association for Information Systems*, *8*, 41–64.

Ratsimor, O., Chakraborty, D., & Joshi, A. Finin, T. (2002). Allia: alliance-based service discovery for ad-hoc environments. In *Proceedings of the 2nd international workshop on Mobile commerce*, (pp. 1-9). New York: ACM press

Robinson, R., & Indulska, J. (2005). A context-sensitive service discovery protocol for mobile computing environments. In *proceedings of International Conference on Mobile Business*, (pp. 565 – 572). Washington, DC: IEEE Press.

Sadeh, N. (Ed.). (2002). *m-Commerce Technologies, Services and Business Models*. New York: Wiley.

Samaras, G. (2002). Mobile Commerce: Vision and Challenges (Location and its Management*)*. In *Symposium on applications and the Internet,* (pp. 43-45). Washington, DC: IEEE Computer Society, Goland, V.Y., Cai, T., Leach, P., & Gu, Y. (1999). Simple service discovery protocol /1.0. *IETF Internet-Draft*. Retrieved from http://www.ietf.org/internet-drafts/draft-cai-ssdp-v1- 03.txt

Tchakarov, J. B., & Vaidya, N. H. (2004). Efficient content location in wireless ad hoc networks. In *proceedings of IEEE International Conference on Mobile Data Management*, (pp. 74).

Varshney, U. (2003). Issues, requirements and support for location-intensive mobile commerce applications. *International Journal of Mobile Communications, 1*(3), 247-263. Retrieved from http://www.csee.umbc.edu/courses/graduate/666/mobile_commerce.pdf

Yuan, Y., & Arbaugh, W. (2003). A Secure Service Discovery Protocol for MANETs. In *proceedings of IEEE symposium on Personal, indoor and mobile radio communications,* (pp. 502-506). Retrieved from http://www.imec.be/pacwoman/Deliverables/WP5/WP5-CPK-D5.2-High_Level_Specification-09-12-2003-V1.0.doc

Zhang, B., Shi, Y., & Xiao, X. *(2007). A Peer-to-Peer Semantic-Based Service Discovery Method for Pervasive Computing Environment. In* Proceedings of 4th International Conference on Ubiquitous Intelligence and Computing, *(Vol. 4611, pp. 195-204). Berlin: Springer.*

## KEY TERMS AND DEFINITIONS

**Cognitive Agents:** Cognitive agents are kind of agents that use Belief-Desire-Intention (BDI) based architecture, which are recently becoming popular due to their human kind of reasoning. Cognitive agents are normally static agents that require higher computation and more databases. These support autonomic computing.

**Context Awareness:** information that can be used to characterize the situation of an entity where an entity is a person, place, or object that is considered relevant to interaction between a user and an application including the user and application themselves. **Context-awareness** is defined as: a property of a system that uses **context** to provide relevant information and/or service to the user, where relevancy depends on the user's task.

**Mobile E-Commerce:** M-Commerce is defined as any type of transaction of an economic value having at least at one end, a mobile terminal and thus using the mobile telecommunications network.

**Multicast:** is a type of communication where one server/client sends message to many clients.

**Ontology:** Ontology is a formal and explicit specification of a shared conceptualization that can be used for sharing and reasoning on knowledge

**Service Discovery:** The process of obtaining a set of services which can possibly fulfill a user request is called **service discovery**.

**Software Agents:** Software **agent** is an autonomous software entity that can interact with its environment. They are implemented using software. **Agent**s are autonomous and can react with other entities, including humans, machines, and other software **agent**s in various environment and across various platforms.

**Web Service:** A Service is a software entity provided by a Service Provider. It performs an action (based on inputs) on behalf of a Service Requestor and provides a result (output).

# Chapter 82

# Perspectives on the Viable Mobile Virtual Community for Telemedicine

**Jan-Willem van 't Klooster**
*University of Twente, The Netherlands*

**Pravin Pawar**
*University of Twente, The Netherlands*

**Bert-Jan van Beijnum**
*University of Twente, The Netherlands*

**Chariz Dulawan**
*University of Twente, The Netherlands*

**Hermie Hermens**
*University of Twente, The Netherlands*

## INTRODUCTION

A *virtual community* is an electronically supported social network: it can be seen as a group of people who have regular social interaction, independent of time and space, because of a common interest such as a problem, task, or feeling exchange (Eysenbach, Powell, Englesakis, Rizo, & Stern, 2004; Rheingold, 1993). When independence of time and space is achieved through the use of mobile devices and wireless communication technologies, such a virtual community is called a *Mobile Virtual Community* (MVC). Existing research interests in the MVC domain are grouped into *technology-centered interest*, *user-centered interest* and *business-centered interest* (El Morr & Kawash, 2007). The technology-centered aspects include issues such as platform design, development framework, mobile network bandwidth limits and intelligent agents. The user-centered issues include user interface, behavior, personalization, privacy, data security and trust. Business-centered aspects include marketing, investment and business models.

In another paradigm known as *telemedicine*, information and communication technologies are being investigated and employed in applications such as health discussion & maintenance, alleviation, cure and prevention of diseases. In recent telemedicine scenarios, sensors attached to the patient's body collect patient's vital signs, transmit them to a mobile gateway device being carried by the patient, which in turn uses wireless communication

DOI: 10.4018/978-1-61520-611-7.ch082

technologies to transmit the data to a healthcare center, for purposes like vital signs analysis and offering emergency assistance to the patient if needed. The sensors and the gateway mobile device together form a so called *Body Area Network* (BAN). Konstantas, van Halteren, & Bults (2004) describe such a BAN for telemedicine purposes. Other supporting actors involved in such a scenario are the technicians, healthcare specialists, doctors and (informal) caregivers.

According to the definition, the telemedicine scenario may be viewed as a virtual community if the patient and other actors could communicate with each other for the purpose of providing medical assistance and counseling to the patient. In situations where patient and caregiver mobility exists, this virtual community, may be said to correspond to a MVC. Such a MVC is an aggregated kind of community as defined in Demiris 2006, where communities of healthcare professionals only, patients/informal caregivers only, combinations of them, and general public communities are defined. The technical system that supports the realization of MVC is referred to as MVC platform (Van Beijnum, Pawar, Dulawan, & Hermens, 2009).

Considering the architecture of the MVC platform, it can be argued that the MVC potentially revolves around a set of services based on the principles of Service Oriented Architecture (SOA) (Papazoglou, 2003; Pawar, Subercaze, Maret, Van Beijnum, & Konstantas, 2008).

Based on the findings of Broens et al., (2007) and Maloney-Krichmar and Preece, (2005) we argue that to be a viable MVC, it should have a tailored focus and robust technical platform: it should be of clear interest to the users and the technology incorporated should be reliable. This chapter contributes to this area in general and mobile patient monitoring and treatment in particular, by 1) analyzing in detail the robustness and other requirements to be fulfilled by the technical platform for MVCs, 2) providing guidelines for MVC platform development based on service orientation, and 3) discussing the actors, front-end views and service components involved.

The reminder of this chapter is organized as follows. The second section of the chapter illustrates a possible telemedicine scenario focused on patient monitoring and treatment which help to elicit the specific requirements to be supported by the MVC platform. Based on the requirements and services elicited in that section, the third section of this chapter presents a possible graphical user interface (GUI) for the platform depicting the requirements to be fulfilled from an end-user perspective. The fourth section discusses the internal design of the possible MVC platform and conclusions are presented in the last section.

## SCENARIO BASED REQUIREMENTS ELICITATION

Scenario analysis is the process of understanding, analyzing, and describing system behavior in terms of particular ways the system is expected to be used (Hsia et al., 1994). Drawing use cases from the scenarios and relating requirements to the use cases is a popular approach in the system design process (Whittle & Krüger, 2004). We use a similar approach here to elicit the requirements for the MVC platform based on a scenario.

### Scenario Description

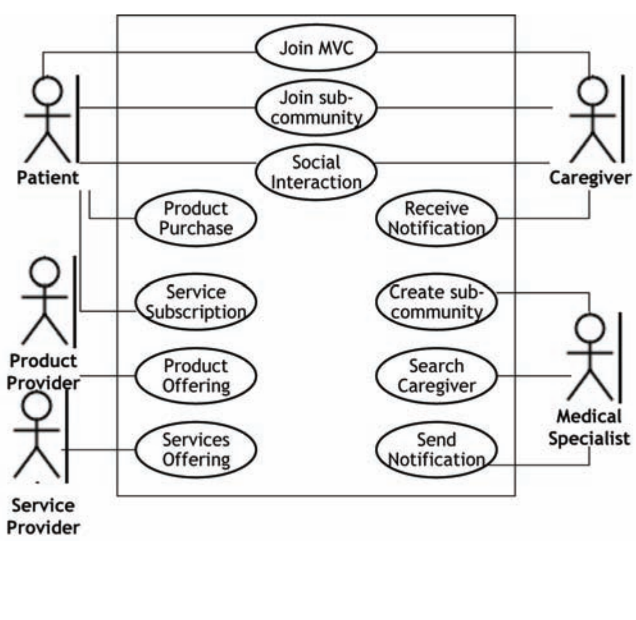
Herewith we present a visionary scenario showing the intended use of the MVC platform. On the MVC platform, a number of different sub-communities could function independent of each other. Member can join these sub-communities as well as the aggregate MVC. One of the sub-communities is used by the persons Bob and Alice in the following scenario.

*Bob (patient) and Alice (caregiver) join a MVC. The local healthcare center creates a sub-community called as telemedicine community. The MVC* *community management service recommends Bob, Alice and other members to join the telemedicine community. Bob and Alice join the community by updating their profile with information specific to the telemedicine community (e.g. problems Bob is suffering from). The MVC matchmaking service recommends the members to be a part of each other's social network based on their telemedicine community centric profile (e.g. interest in the same health condition). Bob, Alice and other members of the telemedicine community, including patients and (informal) caregivers, socialize with each other for sharing their experiences after joining the same sub-community. Meanwhile, the health-care center announces offering of a mobile patient monitoring service for the patients suffering from epilepsy. To facilitate mobile patient monitoring, a number of BAN manufacturers recommended by health-care center offer their BAN to the patients. Using the MVC context-aware matchmaking service, the MVC platform recommends Bob a particular BAN which is compatible with his smartphone. Bob purchases the recommended BAN and subscribes to the mobile patient monitoring service via the community platform. On the day Bob suddenly suffers from an epileptic seizure; the medical specialist at the healthcare center requests the MVC platform to search for the nearest caregiver. On this request, the MVC context-aware matchmaking service searches for the nearest caregiver service based on Bob's and caregivers' current locations. Fortunately, Alice is the nearest informal caregiver to Bob. The medical specialist instructs the MVC platform to notify Alice about Bob's critical condition. Alice receives the notification and reaches to Bob's location for providing assistance.*

## Use Cases

Based on the given scenario, the following use cases can be derived. These use cases not only show possible uses of the MVC platform, but also identify who are involved and what are the tasks in fulfilling the use case. As elicited from the scenario, Figure 1 identifies the uses cases and the involved actor role(s), being patient, caregiver, medical specialist, product provider or service provider. For further illustration, a particular use case in which a sub-community is created is described in detail in Table 1. In this use case, it is shown that parameters of the new sub-

*Figure 1. Use cases derived from the scenario and corresponding roles*



community can be set, including policy rules for the members and whether or not anybody can join the sub-community (public) or only on invitation (private) depending on e.g. the topic and privacy sensitivity of the sub-community.

## Requirements Elicitation

In this section, the use cases derived in the above section are mapped to the high-level requirements to be fulfilled by the MVC platform. An overview of these requirements is provided in Table 2. As seen in this table, the platform should be able to perform various actions and provide various services. Afterwards, this section lists the services and policies necessary to meet these high level requirements.

## Services and Policies

As described in the Introduction, the architecture and software design of the MVC can be made using SOA principles. A *service* refers to a unit of work which can be done by a service provider to achieve desired end results for a service consumer (Subercaze et al., 2009). In traditional virtual communities, services would refer to web-based (interaction) services. However, the impact of mobile technologies makes available a number of mobile services, which are both produced and consumed using mobile devices. Based on the requirements listed above, we identify two groups of services: *mobile device services* and *MVC platform services*. Mobile device services run on the mobile device and platform services are those provided by the MVC platform.

*Policies* refer to the rules or constraints imposed on either the actor roles in the MVC or in the interaction with the services. In terms of the actor roles, there are specific guidelines about what an actor can do and can not do. For example, the product provider cannot search for caregivers. Thus, for the interactions between a role and a service, rules could be related to *permission constraints* and *prohibition constraints*. Permission constraints refer to the prescription that a certain interaction is allowed to occur. A prohibition constraint is the opposite as it describes an interaction that must not occur at all. Specifying policies is also based on the analysis of scenarios, because policies depend on the purpose and use of the MVC as well as on the roles and services that are present in the MVC.

The following listing provides required services in the MVC platform architecture:

- *Member Management Service:* This service includes the invited registration of

*Table 1. Description of the use case create sub-community*

| Use Case Name | Create sub-community |
|---|---|
| Precondition | Medical specialist creating the sub-community is known to the MVC platform |
| Success End-condition | Medical specialist creates the sub-community with specific criteria |
| Failed End-condition | Medical specialist is not able to create the sub-community |
| Actor role | Medical specialist |
| Description | 1. The medical specialist logs in to the MVC platform using his/her username and password<br>2. The medical specialist makes use of a module in the MVC platform that allows him/her to create a sub-community.<br>3. The medical specialist identifies and/or selects appropriate conditions for the sub-community to be created. Such conditions include which roles and services should be present; what policies govern the interactions between roles; and whether the sub-community is private/public.<br>4. The medical specialist saves information and creates the sub-community |

the new members, editing and managing member profiles, the member type (e.g. patient, caregiver), logging in, session handling etc.

- *Directory and announcement Service:* This service provides functionality for the community support providers to post news, list the offered services, and listing of events such as those leading to improvement in the psychological and physical health of the patients.
- *Purchase Service:* this service allows the registration and acquisition of health-related products and services offered in the MVC. This process needs to be moderated by the healthcare center to assure relevance for the members and to avoid that the MVC becomes a brand-oriented advertising channel, therefore a *content moderation service* is required as well.
- *Content moderation service:* Certain types of contents, which negatively affect the psychological and physical health of the patients, are discouraged. Hence, contents such as profile information, pictures posted by the members, product and services description are subject to publishing in the MVC after manual moderation. Automatic moderation techniques could be applied, for interactions such as instant chat. These features will be taken care of by the content moderation service.
- *Alarm Service:* This service enables the alarms, based on a predefined level of urgency. In case of an emergency, this service can be used to notify for example a caregiver.
- *Community Management Service:* This service consists of all the functionalities required to create, join, access and search sub-communities, (such as those of patients with a particular type of condition), publish, get and subscribe to information in the existing sub-communities.
- *Policy making and enforcement service:* To enforce the interactions between an actor

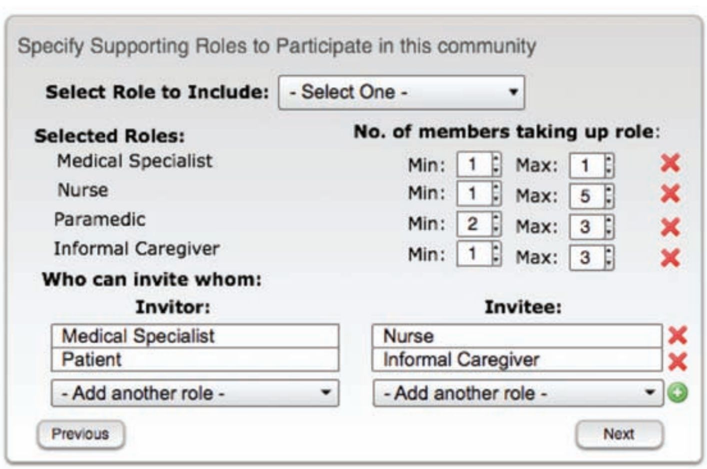
*Table 2. MVC platform requirements and use case mapping*

| **High Level Requirement** | **Use Case(s)** |
|---|---|
| The platform should allow creation of a sub-community. | Create sub-community |
| The platform should allow management of a sub-community such that the preferences and constraints can be made regarding members, roles, and services. | Create sub-community |
| The platform should provide asynchronous and synchronous communications services such as email and instant messaging for inviting existing community members to join sub-community. | Create sub-community |
| The platform should allow creation and management of profiles. | Join MVC, Join sub-community |
| The platform should provide synchronous and asynchronous communication service such for inviting non-community members to join the main community and transmission of information. | Send notification,<br>receive notification,<br>Social interaction |
| The platform should allow product offering and product purchase. | Product offering,<br>product purchase |
| The platform should allow service offering and service subscription | Service offering,<br>service subscription |
| The platform should be able to identify who should be alarmed in case of an emergency. | Search caregiver |
| The platform should have information about the locations of the patient and caregiver | Search caregiver |
| The platform should be able to support multiple devices (e.g. smartphones) associated with multiple services. | Social interaction,<br>social offering |

role and a service, as well as to take into account the trust and privacy requirements in the MVC community, a set of policies need to be developed and enforced. The policy making and enforcement service takes care of the matters such as creation of a new policy and enforcing these policies during the MVC interactions.

- *Social Interaction Service:* This service handles the *one-to-one*, *one-to-many* and *many-to-many* interactions between the MVC members. This includes interaction functions such as instant messaging, group notifications, and subscription to the particular type of content (e.g. information posted by the medical specialist).
- *Context-Aware Matchmaking Service:* Semantic descriptions of the member profiles combined with description logic are powerful tools to perform matchmaking. The context-aware matchmaking functionality of this service could be used for example to recommend new members in the sub-community, or to search for the nearest available caregiver.
- *Content Exchange Service on the Mobile Device:* This service on the patient's mobile device is aimed at sending the contents (e.g. text, images, and streams) generated at the mobile device to the community platform such that this content could be published in the community. Similarly, this service could also request/subscribe to the community content the user is interested in and present this content for user viewing.
- *Vital Sign Monitoring Service:* This service enables the monitoring of vital signs, such as blood pressure and oxygen saturation information.
- *Context Information Service on the Mobile Device:* This service obtains context information (such as location) of the patient and sends this information and subsequent context changes in real-time to the community platform. This information could subsequently be used by the context-aware matchmaking service.
- *Community Service:* This service indexes and allows modifications on what services are available to which sub-community.
- *Chat service:* As a sub-part of social interaction service, this service allows for instant voice, video or message chat amongst members of the MVC.

*Figure 2. Specification of roles in a sub-community*



## FRONT-END DESIGN OF THE MVC PLATFORM

To illustrate how the MVC platform supports the scenario presented in the above section, a design of how to specify some of the preferences is provided in this section. In Figure 2, the creator of a sub-community is asked to establish a set of policy rules related to the roles in the sub-community. As shown, different roles and cardinalities are entered, and rules for invitations to the sub-community apply.

Next to specifying roles, services available for the sub-community should be selected. *Alarm service, Chat Service, Location Service, Viewing Service, and Vital Sign Monitoring Service* are examples of services for the sub-community as applicable in the scenario. These are shown in Figure 3.

In a chat service or other similar social interaction services, policies exist such as who initiates contact to whom. These policies are related to the purpose of the chat session. Figure 4 shows how this can be specified.

Regarding the location service, not all actors are allowed to view the location of other actors. For instance, a service provider does not need to know the location of a medical specialist, but a medical specialist should be able to know the patient's location in an alarm situation. These policies define who is the provider of the location information as well as who are the authorized consumers of this information. Figure 5 shows how this concept can be specified.

## INTERNAL DESIGN OF THE MVC PLATFORM

To support the desired functionalities of the platform described so far, a sound internal design is necessary. This section presents details on the possible internal design of the MVC platform. An overview of the high-level architecture of the MVC platform is presented in Figure 6. To ensure separation of concerns in the platform, three layers are identified:

- *Platform Services Layer:* The platform services layer is responsible for providing the MVC platform services, for example those described in the requirements elicitation section.
- *Mobile Services Layer:* The mobile services layer is responsible for making available the MVC platform services to the mobile

*Figure 3. Specification of services in a sub-community*

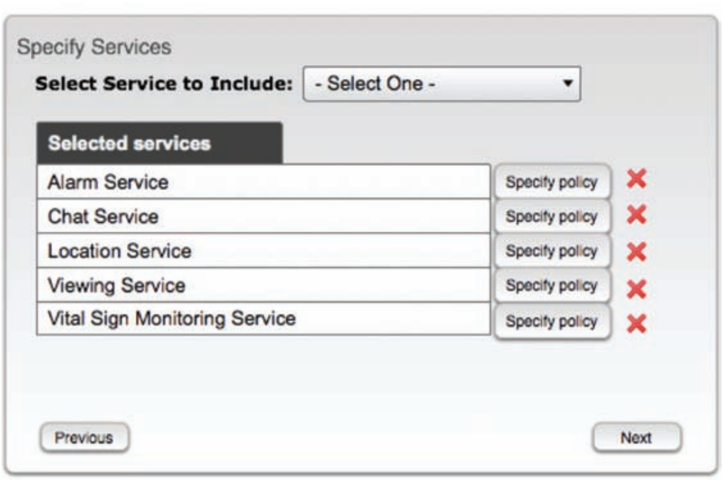


*Figure 4. Specifying policies for a chat service*

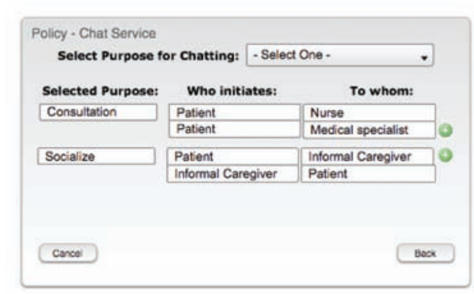



*Figure 5. Specifying policies for a location service*


device and for providing services such as content exchange and context information service from the mobile device to the MVC.

- *Integration Layer:* Because of the use of different nature and technologies at the platform services layer and mobile services layer as well as to take into account the effects of the mobility, an integration layer is envisioned to support the mobile and platform services cooperation.

Internally, the detailed software architecture of the MVC platform could be represented using the Unified Modeling Language (UML). A UML class diagram is a type of diagram that describes the internal structure of a system by showing the system's classes, their attributes, and the relationships between the classes. One of the UML class diagrams for creating a sub-community is presented in Figure 7, with a description of the classes and their relationships in Table 3. A design decision is made to show that parties (actors) have no direct access on the services. The services are linked to the sub-communities since the motivation for using these services should be to support the purpose of the existence of the sub-community was. In the same manner, not all roles have access to the sub-community services. Only authorized roles and parties as set in the policy for using the services are allowed to utilize the service.

## CONCLUSION

Mobile virtual communities (MVC) are being explored in the telemedicine domain for the purpose of social interactions and monitoring to support tasks such as health discussion & maintenance, alleviation, cure and prevention of diseases. In this chapter, we present perspectives on the MVC for telemedicine.

*Figure 6. Overview of the layers in the mobile virtual community platform*

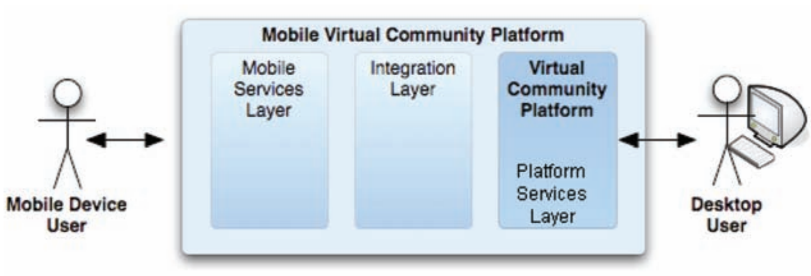
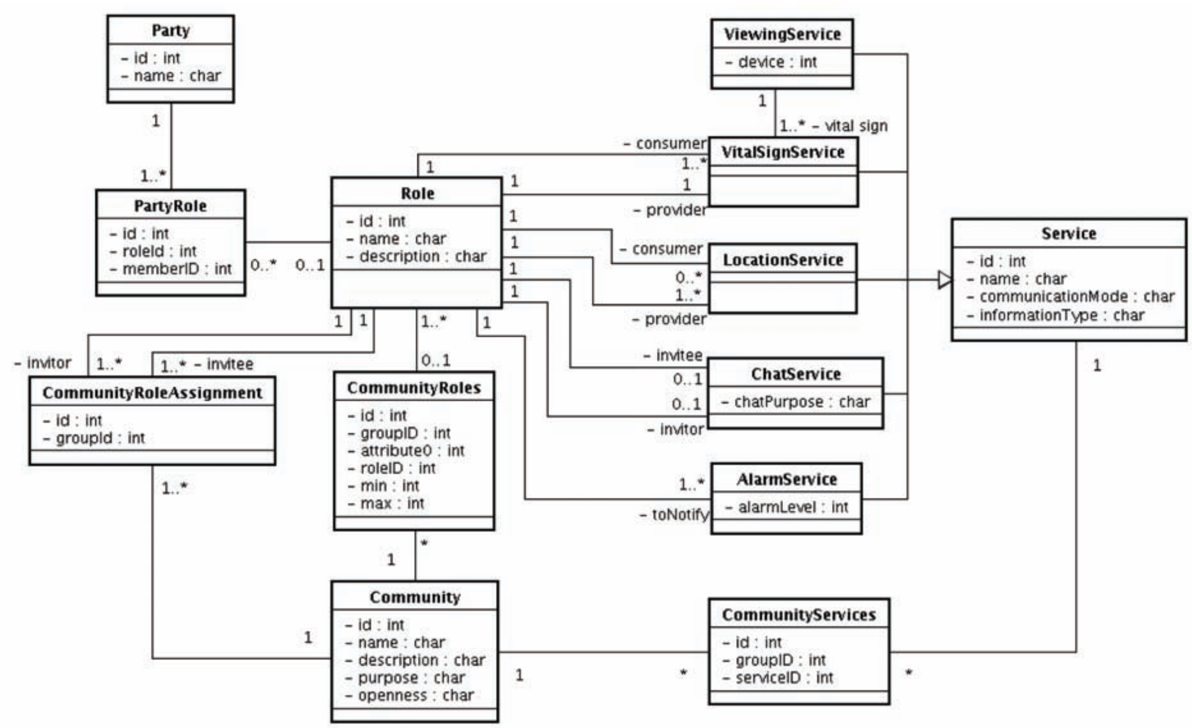



*Figure 7. UML class diagram representing MVC internal structure for the creation of a sub-community*




By means of presenting a possible scenario and scenario based requirements elicitation, we identify requirements and services for such a MVC. The chapter shows how the architecture and software design of the MVC revolves around service oriented principles. Illustrative policy-related interface components are discussed. It is necessary to be able to define rules for the platform users, due to the nature of the actors involved (e.g. healthcare professionals, patients and product providers).

To incorporate mobile services in the platform, a layered high-level architecture is presented that enables a clear separation of concerns between mobile and platform services. Finally, the chapter presents an internal design and an elaboration on the internals of such a platform.

In sum, the chapter provides perspectives on

*Table 3. Description of the UML classes shown in Figure 7*

| Class Name | Description |
|---|---|
| Party | The party class refers to the parties (actors) of the MVC platform. |
| PartyRole | This model element shows the association type between a party and a role. The relationship shows that a party can take up multiple roles and that this is a requirement before a party takes up a role defined in a certain sub-community. |
| Role | The list of roles and its description are represented in this class. |
| CommunityRoles | This model element identifies the distinct roles that can only participate in the sub-community. These roles can be filled up by party roles. |
| Community | This model element refers to the sub-communities that are created in the MVC platform and which uses the services of the MVC platform. A sub-community may use multiple services in order to fulfill its goals. This class knows the name, description and purpose of the sub-community as well as the attribute related to the degree of openness of the sub-community. |
| CommunityRoleAssignment | The class contains the policy on role assignments in the sub-community CommunityServices. This model element refers to the services that are to support the goal of the sub-community. |
| Service | This class refers to the related Telemedicine services that can be utilized by certain sub-communities and is a generalization of various concrete services. |
| CommunityService | This class refers to the related community service that maintains the mapping of Service elements to Community elements. |
| AlarmService | This class contains the policy on whom to notify depending on the alarm level. |
| ChatService | This class contains the purpose of the chat as well as the policy on who initiates the chat and to whom it was initiated. |
| LocationService | This class contains the policy on who provides location information and who can consume the provided information. |
| VitalSignService | This class identifies the vital sign that will be collected from the provider as well as the policy on who consumes the vital sign information. |
| ViewingService | This class contains the device that will be used for viewing the vital sign information. This service is used in conjunction with the VitalSignService, wherein the consumer role makes use of the device preference defined in this ViewingService in order to view the vital sign. |

how the viable MVC for telemedicine can be developed, based on extensive scenario analysis and using service oriented design principles.

## ACKNOWLEDGMENT

This work is part of the IOP GenCom U-Care project (http://ucare.ewi.utwente.nl), sponsored by the Dutch Ministry of Economic Affairs under contract IGC0816, and the Freeband AWARENESS project (http://awareness.freeband.nl), sponsored by the Dutch government under contract BSIK 03025.

## REFERENCES

Broens, T., Huis in 't Veld, R., Vollenbroek-Hutten, M., Hermens, H., van Halteren, A., & Nieuwenhuis, B. (2007). Determinants for successful telemedicine implementations – a literature study. *Journal of Telemedicine and Telecare*, *13*(6), 303–309. doi:10.1258/135763307781644951

Demiris, G. (2006). The diffusion of virtual communities in health care: concepts and challenges. *Patient Education and Counseling*, *62*(2), 178–188. doi:10.1016/j.pec.2005.10.003

El Morr, C., & Kawash, J. (2007). Mobile Virtual Communities Research: A Synthesis of Current Trends and a Look at Future Perspectives. *International Journal of Web Based Communities*, *3*(4), 386–403. doi:10.1504/IJWBC.2007.015865

Eysenbach, G., Powell, J., Englesakis, M., Rizo, C., & Stern, A. (2004). Health Related Virtual Communities and Electronic Support Groups: Systematic Review of the Effects of Online Peer to Peer Interactions. *British Medical Journal*, *328*(7449), 1166. doi:10.1136/bmj.328.7449.1166

Hsia, P., Samuel, J., Gao, J., Kung, D., Toyoshima, Y., & Chen, C. (1994). Formal Approach to Scenario Analysis. *IEEE Software*, *11*(2), 33–41. doi:10.1109/52.268953

Konstantas, D., Van Halteren, A., & Bults, R. (2004). Mobile Patient Monitoring: The MobiHealth System. *The Journal on Information Technology in Healthcare*, *2*(5).

Maloney-Krichmar, D., & Preece, J. (2005). A multilevel analysis of sociability, usability, and community dynamics in an online health community. *ACM Transactions on Computer-Human Interaction*, *12*(2), 201–232. doi:10.1145/1067860.1067864

Papazoglou, M. P., & Georgakopoulos, D. (2003). Service-Oriented Computing. *Communications of the ACM*, *46*(10), 25–28. doi:10.1145/944217.944233

Pawar, P., Subercaze, J., Maret, P., Van Beijnum, B. J., & Konstantas, D. (2008). Towards Business Model and Technical Platform for the Service Oriented Context-Aware Mobile Virtual Communities. *IEEE 13th Symposium on Computers and Communications (ISCC'08)*, Marrakech, Morocco.

Rheingold, H. (1993). *The virtual community: homesteading on the electronic frontier*. Reading, MA: Addison-Wesley Pub.

Subarcaze, J., Maret, P., Calmet, J., & Pawar, P. (2009). A Service Oriented Framework For Mobile Business Virtual Communities. In *9th IFIP Working Conference on Virtual Enterprises*, (PRO-VE 2009) Poznan, Poland.

Van Beijnum, B. J. F., Pawar, P., Dulawan, C., & Hermens, H. (2009). Mobile Virtual Communities for Telemedicine: Research Challenges and Opportunities. *International Journal of Computer Science & Applications*, *6*(2), 38–49.

Whittle, J., & Krüger, I. H. (2004). A Methodology for Scenario-Based Requirements Capture. In *Proceedings of the ICSE 2004 Workshop on Scenarios and State Machines (SCESM)*.

## KEY TERMS AND DEFINITIONS

**Body Area Network (BAN):** A BAN is a network of devices around the body, consisting of multiple devices such as sensors and a gateway device.

**Mobile Virtual Community (MVC):** A virtual community (VC) is an electronically supported social network: it can be seen as a group of people who regularly interact because of a common interest, problem or task assignment. When independence of time and place is achieved through utilizing mobile devices and wireless communication technologies, such a VC is called a Mobile Virtual Community.

**Permission And Prohibition Constraints:** Permission constraints refer to the prescription that a certain interaction is allowed to occur; whereas prohibition constraints refer to permissions of interaction that are not allowed to occur.

**Service Oriented Architecture (SOA):** A SOA is an architectural principle based on the services concept, in which services performed by a services provider can be reused as a standalone component in a web-based architecture. A SOA can for example be implemented by web services technology.

**Service:** A service refers to a unit of work which can be performed by a service provider to achieve desired end results for a service consumer. Services are produced and consumed by both fixed and mobile devices.

**Sub-Community:** A sub-community is a subset of an VC, and refers to a community within the virtual community.

**Telemedicine:** In telemedicine, information and communication technologies (ICT) are researched and employed in medicine areas such as health maintenance, alleviation, cure and prevention of diseases. Originally, telemedicine is a combination of 'tele', meaning (geographical) distance, and medicine. However, next to distance, also time can be bridged using ICT.

**Unified Modelling Language (UML) Class Diagram:** A UML class diagram is a diagram following the rules of the UML, and used to represent the detailed internals of an information system.

**Use Case:** A use case defines a use of a system. It is generally used to concretize instantiated behavior of the system.

# Chapter 83
# Socio-Economic Effects on Mobile Phone Adoption Behavior among Older Consumers

**Sanna Sintonen**
*Lappeenranta University of Technology, Finland*

## INTRODUCTION

Aging is one of the major trends that is about to change the structure of consumer markets. As people age, they face changes in their health and functioning, that make them differ from their younger counterparts. Retiring is one of the changes that people face when they age, it clearly gives them more opportunities to make choices and more time for decision-making, and therefore their consuming power shouldn't be overlooked. As electronic services are continuously developed, it is important to analyze aging people and identify the typical characteristics that affect their mobile phone usage.

The present chapter pursues to evaluate what influences the usage of mobile phones among the aging consumers. It is important to take a look at the typical characteristics related to aging. Technology itself may be strange to people that have retired a decade ago, when the diffusion of mobile phones was accelerating, and it is therefore considered important that technology related fears aren't overlooked. Technology related perceptions have been found to be important determinants of technology usage, and they should also be assessed when the aging consumers are analyzed. For the purposes of identifying relevant future users for mobile services, it is essential to analyze the effects of socio-economic characteristics on mobile phone adoption.

## BACKGROUND

Aging has psychological, biological, social and economic influences on consumers (Pak & Kambil, 2006). For marketers the biological issues create

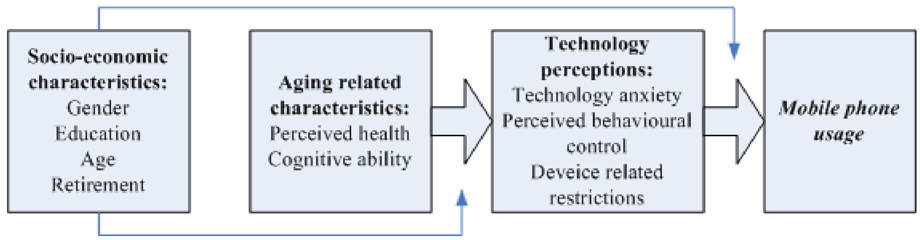
DOI: 10.4018/978-1-61520-611-7.ch083

challenges for product and service designs and communication methods. Changes in memory and information processing result in declining rate of learning and avoiding situations that aren't familiar. Economic situations change due to retirement, but it is considered that elderly have high discretionary income (Lunsford & Burnett, 1992). People age differently and aging itself is a multidimensional process, therefore differences in consumer responses among older people are not likely to be the result of any specific factor (Moschis, 1992), it is thus necessary to become familiar with aging related characteristics. Health has been considered important, when aging consumers have been segmented. Perceptions of health vary among different social groups and depend very much on age and experience and thus self-assessments can be very individual and eccentric (Blaxter, 1990). According to Leinonen (2002), self-rated health is determined by the existence or absence of chronicle diseases, level of functioning, way of living, psychological well-being, socio-demographic and socio-economic factors and adaptation to changes emerging through aging.

According to Czaja and Lee (2007), age-related changes in cognition have important implications for the design of technical systems, because human-technology interaction is an information-processing task. Learning is closely tied to memory functioning and even a normal decline of memory through aging renders difficulties in learning (Suutama, 2004). Cognitive abilities are thus related to technology adoption, because new technology requires new learning, which relies heavily on component cognitive abilities underlying fluid intelligence (Czaja & Lee, 2007). Fluid intelligence includes abstract thinking, reasoning, some of the memory functions and quick problem solving capacity in new situations (Suutama, 2004). This is why the complexity of innovation becomes important for aging consumers decision-making. Theory of planned behavior suggests that perceived behavioral control influences behavioral intentions and refers to people's perception of the ease or difficulty of performing the behavior of interest (Ajzen, 1985, 1991). The effort expected to bring a course of behavior to a successful conclusion is likely to increase with perceived behavioral control (Ajzen, 1991). The greater the perceived behavioral control the stronger should be the intention to perform the behavior and it will more likely occur. The harder the person tries, and the greater is his control over personal and external factors that may interfere, the greater is the likelihood that he will attain his behavioral goal (Ajzen, 1985).

Typical for elderly adopting innovations is the fear that it will not perform as desired (Lunsford & Burnett, 1992). Among older consumers and technology, a common issue under research is the fear for technology, i.e. technology anxiety. According to Meuter, Ostrom, Bitner and Roundtree (2003), technology anxiety focuses on the user's state of mind regarding their ability and willingness to use technology-related tools. Anxiety related to technology originates from computer anxiety, which has been studied rather widely (see Brosnan, 1998). Computer anxiety has been defined as emotional fear, apprehension and phobia felt by the individuals towards interactions with computers or when they think about using computers (Chua, Chen, & Wong, 1999), i.e. anxiety refers to the negative attitudes toward using the computer. It is a kind of state anxiety, which can be changed and measured along multiple dimensions (Chua et al., 1999). Likely the anxiety rises from the inability or lack of self-confidence in effectively managing or controlling the technology (Oyedele & Simpson, 2007). According to Moschis (2003) older consumers prefer avoiding complexity when buying services or products, and also when using them. Offerings are accepted if they are beneficial and they need to match the expectations of the consumer in functioning and quality. Consuming is risk averse and the decisions are mainly based on previous experiences.

*Figure 1. Research model*




## SOCIO-ECONOMIC EFFECTS AND MOBILE PHONE ADOPTION AMONG AGING CONSUMERS

### Research Model

A multitude of variables could potentially influence the beliefs and attitudes people hold: age, gender, ethnicity, socioeconomic status, education, nationality, religious affiliation, personality, mood, emotion, general attitudes and values, intelligence, group membership, past experiences, exposure to information, social support, coping skills and so forth (Ajzen et al., 2005). The present paper suggests that gender, age, education and retirement all impact the mobile phone usage among aging consumers. The basic model behind the analysis is presented in Figure 1. Perceived health is suggested to influence the device related restrictions. Cognitive ability on behalf is proposed to influence on all the introduced technology perceptions: technology anxiety, perceived behavioral control and device related restrictions. The device related restrictions are also suggested to increase technology anxiety. Anxiety and restrictions are suggested to decrease the perceptions of behavioral control and all the technology related perceptions are proposed to influence mobile phone usage. This model will be tested with a multi-group analysis in order to evaluate differences caused by age, gender, education and retirement. It is proposed that socio-economic characteristics might operate as homologizers, indicating that the relationships between the constructs differ based on socio-economic status in the model.

Several researchers have found gender effects on computer anxiety indicating that females have less positive attitudes toward computers (Dyck & Smither, 1996; Gilbert, Lee-Kelley, & Barton, 2003). Gender – anxiety relationship however has been also studied with psychological gender revealing that there is a positive relationship between anxiety and femininity and a negative relationship between masculinity and anxiety (Todman & Day, 2006). Females have many times been later adopting new technology than males (e.g. Vishwanath & Goldhaber, 2003), and males have been found to feel more at ease with technology (Gefen & Straub, 1997). Therefore, when considering the older consumer segment, it is suggested that females are more sensitive to changes in different background factors. The first proposition is:

**Proposition 1:** The relationships between different constructs are stronger for female consumers.

In earlier studies, education has appeared to have influence on computer anxiety (Igbaria & Parasuraman, 1989). Considering mobile phone adoption, lower education consumers have been later adopters (Vishwanath & Goldhaber, 2003). It could be assumed that people with higher level education are more familiar with new technology from their past work experiences, therefore it is suggested:

**Proposition 2:** The relationships between different constructs are weaker for higher educated consumers.

Finally, it is also suggested that age influences mobile phones usage. Age has been found to be a moderator in technology adoption (Morris & Venkatesh, 2000), and Vishwanath and Goldhaber (2003) studied cellular phone adoption, and their results indicated that the non-adopters where distinguished also by older age. Considering the whole aging market, it is here assumed that younger part of older consumers isn't that prone to changes in the factors that affect mobile phone usage, and therefore it is proposed:

**Proposition 3:** The relationships between different constructs are stronger for older consumers.

Retirement is one of the cut points in life. It could be that part of those people still involved in work life, have had no choices but to adopt and start using mobile phones on behalf of their work status. There has not been much research considering the point of retirement and its relationship to technology adoption, but analogous to age it is here proposed that:

**Proposition 4:** The relationships between different constructs are stronger for retired consumers.

## Methodology

The empirical evidence was collected with a traditional mail survey from a middle sized city in Finland. A sample of 1000 consumers aged between 55-79 years was stratified with age in order to form a representative sample, and it covered more than 10 percent of the relevant population. The response rate was rather high, 55.6 percent, and the responses followed the true age distribution of the relevant population. Females covered 56.8 percent of the respondents, which is also congruent with their proportion in the population.

The concepts included in the modeling were mainly measured with statements having five response alternatives ranging from 1=totally disagree to 5=totally agree. The measurement items selected to cover the level of cognitive capacity were drawn from the cognitive factor of Zung Self-Rating Depression Scale (Passik et al., 2000). Perceived health was measured with a global measure for self-rated health (Jelicic & Kempen, 1999) with five response alternatives varying from poor to excellent. This measure was complemented with three additional statements in order to form a multi-item scale and increase the measurement reliability.

Perceived physical restrictions for mobile phone usage were reflected with two statements that discussed the small buttons and small screen size in mobile phones. The measurement of computer anxiety has been extended to measure anxiety related to technology in general (Meuter et al., 2003), and a similar extension was made here for mobile phones. The indicators of computer anxiety included such elements as fear, uncomfort and embarrassment that have been part of the scales used in previous research (e.g. Cohen & Waugh, 1989; Loyd & Loyd, 1985; Selwyn, 1997). Perceived behavioral control items were based on previous literature (Morris & Venkatesh, 2000; Taylor & Todd, 1995). Revisions were made to match the present context, and four statements where used to reflect perceived behavioral control.

As mobile phones are almost at the position of everyday consumption commodity due to the high penetration rates, the traditional measurement for behavioral intention to adopt them was out of the question. In order to cover mobile phone usage, two items were developed for the purpose. One item discussed usage skills and the other captured the range of purposes to which mobile phones are used for. The summated scale composed from these captures the mobile usage from 1=low level users to 3=advanced users of mobile phone.

*Figure 2. Scale statistics*

| Concept (abbreviation) | N of items | Mean | Std Dev | Construct reliability | Average variance extracted |
|---|---|---|---|---|---|
| Cognitive ability (ca) | 2 | 3.574 | 1.224 | .866 | .767 |
| Perceived health (ph) | 4 | 3.325 | .951 | .853 | .510 |
| Physical restrictions (pr) | 2 | 2.850 | 1.376 | .902 | .822 |
| Technology anxiety (anx) | 4 | 1.720 | .803 | .843 | .521 |
| Perceived Behavioral control (pbc) | 4 | 3.681 | 1.087 | .904 | .705 |
| Mobile phone usage (mp) | 2 | 2.097 | .540 | .758 | .613 |

The measurement model was verified with confirmatory factor analysis. The reliability coefficients for latent constructs were rather high and the average variance extracted was over 50 percent for each construct (Figure 2). Measurement invariance was also confirmed for all the subgroups that were analyzed.

## Empirical Assessment of Socio-Economic Differences

Before testing socio-economic differences, the full research model was tested with the whole sample structural equation modeling (Figure 3.). The model fit indices suggested a good fit to the data ($\chi^2$=6.868, p=.141, df=4, NFI=.989, NNFI=.981, GFI=.995, AGFI=.971). R square for mobile phone usage was .498, indicating that the model succeeded rather well.

Nearly all paths were significant, only two paths making an exception. Cognitive ability had no effect on the perceived device related physical restrictions. Additionally, these restrictions had no direct effect on mobile phone usage. It thus seems that health influences the perception of how much the small size of mobile phones bothers its usage. Good cognitive functioning decreases technology anxiety and increases consumers' perceived control related to mobile phones. Physical restrictions increase technology anxiety and together with anxiety they decrease perceived behavioral control. Direct influencers on mobile phone usage were perceived behavioral control and technology anxiety.

After the full model was tested and found to be eligible, four subgroup analyses were conducted in order to detect the effects of gender, education, age and retirement. The first subgroup analysis was conducted based on gender (Figure 4). Unrestricted model means that the path coefficients were allowed to be freely estimated for both groups. In restricted models, each path coefficient one after each other was forced to be the same across the groups. Thereafter, khi square difference

*Figure 3. Empirical validation of the ground model (*indicates a statistically significant path coefficient)*

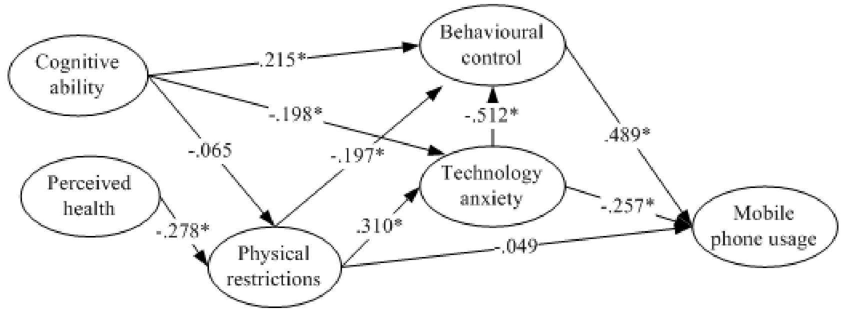


*Figure 4. Gender differences in path coefficients*

| Relationship | Men N=193 | Women N=235 | Unrestricted $\chi^2$ (df=15) | Restricted $\chi^2$ (df=16) | Difference $\chi^2$ (df=1) | p-value |
|---|---|---|---|---|---|---|
| ph → pr | -.171* | -.407**** | 10.91 | 12.78 | 1.87 | |
| ca → pr | -.099 | -.040 | 10.91 | 11.01 | 0.1 | |
| ca → anx | -.235*** | -.266*** | 10.91 | 10.97 | 0.06 | |
| ca → pbc | .173** | .148** | 10.91 | 11 | 0.09 | |
| pr → anx | .319**** | .519**** | 10.91 | 12.97 | 2.06 | |
| pr → pbc | -.093 | -.018 | 10.91 | 11.36 | 0.45 | |
| anx → pbc | -.775**** | -.740**** | 10.91 | 10.97 | 0.06 | |
| **pr → mp** | **-.186**** | **.133** | **10.91** | **15.38** | **4.47** | **<.05** |
| anx → mp | -.193 | -.503** | 10.91 | 11.56 | 0.65 | |
| pbc → mp | .523** | .418* | 10.91 | 11 | 0.09 | |
| ****p≤.001, ***p≤.010, **p≤.050, *p≤.100 | | | | | | |

was measured to clarify whether the decrease in model fit was significant or insignificant. Only one path differed significantly between genders. Completely different from what was assumed; physical restrictions coming along with the size of the device had a different effect on mobile phone usage between male and female consumers. For males, the path coefficient from restrictions to usage was negative and significant, and for females the same coefficient was insignificant.

The second proposition suggested weaker path coefficients for highly educated consumers. Only one path indicated a significant group-wise difference (Figure 5). This was attached with the physical restrictions but this time the influence of it toward perceived behavioral control differed between higher and lower education. Surprisingly, the perception of physical restrictions had a positive effect on perceived behavioral control among lower education consumers. For higher educated consumers, this relationship was totally the opposite, a negative path was found, which is consistent with the model estimated from the complete sample (Figure 3). It could be that the less educated persons facing stronger restrictions through the device size prefer that they have higher control and enough learning and knowledge concerning the usage of the phone, i.e. they have been able to pass the difficulties that the size of the device causes.

For the third proposition, the sample was divided in two groups; 55-64 year old consumers and 65-79 year old consumers (Figure 6). Age appeared to cause differences in one path. The direction was the same as suggested: cognitive ability had a stronger negative effect on perceived technology

*Figure 5. Educational differences in path coefficients*

| Relationship | Lower education N=298 | Higher education N=123 | Unrestricted $\chi^2$ (df=15) | Restricted $\chi^2$ (df=16) | Difference $\chi^2$ (df=1) | p-value |
|---|---|---|---|---|---|---|
| ph → pr | -.128 | -.327*** | 11.77 | 12.88 | 1.11 | |
| ca → pr | -.160 | -.054 | 11.77 | 12.02 | .25 | |
| ca → anx | -.329*** | -.257*** | 11.77 | 12.02 | .25 | |
| ca → pbc | .232*** | .097* | 11.77 | 13.05 | 1.28 | |
| pr → anx | .503**** | .386**** | 11.77 | 12.40 | .63 | |
| **pr → pbc** | **.142*** | **-.113*** | 11.77 | **16.01** | **4.24** | **<.05** |
| anx → pbc | -.745**** | -.778**** | 11.77 | 11.58 | -.19 | |
| pr → mp | .121 | -.040 | 11.77 | 12.65 | .88 | |
| anx → mp | -.408* | -.451* | 11.77 | 11.76 | -.01 | |
| pbc → mp | .499** | .383* | 11.77 | 11.77 | 0 | |
| ****p≤.001, ***p≤.010, **p≤.050, *p≤.100 | | | | | | |

*Figure 6. Age differences in path coefficients*

| Relationship | 55-64 year old N=230 | 65-79 year old N=191 | Unrestricted $\chi^2$ (df=15) | Restricted $\chi^2$ (df=16) | Difference $\chi^2$ (df=1) | p-value |
|---|---|---|---|---|---|---|
| ph → pr | -.207** | -.391*** | 12.57 | 13.67 | 1.1 | |
| ca → pr | .032 | -.059 | 12.57 | 12.85 | 0.28 | |
| **ca → anx** | **-.126*** | **-.408******* | **12.57** | **16.73** | **4.16** | **<.05** |
| ca → pbc | .115** | .142 | 12.57 | 12.6 | 0.03 | |
| pr → anx | .509**** | .324*** | 12.57 | 14.26 | 1.69 | |
| pr → pbc | .049 | -.012 | 12.57 | 12.77 | 0.2 | |
| anx → pbc | -.826**** | -.781**** | 12.57 | 12.69 | 0.12 | |
| pr → mp | .072 | .011 | 12.57 | 12.63 | 0.06 | |
| anx → mp | -.692*** | -.448 | 12.57 | 12.77 | 0.2 | |
| pbc → mp | .140 | .457 | 12.57 | 13.08 | 0.51 | |
| ****p≤.001, ***p≤.010, **p≤.050, *p≤.100 | | | | | | |

anxiety among older consumers. A small decline in cognitive functioning increases technology anxiety more among the older group.

Considering the analysis of age, the majority of the younger group had already retired, although 65 years is the general retiring age in Finland. Therefore, the analysis of based on working status is also considered important. Figure 7 summarizes the results from the multi-group analysis concerning retired and not retired people. It now seems that working life status differentiates the paths more than any other socio-economic characteristic analyzed. The results indicate that the last proposition was in the right direction supporting the notion that retired would have stronger path coefficient in the model. This was true for three paths. First, cognitive ability causes no anxiety for aging still working but for the retired, decrease in cognitive functioning increases anxiety toward mobile phones. The second significant difference between groups was found in the relationship between anxiety and perceived behavioral control. This path is significant for both groups, but stronger for the retired. Among retired people, technology anxiety had a more negative path suggesting that the higher level of anxiety has stronger negative effect on behavioral control, which thus suggests that they are more insecure users of mobile phones. The last difference concerns the effect of perceived control on mobile phone usage. For those still in working life, the path is insignificant and for the retired, the path is positive and significant. This could indicate that the non-retired are very used to using the mobile phone and the control over

*Figure 7. Differences in path coefficients by working status*

| Relationship | Working N=142 | Retired N=273 | Unrestricted $\chi^2$ (df=15) | Restricted $\chi^2$ (df=16) | Difference $\chi^2$ (df=1) | p-value |
|---|---|---|---|---|---|---|
| ph → pr | -.220* | -.231** | 13.79 | 13.78 | .01 | |
| ca → pr | .088 | -.186** | 16.47 | 13.78 | 2.69 | |
| **ca → anx** | **-.086** | **-.351******* | **17.5** | **13.78** | **3.72** | **<.10** |
| ca → pbc | .120** | .105 | 13.78 | 13.78 | 0 | |
| pr → anx | .505**** | .372**** | 14.76 | 13.78 | .98 | |
| pr → pbc | -.055 | .03 | 14.31 | 13.78 | .53 | |
| **anx → pbc** | **-.617******* | **-.872******* | **18.47** | **13.78** | **4.69** | **<.05** |
| pr → mp | .121 | -.092 | 15.59 | 13.78 | 1.81 | |
| anx → mp | -.632**** | -.063 | 16.11 | 13.78 | 2.33 | |
| **pbc → mp** | **.083** | **.708***** | **17.55** | **13.78** | **3.77** | **<.10** |
| ****p≤.001, ***p≤.010, **p≤.050, *p≤.100 | | | | | | |

the device is rather self-evident, and among the retirees, them who have made effort for learning are higher level users of mobile phones.

## FUTURE RESEARCH DIRECTIONS

The current research was conducted among aging consumers, but a similar research would be useful for other age cohorts. As the focus here was mobile phone usage in general heedless of the wide variety of mobile services available, the interests in the future is to aim toward identifying the adoption behavior related to mobile services and to assess the profitability of content services in advance. For the identification of target segments, it is important to evaluate how socio-economic characteristics discriminate consumers and therefore the current research method would provide useful insights if replicated to consumers of a wider age range. Considering the aging market potential for mobile services it would be of great importance to assess how the phone manufacturers and service providers develop their actions to match the needs of the changing market demographics in developed welfare states where age structures will become distorted.

## CONCLUSION

The effects of socio-economic variables have been studied rarely, and when studied, the effects have been rather minor. Their influence has been mainly assessed in regression type research arrangements, and their true effect has remained unsolved. The purpose of the multi-group analysis was to display how the socio-economic indicators discriminate the influences of different factors behind mobile phone usage. Although, there didn't exist multiple diverging relationships in the models, results clearly indicate that gender, age, education and retirement change the nature of the relationship between background characteristics and technology perceptions and between technology perceptions and rate of mobile phone usage. It can also be conjectured whether there would have been additional differences if the sample would have been composed differently.

Gender revealed differences between the technology characteristics and mobile phones usage. Education on behalf caused differences in attitude formation related to technology perceptions. The opposite direction of the coefficient between physical restriction and behavioral control compared with education level is rather interesting. It can be assumed that consumers with lower education place extra effort on behavioral control when the physical restrictions increase. Males and also higher education consumers appear to form a group that suffers from the small size of the mobile phones. This will be one of the future challenges that should be answered by the device and content designers. Age distinguished consumers when the aging related characteristics were concerned. Along with aging people face changes in cognitive functions caused by multiple reasons. The results clearly suggest that the decrease in cognitive ability turns against technological development by increasing technology anxiety. Including the working life status for the analysis pointed out that age truly isn't reasonable distinguisher in consumer behavior related to technology. In recent years, along with high investments on the infrastructure, mobile communication is present in many industries, thus making it familiar. Therefore, the aged consumers already retired even a decade ago don't benefit the influence coming along with technology utilization in working situations. Problems related to technology anxiety are treatable, courses are nowadays organized for senior citizens related to internet and mobile phones, and with training and peer support, the perceived control over the device is also expected to increase and change over time as positive experiences take place. In addition, the design of mobile phones should meet the requirements of elderly as well as the design of services provided through mobile communications.

## REFERENCES


Ajzen, I. (1985). From Intentions to Actions: A Theory of Planned Behavior. In J. Kuhl & J. Beckmann (Eds.), *Action Control: From Cognition to Behavior* (pp. 11-39). Heidelberg: Springer.

Ajzen, I. (1991). The Theory of Planned Behavior. *Organizational Behavior and Human Decision Processes*, *50*, 179. doi:10.1016/0749-5978(91)90020-T

Ajzen, I., Beauducel, A., Biehl, B., Bosniak, M., Conrad, W., & Wagener, D. (2005). Laws of Human Behavior: Symmetry, Compatibility, and Attitude-Behavior Correspondence. In *Multivariate research strategies*. Maastricht. Germany: Shaker Publishers.

Blaxter, M. (1990). *Health and Lifestyles*. London: Tavistock/Routledge.

Brosnan, M. J. (1998). *Technophobia: The Psychological Impact of Information Technology*. London: Routledge.

Chua, S. L., Chen, D.-T., & Wong, A. F. L. (1999). Computer Anxiety and Its Correlates: A Meta-Analysis. *Computers in Human Behavior*, *15*(5), 609–623. doi:10.1016/S0747-5632(99)00039-4

Cohen, B. A., & Waugh, G. W. (1989). Assessing Computer Anxiety. *Psychological Reports*, *65*, 735–738.

Czaja, S. J., & Lee, C. C. (2007). The Impact of Aging on Access to Technology. *Universal Access in the Information Society*, *5*(4), 341–349. doi:10.1007/s10209-006-0060-x

Dyck, J. L., & Smither, J. A.-A. (1996). Older Adults' Acquisition of Word Processing: The Contribution of Cognitive Abilities and Computer Anxiety. *Computers in Human Behavior*, *12*(1), 107–119. doi:10.1016/0747-5632(95)00022-4

Gefen, D., & Straub, D. W. (1997). Gender Differences on the Perception and Use of E-Mail: An Extension to the Technology Acceptance Model. *MIS Quarterly*, *21*(4), 389–400. doi:10.2307/249720

Gilbert, D., Lee-Kelley, L., & Barton, M. (2003). Technophobia, Gender Influences and Consumer Decision-Making for Technology-Related Products. *European Journal of Innovation Management*, *6*(4), 253–263. doi:10.1108/14601060310500968

Igbaria, M., & Parasuraman, S. (1989). A Path Analytic Study of Individual Characteristics, Computer Anxiety and Attitudes toward Microcomputers. *Journal of Management*, *15*(3), 373–388. doi:10.1177/014920638901500302

Jelicic, M., & Kempen, G. I. J. M. (1999). Effect of Self-Rated Health on Cognitive Performance in Community Dwelling Elderly. *Educational Gerontology*, *25*, 13–17. doi:10.1080/036012799267981

Leinonen, R. (2002). *Self-Rated Health in Old Age: A Follow-up Study of Changes and Determinants*. University of Jyväskylä, Jyväskylä, Sweden.

Loyd, B. H., & Loyd, D. E. (1985). The Reliability and Validity of an Instrument for the Assessment of Computer Attitudes. *Educational and Psychological Measurement*, *45*, 903–908. doi:10.1177/0013164485454021

Lunsford, D. A., & Burnett, M. S. (1992). Marketing Product Innovations to the Elderly: Understanding the Barriers to Adoption. *Journal of Consumer Marketing*, *9*(4), 53–63. doi:10.1108/07363769210037097

Meuter, M. L., Ostrom, A. L., Bitner, M. J., & Roundtree, R. (2003). The Influence of Technology Anxiety on Consumers Use and Experiences with Self-Service Technologies. *Journal of Business Research*, *56*(11), 899–906. doi:10.1016/S0148-2963(01)00276-4

Morris, M. G., & Venkatesh, V. (2000). Age Differences in Technology Adoption Decisions: Implications for a Changing Work Force. *Personnel Psychology*, *53*(2), 375–403. doi:10.1111/j.1744-6570.2000.tb00206.x

Moschis, G. P. (1992). Gerontographics: A Scientific Approach to Analyzing and Targeting the Mature Market. *Journal of Services Marketing*, *6*(3), 17–26. doi:10.1108/08876049210035890

Moschis, G. P. (2003). Marketing to Older Adults: An Updated Overview of Present Knowledge and Practice. *Journal of Consumer Marketing*, *20*(6), 516–525. doi:10.1108/07363760310499093

Oyedele, A., & Simpson, P. M. (2007). An Empirical Investigation of Consumer Control Factors on Intention to Use Selected Self-Service Technologies. *International Journal of Service Industry Management*, *18*(3), 287–306. doi:10.1108/09564230710751497

Pak, C., & Kambil, A. (2006). Over 50 and Ready to Shop: Serving the Aging Consumer. *The Journal of Business Strategy*, *27*(6), 18–28. doi:10.1108/02756660610710319

Passik, S. D., Lundberg, J. C., Rosenfeld, B., Kirsh, K. L., Donaghy, K., & Theobald, D. (2000). Factor Analysis of the Zung Self-Rating Depression Scale in a Large Ambulatory Oncology Sample. *Psychosomatics*, *41*(2), 121–127. doi:10.1176/appi.psy.41.2.121

Selwyn, N. (1997). Student's Attitudes toward Computers: Validation of a Computer Attitude Scale for 16-19 Education. *Computers & Education*, *28*(1), 35–41. doi:10.1016/S0360-1315(96)00035-8

Suutama, T. (2004). Kognitiivisest toiminnot. In T. Raitanen, T. Hänninen, H. Pajunen & T. Suutama (Eds.), *Geropsykologia: Vanhenemisen ja vanhuuden psykologia* (pp. 76-108). Porvoo, Finland: WSOY.

Taylor, S., & Todd, P. A. (1995). Understanding Information Technology Usage: A Test of Competing Models. *Information Systems Research*, *6*(2), 144. doi:10.1287/isre.6.2.144

Todman, J., & Day, K. (2006). Computer Anxiety: The Role of Psychological Gender. *Computers in Human Behavior*, *22*(5), 856–869. doi:10.1016/j.chb.2004.03.009

Vishwanath, A., & Goldhaber, G. M. (2003). An Examination of the Factors Contributing to Adoption Decisions among Late-Diffused Technology Products. *New Media & Society*, *5*(4), 547–572. doi:10.1177/146144480354005

## KEY TERMS AND DEFINITIONS

**Adoption:** A decision to buy and start using an innovation.

**Cognitive Ability:** The degree of the ability to learn and take care of normal matters.

**Innovation:** Idea, product or service that is new to the adopting consumer.

**Perceived Behavioral Control:** The degree to which the innovation is understandable and easy to use.

**Perceived Health:** The degree to which individuals perceived one's own well-being in terms of health conditions.

**Physical Restrictions:** The degree of problems arising from the size of the mobile phones.

**Technology Anxiety:** The degree to which the usage or idea of using the technology in question arouses unfavorable feelings and fear.

# Chapter 84
# Mobile Agents in E-Commerce

**Bo Chen**
*Michigan Technological University, USA*

## INTRODUCTION

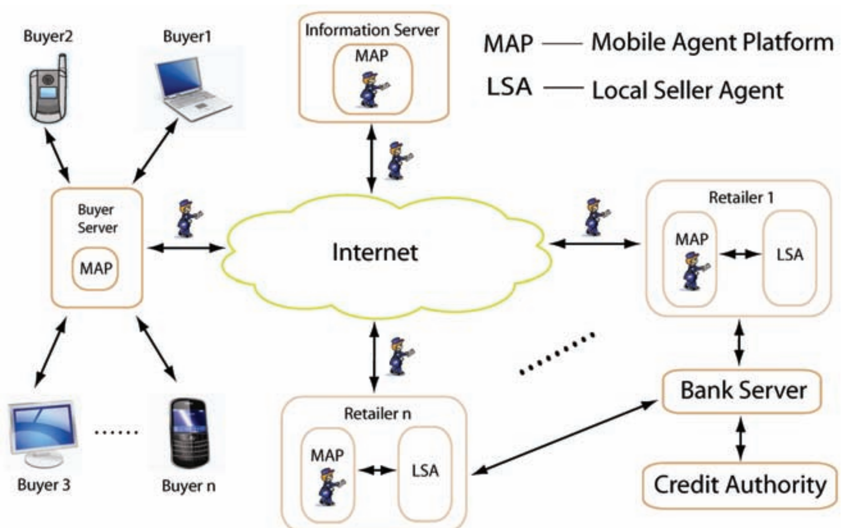
A **mobile agent** is a composition of computer program, data, and execution state, which is able to move from one computer to another autonomously and continue its execution on the destination computer. Mobile agents provide a new programming paradigm for building agile distributed systems. The ability to travel allows a **mobile agent system** to move computation to data source systems. This decentralized approach improves network efficiency since the processing is performed locally. For example, in an **e-commerce** application shown in Figure 1, mobile agents are used to search and purchase products. Once the *Buyer Server* receives a buyer's purchase request, it generates a mobile agent and sends it to the *Information Server* to search retailers who sell the product. Having a list of retailers, the *Buyer Server* dispatches a mobile agent visiting these retailers. The mobile agent negotiates with retailers' local seller agents and reports the offers to the *Buyer Server*. The *Buyer Server* evaluates all the offers, and sends a purchase mobile agent to the best offer retailer to make the final purchase.

Some advantages which **mobile agents** possess over conventional computing paradigms are follows.

- Reduce network traffic and overcome network latency. Mobile agents can move to remote computers that contain objects with which the mobile agents want to interact, and take the advantage of being at the same host.
- Work in heterogeneous network hosts if a run-time support environment is installed on these hosts.
- Tolerant to network failures and support disconnected operation. Mobile agents are able

DOI: 10.4018/978-1-61520-611-7.ch084

*Figure 1. Mobile agents migrate over networks searching and purchasing products*




to operate without an active connection between the destination and the home host.

- Work autonomously.
- Flexible to change an agent's actions. Only the agent program rather than the computation hosts must be updated.
- Applications become in-situ reprogrammable using mobile code in mobile agents.

**Mobile agents** have received a diverse range of applications in information retrieval, network management, e-commerce, transportation systems, distributed control systems, and manufacturing. The advantages of mobile agents, such as reducing network traffic, supporting disconnected operation, overcoming network latency, and roaming ability in heterogeneous platforms, have great value to build ubiquitous e-commerce/m-commerce systems. Most **e-commerce** applications involve a large amount of information exchange and intensive data processing. Mobile agent approach scales effectively as the size of data to be processed and the number of data servers increase (Patel & Garg, 2005). Compared to the conventional **client-server** paradigm, mobile agents provide fast and efficient interaction with remote services and save network bandwidth (Zhao & Blum, 2000).

**M-commerce** is an emerging e-commerce model, which conducts commerce using mobile devices such as mobile phones and PDAs (Personal Digital Assistant**)**. Due to physical and network constraints (low CPU speed, small memory size, poor network connectivity, and limited bandwidth), the implementation of client/server approach in m-commerce systems faces significant challenges. The mobile agent paradigm offers an appropriate solution to reduce network traffic and tolerate poor network connectivity in m-commerce systems (Li, 2007).

This chapter attempts to highlight good features of the mobile agent paradigm for the applications in e-commerce. A number of selected mobile agent-based e-commerce systems and the agent platforms are introduced. The major security and privacy concerns in mobile agent-based e-commerce systems and the commonly used approaches to address these issues are discussed. The future research directions are recommended in the conclusions.

## MOBILE AGENT-BASED E-COMMERCE APPLICATIONS

E-commerce is the greatest potential application area for mobile agents where the agents facilitate the phases of brokering, negotiation, payment, and delivery of a transaction (Zhao & Blum, 2000). A survey conducted by Kowalczyk (Kowalczyk, et. al., 2003) showed that the research community had made effort of using mobile agents to advance e-commerce. Mobile agent technology has been applied to e-commerce to provide functions, such as **e-trading** (Chen, et. al., 2007; Dasgupta, et. al., 1999), **brokering** service and **e-marketplace** (Du, et. al., 2005; Hu, 2007; Wang, et. al., 2002), **auction** (Lee, et. al., 2003; Shih, et. al., 2005), **electronic payment** (Guan, et. al., 2004; Patel & Garg, 2004), mobile stock investment decision-making (Wu, et. al., 2008), and global logistic services (Trappey, et. al., 2004). Typical mobile agent tasks include searching product information, making routing purchase, and conducting negotiations. In this section, several selected mobile agent-based e-commerce applications are briefly introduced.

The **electronic marketplace** provides a platform to facilitate buyers and sellers exchanging information about goods and services, match buyers with sellers, and make payments. To provide autonomy and independence for participating parties, Du, et. al. (2005) propose a mobile agent-based marketplace, which allows corporate data to be maintained by local buyers and sellers and transferred to the marketplace only when orders are matched. The **e-marketplace** consists of buyers, an intermediary server, and suppliers. Buyers send the request information to the intermediary server. The intermediary server aggregates demands, filters unqualified buyers or suppliers, generates the itinerary of the mobile agents for visiting potential suppliers, matches orders, keeps information about suppliers, and manages agents in the marketplace. When a mobile agent inquires product information in a supplier's server, a stationary agent residing in the supplier's server is activated. The local stationary agent searches the inventory database and reports to the mobile agent about the availability of the product.

MAGICS (Business-to-consumer mobile agent-based Internet commerce system) (Chen, et. al., 2007) is a mobile agent-based commerce system to facilitate the consumer buying process: search, evaluation, and purchase. The MAGICS allows customers to provide buying requirements to a proxy/agent server through a Web interface or a wireless terminal. Once the server receives a customer's request, mobile agents will be generated for the customer to get offers from merchants, evaluate offers, and even complete purchases.

**Electronic payment** is a critical step in e-commerce. An electronic payment system for agent-based e-commerce (Guan, et. al., 2004) employs Secure Electronic Transaction (EST) protocol and E-cash for online payment. The payment system includes entities such as Agent Butler, Merchant Host, Payment Gateway, Financial Institutions, and Trusted Third Party. The Agent Butler represents the cardholder who makes payment using a payment card through the EST protocol and dispatches mobile agents to Merchant Hosts for collecting product information. During the purchasing process, the Merchant Hosts invoke Payment Authorization request to the Payment Gateway for checking the credentials of the cardholder. If the cardholder is verified, the Merchant Hosts will receive payment capture token from the Payment Gateway and use it for actual payment.

A mobile reverse **auction** agent system (MoRAAS) (Shih, et. al., 2005) uses collaborative mobile agents to mediate between a buyer and sellers. The MoRAAS system consists of three components: a buyer agent, a broker agent, and a bid agent. When a mobile user wishes to make a purchase, he/she connects to a buyer agent server in the wired network through a mobile device. On the other hand, a broker agent chooses mobile sellers who agree to make a sell. Selected mobile sellers connect to bid agents and send information about the goods. As soon as the buyer agent has been created, it moves to the hosts of the selected sellers to negotiate with them. At the end of the negotiation and auction, the buyer agent sends the results to the user.

## MOBILE AGENT PLATFORMS FOR SUPPORTING E-COMMERCE APPLICATIONS

A number of mobile agent platforms have been developed for e-commerce applications. Nomad (Sandholm & Huai, 2000) is a mobile agent-based **auction** system consisting of distributed auction servers – eAuctionHouse. Nomad allows mobile agents to travel to the eAuctionHouse site and actively participate in auctions on the user's behalf even when the user is disconnected from the network. The main components of the Nomad system include an interface for agent generation, an agent dock, an agent manager, and an agent database. The *Concordia* agent system is used as the basis of the Nomad agent dock. The agent manager notifies agents when the auction information they are interested in is altered. Nomad allows users to program their own agents or lunch predefined template agents from a web interface.

MAgNET (Dasgupta, et. al., 1999) is a networked **electronic trading** system that is implemented based on a mobile agent system called *Aglets*. If a buyer wants to find suppliers who provide the component parts required for manufacturing a product, the buyer creates a mobile agent with an itinerary of supplier sites and criteria for the acquisition of the product and dispatches the mobile agent to the potential suppliers. The buyer's subsystem consists of the buyer's stationary agent and a graphical user interface (GUI). The buyer's stationary agent creates and manages the buyer's mobile agents, and interacts with a human buyer through the GUI. The supplier's stationary agent in the supplier's subsystem interacts with the buyer's mobile agents.

MASISS (Wu, et. al., 2008), a Mobile Agent-based Stock Intermediary Services System, provides ubiquitous and seamless transaction activities for financial institutions. The MASISS framework is developed by the integration of J2ME and J2EE environment, consisting of mobile agent layer, business application layer, and resource layer. The mobile agent layer includes communication manager, agent gateway, and mobile server channel. The mobile agent layer is built on an agent platform, *Tahiti*, supported by IBM's Tokyo laboratory. It creates, clones, and dispatches mobile agents. The business application layer consists of service manager to provide services to investors, and data mining engine to find optimal association rule. The resource layer includes a user subscriber database, a stock price historical database, and a category stock association rule database.

IMAGO (Intelligent Mobile Agent Gliding on-line) system (Li, 2007) allows consumers to dispatch mobile agents from their handheld devices to visit E-stores for searching, comparing, evaluation, buying, and making payment. The IMAGO m-commerce framework defines three types of agents: device agents, stationary agents, and mobile agents. A device agent is installed on the handheld device allowing a mobile user to locate its home server, communicate with the home agent to invoke an m-commerce application. A stationary agent resides at its host to provide a bridge between the mobile users and the m-commerce applications, discover services, and act as the representative of the seller. A mobile agent represents the user roaming the Internet to visit vendors that may carry product desired by the customer, look for a special service, and conduct the transaction according to a specific trading policy. A simplified IMAGO IDE is implemented as a mobile portal on the handheld devices.

## SECURITY ISSUES AND TECHNIQUES IN MOBILE AGENT E-COMMERCE SYSTEMS

Due to the open nature of the Internet, security and privacy issues are major concerns in e-commerce scenario where two unfamiliar parties engage in a trade. Strong encryption and authentication are commonly used approaches to build the trustworthiness of transactions over the Internet (Zhao & Blum, 2000). The protection of privacy includes the identities of customers and vendors, customer's bank account details, and exchanged information such as the integrity of bids, negotiated issues, and transaction details.

The most obvious security issues that a mobile agent security infrastructure must handle include host security and mobile agent security. In addition, a secure channel is needed over which a mobile agent can migrate. The host security is concerned with protecting a host from harmful behaviors of malicious mobile agents, while the agent security is concerned with protecting a mobile agent from malicious hosts. A **malicious agent** is an agent that performs harmful actions, such as unauthorized access and alteration of local resources (data, system calls), or an overuse of a host's local resources. A **malicious host** is an agent server that attempts to spy out and manipulate agent code or data and control flow, provide fake system calls, and execute agent code incorrectly, or to reverse engineer and manipulate agent code and trade secrets (Zhao & Blum, 2000). The commonly used approaches to address the host security include a secure runtime environment, runtime checking and access control, authenticating the owner of an incoming agent, code signature to prove that the agent has not been tampered with, and authorizing request services based on security policy. The problem of protecting a mobile agent from malicious hosts is challenging since it is difficult to protect an executing program from the host or interpreter, which is responsible for its execution. There are several approaches to address this challenge. One possible approach is to employ host authentication to prove that the agent moves to the intended host. Software-based approaches are mainly based on cryptography.

Some of these security approaches have been used to implement secure mechanisms in mobile agent-based e-commerce systems. For example, Corradi et. al. (Corradi, et. al., 1999) propose a MH (Multiple-Hops) protocol to preserve the agent integrity. The MH protocol has the goal of detecting whether the collected data in the agent state portion has been maliciously modified and/or deleted by any visited e-commerce service providers. For the protection of information exchange, Zhang et. al. (Zhang, et. al., 2004) proposed an agent-based fair signature exchange protocol, which allows a party to delegate a mobile agent with the power to digitally sign a document on its behalf without disclosing its private key. Secure mobile agent-based E-negotiation (Al-Jaljouli & Abawajy, 2007) propose a security protocol that protects the information exchanged between the mobile agents during e-negotiations. Trust-reputation approach (Gan, et. al., 2008; Zhao & Blum, 2000) is also used to mitigate transaction risk by deriving the trustworthiness of certain agent from its transaction history.

Song and Korba (Song & Korba, 2003) propose a secure communication architecture for the mobile agents. Every agent must register and get its certificate from a Certificate Authority in the agent platform. All agents store their private key in their home platform. When an agent wants to move to other host for its e-business, the agent clones a representative mobile agent, signs and sends the mobile agent to the remote host with its certificate but without its private key. The representative agent communicates with other agents. When the communication involves important information exchange or needs to be signed with their private key, the representative mobile agent will build a secure channel and forward the messages to their home agent. The home agent then processes the messages with its private key.

With the roaming capability, mobile agent-based e-commerce systems raise significant new security threats from malicious agents and hosts. As an agent needs to move among external hosts to perform its tasks, the data collected by the agent may be modified, the credit carried by the agent may be stolen, and the mission statement of the agent may be changed during transport (Guan & Yang, 2002). The commonly used methods for protecting a mobile agent in transit include: bundling an agent in a secure envelop such that only the destination host will be able to read it or use cryptographic network protocols, such as secure socket layer. SAFE: secure agent roaming for e-commerce (Guan & Yang, 2002) proposes three transport protocols: supervised agent transport, unsupervised agent transport, and bootstrap agent transport, to provide a secure roaming mechanism for agents. Under supervised agent transport protocol, an agent has to request roaming permit from its owner before roaming. The owner decides if the roaming request is approved, which provides a mechanism to prevent its agent from roaming to undesired hosts. During roaming, the sensitive code/data of the agent are frozen. The host protection mechanisms include inspecting agent's credentials and authenticating incoming mobile agents.

## CONCLUSION

Mobile agent technology has received an increasing interest in e-commerce applications. A numerous research efforts have been made for the implementation of e-commerce functions using mobile agents, design secure mechanisms to protect mobile agents and agent hosts, and the development of mobile agent platforms to support agent communication and migration. The research results clearly demonstrate the potential of using mobile agent technology to improve the flexibility and efficiency of e-commerce systems. Despite the accomplished achievements, the application of mobile agent technology in e-commerce is still at infant state. The future research directions are recommended to promote standardization, enhance security, reduce footprint of agent platforms, and incorporate new technologies.

- Most reported mobile agent e-commerce systems are built on general purpose mobile agent systems, such as Aglets and Concordia. These agent systems are not compliant to two major **agent standards**, the IEEE FIPA (Foundation for Intelligent Physical Agents) standards and the MASIF (Mobile Agent System Interoperability Facility). The compliance with agent standards is important for the interoperation and cooperation among agents and agent systems.
- As the PDAs and mobile cellular phones widely spread, the m-commerce that combines e-commerce with mobile devices is likely to become a major business model in the near future. The physical constraints in mobile devices require agent platforms having very small footprint.
- XML (extensible markup language) is a recent standard recommended by the World Wide Web consortium for encoding information and their structures. XML is more flexible than HTML (Hypertext Markup Language) and less complex than SGML (Standard Generalized Markup Language) for Web-based applications. Using XML to encode agent communication language messages and represent different types of data facilitates the practical integration with a variety of Web technology and leverage Web-based tools and infrastructure.

## REFERENCES

Al-Jaljouli, R., & Abawajy, J. H. (2007). Secure mobile agent-based e-negotiation for on-line trading. *2007 IEEE International Symposium on Signal Processing and Information Technology*, (pp. 610-615).

Chen, H., Lam, P. P. Y., Chan, H. C. B., Dillon, T. S., Cao, J., & Lee, R. S. T. (2007). Business-to-consumer mobile agent-based Internet commerce system (MAGICS). *IEEE Transactions on Systems, Man and Cybernetics. Part C, Applications and Reviews*, *37*(6), 1174–1189. doi:10.1109/TSMCC.2007.900653

Corradi, A., Cremonini, M., Montanari, R., & Stefanelli, C. (1999). Mobile agents integrity for electronic commerce applications. *Information Systems*, *24*(6), 519–533. doi:10.1016/S0306-4379(99)00030-7

Dasgupta, P., Narasimhan, N., Moser, L. E., & Melliar-Smith, P. M. (1999). MAgNET: Mobile agents for networked electronic trading. *IEEE Transactions on Knowledge and Data Engineering*, *11*(4), 509–525. doi:10.1109/69.790796

Du, T. C., Li, E. Y., & Wei, E. (2005). Mobile agents for a brokering service in the electronic marketplace. *Decision Support Systems*, *39*(3), 371–383. doi:10.1016/j.dss.2004.01.003

Gan, Z., Li, Y., Xiao, G., & Wei, D. (2008, 24-26 April). A novel reputation computing model for mobile agent-based e-commerce systems. In *2008 International Conference on Information Security and Assurance (ISA '08),* (pp. 253-260), Busan, South Korea.

Guan, S.-U., Tan, S. L., & Hua, F. (2004). A modularized electronic payment system for agent-based e-commerce. *Journal of Research and Practice on Information Technology*, *36*(2), 67–87.

Guan, S.-U., & Yang, Y. (2002). SAFE: secure agent roaming for e-commerce. *Computers & Industrial Engineering*, *42*(2-4), 481–493. doi:10.1016/S0360-8352(02)00042-6

Hu, H. Y. (2007). A reliable and configurable e-commerce mechanism based on mobile agents in mobile wireless environments. In *2007 International Conference on Intelligent Pervasive Computing,* (pp. 7-10), Jeju City, South Korea.

Kowalczyk, R., Ulieru, M., & Unland, R. (2003). Integrating mobile and intelligent agents in advanced e-commerce: a survey. In R. Kowalczyk, J. P. Muller, H. Tianfield & R. Unland (Eds.), *Agent Technologies, Infrastructures, Tools, and Applications for E-Services. NODe 2002 Agent-Related Workshops. Revised Papers,* (pp. 295-313). Erfurt, Germany: Springer-Verlag.

Lee, K. Y., Yun, J. S., & Jo, G. S. (2003). MoCAAS: auction agent system using a collaborative mobile agent in electronic commerce. *Expert Systems with Applications*, *24*(2), 183–187. doi:10.1016/S0957-4174(02)00141-0

Li, X. (2007). The role of mobile agents in M-commerce. In *The sixth Wuhan international conference on E-Business*, (pp. 403-408).

Patel, R. B., & Garg, K. (2004). Distributed banking with mobile agents: an approach for e-commerce. *WSEAS Transactions on Computers*, *3*(1), 98–102.

Patel, R. B., & Garg, K. (2005). A comparative study of mobile agent and client-server technologies in a real application. *Advances in data management*, (pp. 176-182).

Sandholm, T., & Huai, Q. B. (2000). Nomad: Mobile agent system for an Internet-based auction house. *IEEE Internet Computing*, *4*(2), 80–86. doi:10.1109/4236.832950

Shih, D.-H., Huang, S.-Y., & Yen, D. C. (2005). A new reverse auction agent system for m-commerce using mobile agents. *Computer Standards & Interfaces*, *27*(4), 383–395. doi:10.1016/j.csi.2004.10.006

Song, R., & Korba, L. (2003). Security communication architecture for mobile agents and E-commerce. In *Proceedings of the 2003 international workshop on Mobile Systems, E-commerce Agent Technology*.

Trappey, A. J. C., Trappey, C. V., Hou, J. L., & Chen, B. J. G. (2004). Mobile agent technology and application for online global logistic services. *Industrial Management & Data Systems*, *104*(1-2), 169–183. doi:10.1108/02635570410522143

Wang, Y., Tan, K.-L., & Ren, J. (2002). A study of building Internet marketplaces on the basis of mobile agents for parallel processing. *World Wide Web (Bussum)*, *5*(1), 41–66. doi:10.1023/A:1015798306889

Wu, W.-H., Ko, P.-C., Lin, P.-C., & Su, M.-H. (2008). Applying mobile agent to a mobile stock intermediary services system development. *International Journal of Smart Home*, *2*(2), 1–12.

Zhang, N., Shi, Q., Merabti, M., & Askwith, R. (2004). Autonomous mobile agent based fair exchange. *Computer Networks*, *46*(6), 751–770. doi:10.1016/j.comnet.2004.06.005

Zhao, J., & Blum, T. (2000). Next-generation e-commerce: XML+mobile agent+trust. *CG topics*, (pp. 26-28).

## KEY TERMS AND DEFINITIONS

**Client-Server:** one type of network architecture in which the client system makes service requests to the server system.

**E-Commerce:** buying and selling products or services over electronic systems such as the Internet.

**Malicious Agent:** an agent that performs harmful actions.

**Malicious Host:** an agent server attacks mobile agents to achieve a malicious goal.

**M-Commerce:** conduct commerce using mobile devices.

**Mobile Agent System:** provide mechanisms to support agent management, migration, execution, communication, and directory maintenance.

**Mobile Agent:** a piece of software that is able to move from one computer to another in a network.

# Chapter 85
# Mobile Telephony as a Universal Service

**Ofir Turel**
*California State University Fullerton, USA*

**Alexander Serenko**
*Lakehead University, Canada*

*If we cannot end now our differences, at least we can help make the world safe for diversity.* -- John F. Kennedy

## INTRODUCTION

The opening quote nicely conceptualizes one of the most difficult challenges managers and regulators in the telecommunications sector face. While such individuals are not, for the most part, concerned with world-safety, they do need to address similar diversity issues in order to be profitable and to provide true universal services (i.e., reasonably priced, high quality telecommunication services to everyone who wishes to use them). Similarly to John F. Kennedy, managers and regulators understand that one-service or set of regulations that fits all may not be a wise strategy. Rather, their offerings and regulatory mechanisms are always flexible, and they cater to a heterogonous subscriber market. While wireless service providers do try to cater to different market segments by offering a variety of service packages, regulators often employ a single set of regulations that serve the entire market. On the one hand, organizations offering mobile services to individuals attempt to segment the market to maximize various performance factors, such as usage airtime, revenues, and customer base. On the other hand, policies should be in place to avoid the discrimination of specific less profitable customer categories. In fact, in the 21st century, mobile telephony has become so critical for the well-being of millions of people that it is vital to ensure the fairness of mobile services delivery.

DOI: 10.4018/978-1-61520-611-7.ch085

## OVERVIEW

### The Need For Market Oriented Policies

Market segmentation is an obvious concept for wireless service providers. Its importance is further emphasized in today's networked society. Currently, many telecommunication service providers cater to a much broader market than the one they had initially targeted. For example, twenty years ago, expensive handset and service charges led to the adoption of wireless services by mostly high-income individuals. In today's markets, however, the penetration of mobile telephony has reached lower-income individuals as well (Jain, 2006). Thus, in modern heterogeneous markets, businesses continuously investigate demographic and psychographic profiles that affect subscriber interaction with telecommunication services (e.g., Chaudhuri, Flamm, & Horrigan, 2005; Rice & Katz, 2003). Their objective is to identify a number of distinct user groups and to serve them differently. For this, regulators utilize behavioral research to understand how subscribers, belonging to different market segments, develop perceptions and form behavioral outcomes of service usage, resulting in company revenues (Schejter, Serenko, Turel, & Zahaf, 2010). Therefore, mobile service providers may potentially discriminate against specific less profitable customer segments, for instance, low-income households who mostly subscribe to inexpensive basic plans, avoid premium services, live in remote regions, or are located in infrastructurally challenged areas.

To emphasize the importance of this issue, we may recall Hurricane Katrina, one of the deadliest natural disasters in the US history. Throughout this tragedy, wireless services were the only public communication means that remained intact. Thus, the potential use of mobile phones by lower-income individuals in the New Orleans area may have saved lives. Therefore, one may ask – 'would things have been different had the Federal Communications Commission (FCC) enforced affordable access to wireless services for low-income families?,' or 'would things have been different had the FCC enforced certain quality standards (e.g., maximum number of disconnected calls) in low-income areas?' It is believed that this argument conveys that both regulators and service providers should not only concentrate on differences in market segments to maximize their profits, but also on the facilitation of universal services.

### Universal Services

Universal service is a key desirable objective for many regulators. It is broadly defined as providing reasonably priced, high quality telecommunication services to everyone who wishes to use them (Melody, 1997). This is an important concept because access to such services enables full participation in modern society (Blackman, 1995). To ensure the universality of telecommunication services, regulators typically define 'Universal service obligations' (USO) that are implemented through coverage constraints (Valletti, Hoernig, & Barros, 2002) and price-capping (Baake, 2002). Financing the nationwide provision of services in the US is done through a Universal Service Fund (Prieger, 1998) that subsidizes for telephone service in areas with no business-justification for service provisioning.

The term "universal service" has emerged in the early 20th century for describing the need for interconnecting the thousands of local phone companies that existed in the US (Mueller, 1997). Given the myriad of new communication bearer technologies, however, one of the ongoing debates relates to the scope of services included under this umbrella (e.g., broadband, cable, and cellular communications) (Pitt & Levine, 2004). For example, the 1996 Telecommunications Act in the US is pretty vague with regards to this scope. The

FCC states that the goal of universal service is to "increase access to advanced telecommunications services throughout the Nation; [and] advance the availability of such services to all consumers, including those in low income, rural, insular, and high cost areas" (Federal Communications Commission, 2006). The definition of "advanced telecommunications services" is left for a "joint board on universal service" that operates under the auspices of the FCC.

## MOBILE TELEPHONY AND UNIVERSAL SERVICES

Currently, universal service policies do not explicitly deal with the wireless market. At the same time, it may be desirable to consider universal service policies that ensure various market segments have access and use wireless telephony services. That is, mobile services should be part of the "universal service" concept because they provide an invaluable service that puts those who cannot afford them in a disadvantage socially, economically, and even physically. Similar expansions of the universal service concept were suggested by several academics (Barrantes & Galperin, 2008; Burkart, 2007; Frieden, 1997; Navarro, 1996; Xavier, 1997) who call for the inclusion of 'essential' and 'socially desirable' telecommunication services (e.g., Broadband) under the universal service umbrella, and in the 'Universal Service Obligations' as defined by regulators. Some studies even suggest practical ways to estimate the essentiality and desirability of services to be included under this umbrella.

The recent years have brought additional criticism of the current American universal service regulations and the way they are implemented through regulations aimed at increasing competition while enforcing coverage. For example, it was argued that in contrast to government expectations, universal service regulations have not led to a significant increase in telephone penetration because of the associated implementation cost (taxation) which distorts the market (Rosston & Wimmer, 2000). Furthermore, the FCC's objective of increased competition for enhancing service penetration has been criticized. It was suggested that greater competition is a dubious goal; consumer satisfaction is a better objective that can more effectively promote service penetration and use (Shugan, 2003). The notion that customer satisfaction is a central concept worth studying by regulators was further supported in other investigations (Turel & Serenko, 2006; Turel, Serenko, Detlor, Collan, Nam, & Puhakainen, 2006).

It may be socially just and desirable to include mobile telephony services in the "universal service" basket. The first step for regulators, however, would be to expand the universal service basket to include mobile telecommunications services. This may either be enforced by regulators or self-imposed by operators, should they understand the legal and ethical implications. With respect to legal outcomes, the elimination of customer discrimination based on their demographic or psychographic characteristics may potentially reduce future legal actions taken by individuals, consumer organizations, or authorities. For example, people living in areas with no or poor quality mobile services may sue service providers. With regards to ethical outcomes, providers may be held morally responsible if they deprive individuals their basic right for communication.

## CONCLUSION

So where should we go from here? The inclusion of mobile telephony in a more general definition of universal services is the first step that both businesses and regulators should take. This will allow individuals from different market segments to gain access to this important; some may say life-saving, technology, which allows individuals to become active contributing members of our society. This suggestion is in line with recent findings. For example, it has been found that (1) the poor typically use more expensive (prepaid) services to control their costs, and (2) affordability is an important predictor of mobile penetration, especially in the poor market segment, and as such, it has been suggested that priority should be placed on policies aimed at reducing the cost of mobile telephony for low-income groups (Barrantes et al., 2008). We echo these recommendations, but also provide a discussion about the means through which such recommendations can be implemented, namely market oriented universal service policies.

In terms of the Hurricane Katrina example discussed in beginning of this chapter, it is believed that if mobile telephony was offered as a universal service in New Orleans, more lower-income families may have had access to communication and more lives would have been saved during the disaster. In fact, wireless telephony requires less infrastructure than other communications means, including the Internet. Thus, it is infrastracturally efficient. It is a truly ubiquitous technology, available 24/7 that may be utilized for both every-day and emergency communication. Therefore, it is critical to ensure that people from various market segments may utilize it. This is why this issue has been perceived as important by academics and practitioners, as evident by the many papers that discuss this topic. It is hoped that further research will be conducted on this issue, and that regulators start embracing the idea of universal mobile telephony services.

## REFERENCES


Baake, P. (2002). Price caps, rate of return constraints and universal service obligations. *Journal of Regulatory Economics*, *21*(3), 289–304. doi:10.1023/A:1015312531833

Barrantes, R., & Galperin, H. (2008). Can the poor afford mobile telephony? *Evidence from Latin America. Telecommunications Policy*, *32*(8), 521–530. doi:10.1016/j.telpol.2008.06.002

Blackman, C. R. (1995). Universal Service - Obligation or Opportunity. *Telecommunications Policy*, *19*(3), 171–176. doi:10.1016/0308-5961(94)00020-S

Burkart, P. (2007). Moving targets: Introducing mobility into universal service obligations. *Telecommunications Policy*, *31*(3-4), 164–178. doi:10.1016/j.telpol.2007.01.002

Chaudhuri, A., Flamm, K. S., & Horrigan, J. (2005). An analysis of the determinants of internet access. *Telecommunications Policy*, *29*(9-10), 731–755. doi:10.1016/j.telpol.2005.07.001

Federal Communications Commission. (n.d.). *Universal service*. Retrieved August 20, 2006 from http://www.fcc.gov/wcb/universal_service/

Frieden, R. (1997). Widespread deployment of wireless telephony - Business, legal, regulatory and spectrum challenges. *Telecommunications Policy*, *21*(5), 451–459. doi:10.1016/S0308-5961(97)00020-7

Jain, R. (2006). Interconnection regulation in India: Lessons for developing countries. *Telecommunications Policy*, *30*(3-4), 183–200. doi:10.1016/j.telpol.2005.11.005

Melody, W. H. (1997). Policy objectives and models of regulation. In W. H. Melody (Ed.), *Telecom reform: Principles, policies and regulatory practices*, (1st ed.), (pp. 13-27). Lyngby, Denmark: Technical University of Denmark.

Mueller, M. L. (1997). *Universal Service: Competition, interconnection, and monopoly in the making of the American telephone system*. Cambridge, MA: MIT Press and AEI Press.

Navarro, J. (1996). Access technology for universal mobility. *Alcatel Telecommunications Review,* (3), 176-183.

Pitt, D., & Levine, N. (2004). Universal service and the future of regulation. *Telecommunications Policy*, *28*(3-4), 227–232. doi:10.1016/j.telpol.2004.01.003

Prieger, J. (1998). Universal service and the Telecommunications Act of 1996 - The fact after the act. *Telecommunications Policy*, *22*(1), 57–71. doi:10.1016/S0308-5961(97)00057-8

Rice, R. E., & Katz, J. E. (2003). Comparing internet and mobile phone usage: digital divides of usage, adoption, and dropouts. *Telecommunications Policy*, *27*(8-9), 597–623. doi:10.1016/S0308-5961(03)00068-5

Rosston, G. L., & Wimmer, B. S. (2000). The 'state' of universal service. *Information Economics and Policy*, *12*(3), 261–283. doi:10.1016/S0167-6245(00)00011-1

Schejter, A., Serenko, A., Turel, O., & Zahaf, M. (2010). Policy implications of market segmentation as a determinant of fixed-mobile service substitution: What it means for carriers and policy makers. *Telematics and Informatics*, *27*(1), 90–102. doi:10.1016/j.tele.2009.05.002

Shugan, S. M. (2003). Marketing perspectives on federal communications commission policies. *Journal of Public Policy & Marketing*, *22*(1), 35–40. doi:10.1509/jppm.22.1.35.17617

Turel, O., & Serenko, A. (2006). Satisfaction with mobile services in Canada: An empirical investigation. *Telecommunications Policy*, *30*(5-6), 314–331. doi:10.1016/j.telpol.2005.10.003

Turel, O., Serenko, A., Detlor, B., Collan, M., Nam, I., & Puhakainen, J. (2006). Investigating the determinants of satisfaction and usage of Mobile IT services in four countries. *Journal of Global Information Technology Management*, *9*(4), 6–27.

Valletti, T. M., Hoernig, S., & Barros, P. P. (2002). Universal service and entry: The role of uniform pricing and coverage constraints. *Journal of Regulatory Economics*, *21*(2), 169–190. doi:10.1023/A:1014387707275

Xavier, P. (1997). Universal service and public access in the networked society. *Telecommunications Policy*, *21*(9-10), 829–843. doi:10.1016/S0308-5961(97)00050-5

## KEY TERMS AND DEFINITIONS

**Federal Communications Commission (FCC):** The FCC is an independent agency of the United States government, created, directed, and empowered by Congressional statute, which regulates the telecommunications sector in the US.

**Government Regulation:** Government control over companies and consumer behaviors through rules, in order to produce outcomes which might not otherwise occur.

**Market Segmentation:** The process of classifying a collection of consumers into distinct sub-groups (segments) that behave in similar manners, share the same characteristics, or have similar needs.

**Mobile Phone:** Mobile phones are is a long-range, non-stationary, electronic device used for mobile voice and/or data communication over a wireless network which is comprised from a collection of transmission receiver base stations.

**Universal Service:** A legal and business concept used mostly in regulated industries.

Originating in the telecommunications sector of the United States, universal service refers to the practice of providing a baseline level of services to every resident of a country.

# Section 9
# Web Services and E–Business Process Integration

# Chapter 86
# Web Service Discovery, Composition, and Interoperability

**Duy Ngan Le**
*Nanyang Technological University (NTU), Singapore*

**Karel Mous**
*Nanyang Technological University (NTU), Singapore*

**Angela Goh**
*Nanyang Technological University (NTU), Singapore*

## ABSTRACT

*Web services have been employed in a wide range of applications and have become a key technology in developing business operations on the Web. In order to leverage on the use of Web services, Web service operations such as discovery, composition, and interoperability need to be fully supported. Several approaches have been proposed for each of these operations but these have advantages and disadvantages as well as varying levels of suitability for different applications. This leads to a motivation to explore and to compare current approaches as well as to highlight problems of the operations and their possible solutions. In this chapter, an introduction, a brief survey, problems and possible solutions to the three Web service operations mentioned above are discussed. The research opportunities and possible future directions on Web service are also presented.*

## INTRODUCTION

Web service is a software component representing a service which is deployed in the Web platform supporting automatic interaction between machines over a network. It has the following features: *platform independence, Internet scoped, loosely coupled,* and *support easy interaction*. As a result, Web services have been applied in various domains and have become a key technology on the Web. Current Web services based on Web Service Description Language (WSDL) (Walsh, 2002) are termed "non-semantic Web services" as they only

DOI: 10.4018/978-1-61520-611-7.ch086

support keywords to describe the services. This limitation prevents fully automatic discovery, composition, and interoperability. The reason for this shortcoming is the lack of semantic understanding. Semantic Web service (Honglei & Son, 2001) has been proposed to address this problem. Semantic Web service is a Web service that uses semantic Web technology (Berners-Lee, Hendler, & Lassila, 2001) to describe the service instead of using WSDL.

Web service *discovery, composition,* and *interoperability* are three most important operations which need to be fully supported to leverage the use of Web services. *Discovery* is a process that locates advertised Web services to satisfy a requested Web service's requirement. It is a very important function as the advertised Web services are useless if they are not discovered and so they may have never been used. In case a single Web service cannot satisfy the requirement, multiple Web services are *composed* to satisfy the requirement. After Web services are discovered or composed, they need to perform the *invocation* function which leads to *interoperability* issue to execute the services. Since the three functions are important, many approaches have been proposed to support the functions. This serves as the motivation of this chapter to point out the advantages and disadvantages of each approach.

The aim of this chapter is to present the state of the art of the Web services *discovery, composition,* and *interoperability*. The core technologies involve in the semantic Web service model including WSDL, semantic Web service, ontologies, SOAP, and UDDI (OASIS). WSDL (Walsh, 2002) is an XML format for describing network services as a set of endpoints operating on messages containing either document-oriented or procedure-oriented information. Semantic Web service is a Web service that uses semantic Web technology to describe the service instead of using syntactic technology such as Web Service Description Language. Ontologies (Gruber, 1993) is a formal representation of a set of concepts within a domain and the relationships between those concepts. SOAP (Walsh, 2002) is a protocol specification for exchanging structured information in the implementation of Web Services in computer networks. UDDI (OASIS) is a platform-independent, Extensible Markup Language (XML)-based registry for businesses worldwide to list themselves on the Internet.

The chapter first starts with the background and a brief survey of the activities. It next presents the current problems and possible solutions to solve the problems. Possible directions of Web services are also discussed, followed by the conclusion and some additional references for further reading as well as key word definitions in Web service research.

## BACKGROUND

The Web service model is represented in figure 1 showing, the interaction between *a service requester, service providers,* and *a service registry* which is a Web service discovery system (Fensel & Bussler, 2002). The three components interact with each other via *publishing, discovery,* and *binding operations*. This section will introduce the background and a brief survey of operations including discovery and composition which are for Web service discovery purpose and interoperability which is for Web service invocation purpose.

The core technologies involve in the semantic Web service model including WSDL, semantic Web service, ontologies, SOAP, and UDDI (OASIS). WSDL (Walsh, 2002) is an XML format for describing network services as a set of endpoints operating on messages containing either document-oriented or procedure-oriented information. Semantic Web service is a Web service that uses semantic Web technology to describe the service instead of using syntactic technology such as Web Service Description Language. Ontologies (Gruber, 1993) is a formal representation of a set of concepts within a domain and the relationships

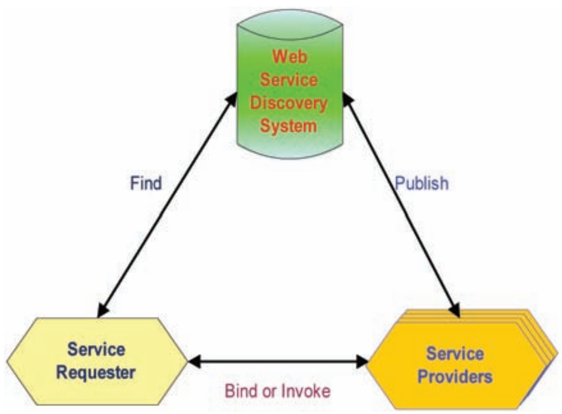



*Figure 1. Web service model*

between those concepts. SOAP (Walsh, 2002) is a protocol specification for exchanging structured information in the implementation of Web Services in computer networks. UDDI (OASIS) is a platform-independent, Extensible Markup Language (XML)-based registry for businesses worldwide to list themselves on the Internet.

## Web Service Discovery

Web service discovery is a process that locates advertised Web services to satisfy a requested Web service's requirement. It is widely used in workflow, e-learning, and e-business systems such as e-supply chain, e-manufacturing, etc. Non-semantic web services (that is, Web services described by WSDL) can be discovered using UDDI (Walsh, 2002). For discovering semantic Web services, several semantic Web service discovery systems have been proposed. Figure 2 presents a taxonomy of Web service discovery systems.

Web service discovery systems can be classified into systems for matching semantic web services and systems for matching non-semantic web services. The semantic web service discovery systems include systems that support matching web services using different ontologies and systems that support matching web services using the same ontology. There are three main approaches for matching semantic web services using the same ontology, namely, dividing matching process into several stages, matching two profiles directly and supporting UDDI. Different approaches having different advantages and disadvantages. When designing a web service discovery system, the main problem of dynamic matchmaking in the Internet, namely the trade-off between performance and quality of matching should be borne in mind. A more details of the survey can be found in (Le, Goh, & Cao, 2007).

## Web Service Composition

Web service discovery locates single advertised Web service to meet a requester's requirement. However, in case no single Web service matches

*Figure 2. Taxonomy of web service discovery systems*

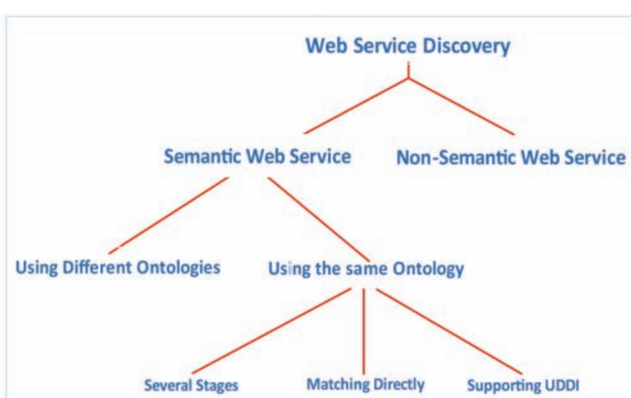
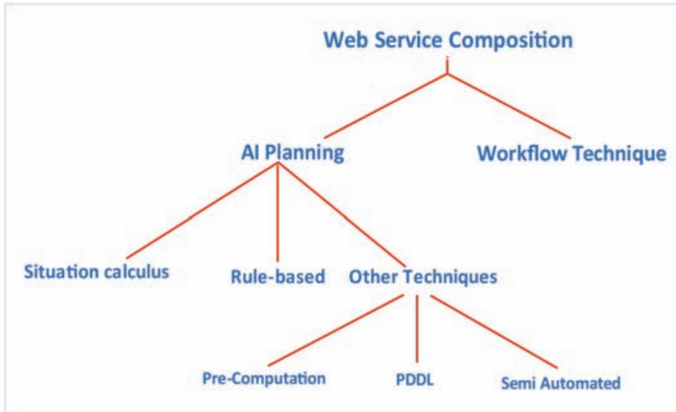


*Figure 3. Taxonomy of web service composition systems*




the requirement, a composition of more than one Web service may be able to satisfy the requirement. Web service composition is a process that combines *all* or *some* Web services, to accomplish a determined goal. Several approaches have been proposed to meet the need. Figure 2 presents the taxonomy of Web service composition approaches.

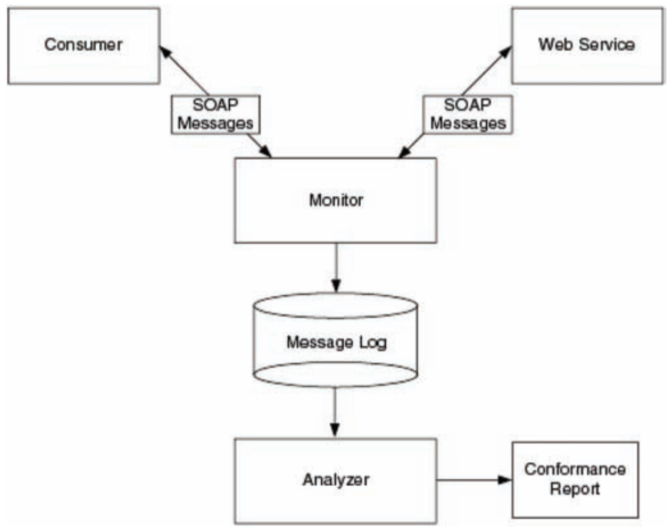
Web service composition approaches can be divided into *Workflow* approach and *AI (Artificial Intelligence) planning* approach. In a Workflow based approach, where a composed requested Web services is predefined, advertised Web Services are matched against single requested Web services. This approach lacks a dynamic aspect. In contrast, AI planning approaches are dynamic, by using only inputs and outputs of Web services. However, AI planning sometimes result in a meaningless composition. That is, even though the input/output matches, the composed Web service may not represent a meaningful function. AI planning approaches can be further classified into situation calculus(Wu, Sirin, Parsia, Hendler, & Nau, 2003); rule based planning(Medjahed, Bouguettaya, & Elmagarmid, 2003), and other approaches which include pre-computation(Kwon, Park, Lee, & Lee, 2007; Lecue & Leger, 2006a, 2006b), PDDL (Planning Domain Definition Language), and semi-automatic(Sirin, Parsia, & Hendler, 2004).

## Web Service Invocation

After discovery and composition, the next stage will execute the services, if the advertised services are found. In other words, the invocation function is invoked. Web services interoperability provides a facility to ensure that communication between Web services is across multiple applications, operating systems, and platforms. Web Services Interoperability Organization (WS-I)[1] was formed to meet the requirement.

WS-I defines interoperability between Web services via a 'Basic Profile' which consists of a set of constraints and guidelines that help developers write interoperable Web services. The Profile only supports 'syntactic Web service' since it uses WSDL to enable the description of services as sets of endpoints operating on messages. The WS-I proposed two tools, a monitor and an analyzer, which are employed in conjunction with each other for evaluating if a Web service follows the Basic Profile guidelines as presented in figure 4. The monitor captures and logs the messages between Web services and users.

*Figure 4. WSI Test model*[2]




## WEB SERVICE PROBLEMS AND SOLUTIONS

This section discusses problems on Web service discovery, composition, and interoperability, followed by initiatives to tackle the problems.

### Web Service Activity Problems

**Web service discovery:** Each discovery system only supports one particular description language while a Web service can be described by different languages and ontologies. However, two Web services described by two different languages or ontologies can be matched. In other words, two Web services maybe perform the same function. This leads to a mismatching problem in current discovery systems. In particular, the limitations of current approaches include the failure to *match semantic Web services against non-semantic Web services*, *match semantic Web services using different description languages*, and *match semantic Web services using distinct ontologies.*

**Web service composition:** Current Web Service composition approaches do not always enact realistic business processes. *AI planning* based approach composed inputs and outputs advertised services based on the '*best matches*' between the inputs and outputs. The matching process will terminate when the input and output of the requested Web service are matched against the input and output of the composed Web services. This result in a composition does not guarantee a meaningful solution from a business point of view. In contrast, *Workflow* based approach does result in business process being enacted as the business process is predefined. However, the approach borders more on choreography then on dynamic composition.

**Web service interoperability:** Although Web services are based on XML to describe SOAP and WSDL, there are still interoperability problems which are related to the communication between Web services. These problems are caused by the descriptions of SOAP messages and WSDL specifications because of the complexity, the extensibility, and different schema between SOAP messages and WSDL specifications. Moreover, the supporting multiple programming languages are also a problem since different languages may have different data type definitions. These problems have been addressed by Web Services Interoperability (WS-I) Organization. As mentioned, WS-I *Basic Profile* has been created to enable the interoperability among Web services. However, despite the WS-I efforts, interoperability errors in the area of Web Services are still found when a developer uses certain tools or implementations of new Web Services specifications.

## Initiatives

A brief overview of our proposal to tackle the above three problems is given below:

**Web service discovery:** A Web service is described by any languages including input, output, precondition, and post condition which are called a functional description. The core of discovery Web services is a matching process which is based on the functional descriptions. Therefore, whatever language is used, the information is extracted and matched in order to tackle the three problems related to the specification languages. Matching is usually done with input and output of the two Web services by measuring the similarities between inputs and outputs. The similarity is based on *syntactic* or *semantic* measures depending on particular applications. Precondition and post condition can also be used but they are not used significantly currently since the lack of maturity in this area has led to low usage of these features.

**Web service composition:** *Workflow* based and AI *Planning* based approaches have pros and cons. This leads to a need for a hybrid approach which exploits the advantages of the two approaches. A proposed hybrid approach takes the Object Managements Group (OMG)'s Model Driven Architecture (MDA) (Miller et al., 2001) as a starting point. A *Workflow* is described in the form of executable tasks with their respective goals. The goals of the tasks, together with the input, output and states of the tasks, are then translated to a Web Service Modelling Ontology (WSMO) profile. Based on the WSMO profile (Sapkota, Kilgarrif, Moyano, Toma, & Krummenacher, 2005) *AI Planning* techniques can then be employed to create a Web Service Composition to implement a described task within the described workflow. The approach takes into consideration that some tasks within a Workflow must be executed by the same party.

**Web service interoperability**: Much effort is still needed for the Web services community to gain the goal of the real interoperability. An initiative is *using Business Process Execution Language for Web Services* (BPEL4WS) (Andrews et al., 2007) and *Web Service Choreography Interface* (WSCI)[3] as two Web services flow representations so that a middle layer is created to hide the difference between those two specifications. This middle layer could become a WS-I Basic Profile for Web services interoperation. Web services is a specification with inputs and outputs. Hence, mathematical foundation of Web services interoperability could be proposed to model the system interaction behaviour based on the interface descriptions.

# FUTURE RESEARCH DIRECTIONS

This section discusses on possible trends and directions of Web services. Web services are likely to follow the three trends: *Cloud computing, Grid service,* and *semantic Web service*.

## Cloud Computing

*Cloud computing* is known as 'Software as a Service' (SaaS) which has the potential to transform the way information technology becomes providers of computing services. The emergence of SaaS as an effective software-delivery mechanism creates an opportunity to change the focus from deploying and supporting applications to managing the services that those applications provide. Cloud computing has the following advantages: leveraging existing assets, service communication capabilities, dynamic connectivity capabilities.

## Grid Services

The Open Grid Services Architecture (OGSA) represents an evolution towards a Grid system architecture based on Web services concepts and technologies. A Grid service is simply a Web service that conforms to a particular set of conventions. Grid services have the following advantages to compare with Web services: a base set of service capabilities, including rich discovery facilities, and 'state of the services' with lifetime management as Web services do not have state.

## Semantic Web Services

Semantic Web is considered as the next generation of the Web. Applying the semantic Web technology to Web services make the Web services 'more intelligent' and therefore, the services will be fully supported by functions including discovery, composition, invocation, and monitoring. If Semantic Web service is successful, it is likely to become a 'new wave' in the Internet technology.

# CONCLUSION

The chapter focuses on Web service operations, their problems and initiatives as well as possible trends of Web services in the future. Web service operations including discovery, composition, and interoperation were introduced. Their current problems and possible solutions were also discussed. The future of web services are related to the work carried out in cloud computing, grid computing and the semantic web. There is therefore a large scope of work to be carried out in the research community.

# REFERENCES

Andrews, T., Curbera, F., Dholakia, H., Goland, Y., Klein, J., Leymann, F., et al. (2007). *Business Process Execution Language For Web Services Version 2.0. Ws-Bpel Tc Oasis*.

Berners-Lee, T., Hendler, J., & Lassila, O. (2001). The Semantic Web. *Scientific American*, *284*(5), 34–43. doi:10.1038/scientificamerican0501-34

Fensel, D., & Bussler, C. (2002). *The Web Service Modeling Framework Wsmf.* Paper Presented At The Electronic Commerce Research And Applications.

Gruber, T. R. (1993). *A Translation Approach To Portable Ontology Specifications.* New York: Academic Press.

Honglei, Z., & Son, T. C. (2001). Semantic Web Services. *Intelligent Systems (Ieee)*, *16*, 46–53.

Kwon, J., Park, K., Lee, D., & Lee, S. (2007). *PSR: Pre-Computing Solutions In Rdbms For Fastweb Services Composition Search.* Paper Presented At The Web Services, 2007. Icws 2007. Ieee International Conference On.

Le, D. N., Goh, A. E. S., & Cao, H. T. (2007). A Survey And A Taxonomy Of Web Service Discovery Systems. *The International Journal Of Information Technology And Web Engineering*.

Lecue, F., & Leger, A. (2006a). *A Formal Model For Semantic Web Service Composition*. Athens, GA.

Lecue, F., & Leger, A. (2006b). *Semantic Web Service Composition Based On A Closed World Assumption*. Zurich, Switzerland.

Medjahed, B., Bouguettaya, A., & Elmagarmid, A. (2003). Composing Web Services On The Semantic Web. *The Vldb Journal The International Journal On Very Large Data Bases*, *12*(4), 333–351. doi:10.1007/s00778-003-0101-5

Miller, J., Mukerji, J., Burt, C., Dsouza, D., Duddy, K., Kaim El, W., Et Al. (2001). *Model Driven Architecture (Mda)*.

Oasis. (n.d.). Uddi - Universal Description, Discovery And Integration. In *Organization*.

Sapkota, B., Kilgarrif, E., Moyano, F. J. M.-R., Toma, I., & Krummenacher, R. (2005). *D21.V0.1 Wsmx Triple-Space Computing*, Wsmo Working Draft.

Sirin, E., Parsia, B., & Hendler, J. (2004). Filtering And Selecting Semantic Web Services With Interactive Composition Techniques. *Intelligent Systems*, *19*(4), 42–49. doi:10.1109/MIS.2004.27

Walsh, A. E. (2002). *Uddi, Soap, And Wsdl: The Web Services Specification,* (1st Ed.). Upper Saddle River, NJ: Pearson Education.

Wu, D., Sirin, E., Parsia, B., Hendler, J., & Nau, D. (2003). *Automatic Web Services Composition Using Shop2*. Paper Presented At The Workshop On Planning For Web Services.

## ADDITIONAL READING

Andrews, T., Curbera, F., Dholakia, H., Goland, Y., Klein, J., Leymann, F., et al. (2002). Business Process Execution Language for Web Services Version 1.0. WS-BPEL TC OASIS.

Arafah, M. A., Al-Harbi, H. S., & Bakry, S. H. (2007). Grid computing: a STOPE view. *International Journal of Network Management*, *17*(4), 295–305. doi:10.1002/nem.634

Baader, F., Calvanese, D., Mcguinness, D., Nardi, D., & Patel-Scheneider, P. (2003). *The Description Logic Handbook: Theory, Implementation and Applications*: Cambridge University Press.

Bayardo, R., Bohrer, W., Brice, R., Cichocki, A., Fowler, G., Helal, A., et al. (1997). *InfoSleuth: agent-based semantic integration of information in open and dynamic environments.* Paper presented at the Proceedings of the 1997 ACM International Conference on the Management of Data (SIGMOD), Tucson, Arizona, United States.

Benatallah, B., Hacid, M. S., Leger, A., Rey, C., & Toumani, F. (2005). On automating Web services discovery. *The VLDB Journal — The International Journal on Very Large Data Bases, 14*(1), 84-96.

Berman F, F. G., Hey T. (2003). The grid: past, present, future. *Grid Computing: Making the Global Infrastructure a Reality*, 9-50.

Cardoso, J., & Sheth, A. (2003). Semantic e-Workflow Composition. *Journal of Intelligent Information Systems*, *21*(3), 191–225. doi:10.1023/A:1025542915514

Carroll, J. J. (2002). *Matching RDF graphs.* Paper presented at the First International Semantic Web Conference on The Semantic Web, Sardinia, Italy.

Chaudhri, V. K., Farquhar, A., Fikes, R., Karp, P. D., & Rice, J. P. (1998). *OKBC: A programmatic foundation for knowledge base interoperability.* Paper presented at the the 15th National Conference on Artificial Intelligence (AAAI-98) and of the 10th Conference on Innovative Applications of Artificial Intelligence (IAAI-98).

Cohen, W. W. (2000). Data integration using similarity joins and a word-based information representation language. *ACM Transactions on Information Systems*, *18*(3), 288–321. doi:10.1145/352595.352598

Cui, Z., & O'Brien, P. *Domain Ontology Management Environment.* Paper presented at the In Proceedings of the 33rd Hawaii International Conference on System Sciences - 2000, Hawaii, USA.

David, E., Losada, & Barreiro, A. (2003). Embedding term similarity and inverse document frequency into a logical model of information retrieval. *Journal of the American Society for Information Science and Technology*, *54*(4), 285–301. doi:10.1002/asi.10209

Doan, A. H., Madhavan, J., Dahamankar, R., Domingos, P., & Halevy, A. (2003). Learning to match Ontologies on the semantic web. *The VLDB Journal*, *12*(4), 303–319. doi:10.1007/s00778-003-0104-2

Farquhar, A., Fikes, R., & Rice, J. (1997). The Ontolingua Server: A Tool for Collaborative Ontology Construction. *International Journal of Human-Computer Studies*, *46*(6), 707–727. doi:10.1006/ijhc.1996.0121

Gagnes, T., Plagemann, T., & Munthe-Kaas, E. (2006). *A Conceptual Service Discovery Architecture for Semantic Web Services in Dynamic Environments.* Paper presented at the The 22nd International Conference on Data Engineering, Georgia, USA.

Hayashi, H. (2005). *eScience Meets eBusiness: Blueprint for Next Generation Grid Computing*. Paper presented at the Proceedings of 25th IEEE International Conference on Distributed Computing Systems ICDCS 2005

Hayes, B. (2008). Cloud computing. *Communications of the ACM*, *51*(7), 9–11. doi:10.1145/1364782.1364786

Heflin, J., & Pan, Z. (2004). *A Model Theoretic Semantics for Ontology Versioning.* Paper presented at the Semantic Web - ISWC 2004: Third International Semantic Web Conference, Hiroshima, Japan.

Oh, J. Y., Jung, J.-y., Cho, N. W., Kim, H., & Kang, S.-H. (2005). Integrated Process Modeling for Dynamic B2B Collaboration. In *Knowledge-Based Intelligent Information and Engineering Systems* (pp. 602-608).

Ouyang, C., Dumas, M., Hofstede, A. H. M. t., & Aalst, W. M. P. d. (2006). *From BPMN Process Models to BPEL Web Services.* Paper presented at the ICWS - EEE International Conference on Web Services, Chicago, USA.

Smari, W. W., Donepudi, S., Seung-yun, K., & McQuay, W. K. (2006). *Efficient Handling of Changes in Dynamic Workflow Systems.* Paper presented at the Collaborative Technologies and Systems, 2006. CTS 2006. International Symposium on.

Sun, W., Zhang, K., Chen, S.-K., Zhang, X., & Liang, H. (2008). *Software as a Service: An Integration Perspective* Springer Berlin / Heidelberg.

Turner, M., Budgen, D., & Brereton, P. (2003). Turning software into a service. *Computer*, *36*(10), 38–44. doi:10.1109/MC.2003.1236470

White, S. (2004). Process Modeling Notations and Workflow Patterns. *Workflow Handbook*, 265–294.

Yu, S., Liu, J., & Le, J. (2004). *Decentralized Web Service Organization Combining Semantic Web and Peer to Peer Computing.* Paper presented at the European Conference on Web Services ECOWS 2004, Erfurt, Germany.

## KEY TERMS AND DEFINITIONS

**AI Planning Based Web Service Composition:** is an approach to Web Service Composition based on a determined start and end state of a service function.

**Semantic Web Service:** is a Web service that uses semantic Web technology to describe the service instead of using syntactic technology such as Web Service Description Language.

**The Semantic Web:** is an extension of the current World Wide Web through the use of semantic technology to describe the Web so that it can be both understood by humans and interpreted automatically by machines.

**Web Service Composition:** is a process that combines the total or partial function of multiple web services, to accomplish a determined goal.

**Web Service Discovery:** is a process that locates advertised Web services to satisfy a requested Web service's requirement

**Web Service Invocation:** is an action whereby a Web service is invoked to carry out its function

**Web Service:** is a software component representing a service which is deployed in the Web platform supporting automatic interaction between machines over a network.

## ENDNOTES

1. Web Services Interoperability Organization *(WS-I):* www.ws-i.org/
2. Microsoft MSDN Corp: http://msdn.microsoft.com/en-us/library/ms953973.aspx
3. www.w3.org/TR/***wsci/***

# Chapter 87
# Case Based Web Services

**Zhaohao Sun**
*University of Ballarat, Australia*

**Gavin Finnie**
*Bond University, Australia*

**John Yearwood**
*University of Ballarat, Australia*

## INTRODUCTION

Web services are Internet-based application components published using standard interface description languages and universally available via uniform communication protocols (Singh & Huhns, 2005). Web services can be also considered the provision of services over electronic networks such as the Internet and wireless networks (Rust & Kannan, 2003). Web services is a new computing paradigm that has drawn increasing attention in information technology (Deitel, et al, 2004, p.13), information systems, and is playing a pivotal role in service computing and service intelligence (Singh & Huhns, 2005). Web services is a new business paradigm that is playing an important role in e-business, e-commerce and business intelligence (Wang, et al, 2006). The key motive for the rapid development of web services is the ability to discover services that fulfil users' demands, negotiate service contracts and have the services delivered where and when the users request them (Tang, et al, 2007). The current research trend is to add intelligent techniques to web services to facilitate discovery, invocation, composition, and recommendation of web services (Wang, et al, 2006).

Case-based reasoning (CBR) is an artificial intelligence technique that solves problems by reasoning from a case base of previously solved cases, either by finding an exact solution to a previously solved problem or by adapting one or more past solutions (Kolodner, 1994). The most similar set of cases to the current problem will be extracted from

DOI: 10.4018/978-1-61520-611-7.ch087

the case base (Sun & Finnie, 2004). CBR as an intelligent technique has found many successful applications in e-business (Sun & Finnie, 2004) and web services (Lu, et al, 2007), especially in service retrieval, discovery, brokering, composition and recommendation of web services (Yao, 2006). For example, Ladner et al (2008) use a case-based classifier for web services discovery. However, what is the relationship between CBR and web services? How can CBR be applied to the main activities of a web service lifecycle? These problems still remain open. This article will address the above mentioned problems by proposing a unified CBR approach for the main activities of the web service lifecycle. To this end, the remainder of this article is organized as follows: It first looks at web service lifecycle from a requester's demand perspective. Then it proposes CWSR: a case-based web service reasoner. It examines the correspondence relationship between web services and CBR and provides a unified treatment for case-based web service discovery, composition and recommendation. It also looks at some future research directions. The final section ends the article with some concluding remarks and future work.

## WEB SERVICE LIFECYCLE: A WEB SERVICE REQUESTER'S PERSPECTIVE

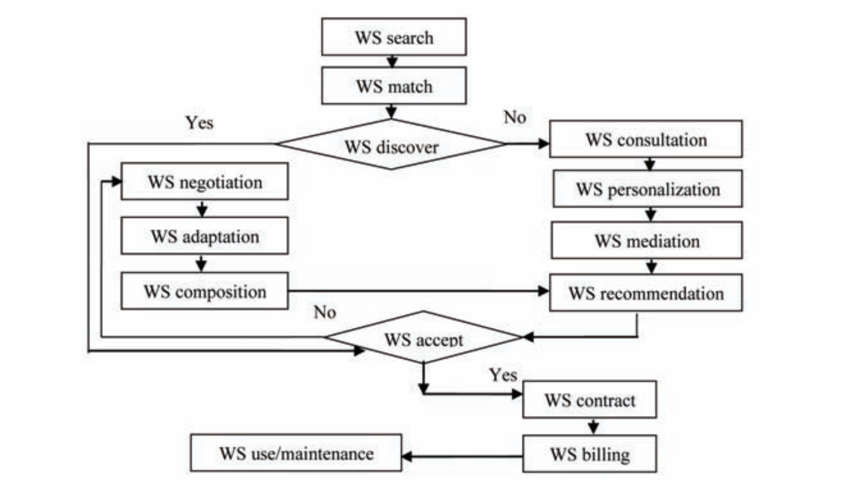
From the perspective of computer science (Pressman, 2001), the software development lifecycle (SDLC) describes the life of a software product from its conception, to its implementation, delivery, use, and maintenance (Pfleeger & Atlee, 2006). A traditional SDLC mainly consists of seven stages: planning, requirements analysis, systems design, coding, testing, delivery and maintenance. Based on this, a web service lifecycle (WSLC) consists of the start of a web service (WS) request (He, et al, 2004) and the end of the WS transaction as well as its evolutionary stages that transform a web service from the start of the request to the end of the transaction.

There have been many attempts to address the WSLC in the web service community. For example, Sheth (2003) proposes a semantic web process lifecycle that consists of web description, discovery, composition and execution or orchestration. Zhang and Jeckle (2003) propose a WSLC that consists of WS modelling, development, publishing, discovery, composition, collaboration, monitoring and analytical control from a perspective of developers. Kwon (2003) proposes a WSLC consisting of four fundamental steps: WS identification, creation, use and maintenance. Narendra and Orriens (2006) consider the WSLC consisting of WS composition, execution, midstream adaptation, and re-execution. Tsalgatidou and Pilioura (2002) propose a WSLC consisting of two different layers: a basic layer and a value-added layer. The former contains WS creation, description, publishing, discovery, invocation and unpublishing. The latter contains the value-added activities of composition, security, brokering, reliability, billing, monitoring, transaction handling and contracting. They acknowledge that some of these activities take place at the WS requester's site, whereas others take place at the WS broker's or provider's site. However, they have not classified the proposed activities based on the WS requester, provider, and broker in detail.

Demand is an important factor for market and economy development (Jackson & McIver, 2004). The demand of WS requesters or customers is the significant force for promoting the research and development of web services. In what follows, we will examine a WSLC from a WS requester's demand perspective.

As a WS requester, he (for brevity, we use he to represent she or he) usually searches, matches web services to meet his demands. For example, if he

*Figure 1. A requester's demand-driven web service lifecycle*




pays the car registration fee to VicRoad, Australia, he uses Google to search and match "VicRoad" and its web services for car registration. After he discovers a web service that meets his demands, he can pay his registration fee online. Based on this consideration, we can see that WS search, matching and discovery (Ladner, 2008; Tang, 2007) are the common demands of ordinary customers for web services. However, if the service requester cannot discover a satisfactory web service by himself, he has to ask an intermediary or agent for help with providing consultation, mediation and recommendation of WS to her/him. If the agent recommends some web services to the requester after consultation and mediation, the requester accepts one of the recommended WS after evaluation, the WS consultation, mediation (Ladner, 2008) and recommendation are completed. Otherwise, the requester asks the agent to compose the web services to meet his demands. In this case, the agent will negotiate with the requester over the price for composing web services, because he needs WS adaptation. After a successful negotiation, the agent recommends the composite WS to the requester. If the requester accepts the recommended composite WS, then WS composition, adaptation, mediation and recommendation are successful. In practice, the requester also demands personalization, contracting and billing for commercial WS. Therefore, we can illustrate a demand-driven WSLC for WS requesters using Figure 1. This WSLC consists of many activities of web services such as WS search, matching, discovery, adaptation, use/reuse, consultation, personalization, composition, recommendation, negotiation, contracting and billing. All of these have drawn some attention in web services (Singh & Huhns, 2005). In what follows, we only review web service discovery, composition and recommendation in some detail.

Web service (WS) discovery is a process of finding the most appropriate web service for a WS requester (Singh & Huhns, 2005). It identifies a new web service and detects an update to a previously discovered web service (Ladner, 2008). There have been a variety of techniques developed for WS discovery. For example, OWL-S (of W3C) provides classes that describe what the service does, how to ask for the service, what happens when the service is carried out, and how the service can be accessed (Ladner, 2008).

Web service (WS) composition primarily

concerns requests of WS users that cannot be satisfied by any available web services (Narendra & Orriens, 2006). WS composition also refers to the process of creating personalized services from existing services by a process of dynamic discovery, integration and execution of those services in order to satisfy user requirements (Limthanmaphon & Zhang, 2003). WS composition is an important topic for service computing, because composing web services to meet the requirement of the WS requester is one of the most important issues for WS providers and brokers.

Web service (WS) recommendation aims to help WS requesters with selecting web services more suitable to their needs (Lorenzi & Ricci, 2005). WS recommendation can be improved through optimization, analysis, forecasting, reasoning and simulation (Kwon, 2003). Recommender systems have been studied and developed in e-commerce, e-business and multiagent systems (Lorenzi & Ricci, 2005; Sun & Finnie, 2005). Sun and Lau (2007) examine case based web service recommendation. However, how to integrate WS discovery, composition, and recommendation in a unified way is still a big issue for web services. This article will address this issue in later section in more detail.

## CWSR: A CASE BASED WEB SERVICES REASONER

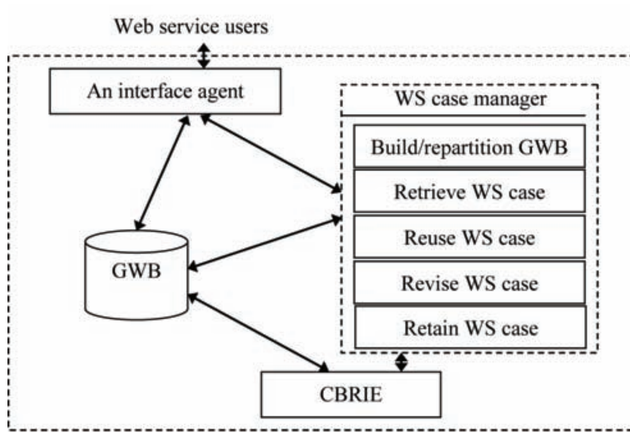
Case-based reasoning (CBR) is a reasoning paradigm based on previous experiences or cases; that is, a CBR system solves new problems by adapting solutions that were used to successfully solve old problems (Ladner, 2008; Sun & Finnie, 2005). Ladner et al (2008) use case-based classification for WS discovery by applying CBR to supervised classification tasks. Kwon (2003) examines how to find the most similar WS case among cases using CBR. Limthanmaphon and Zhang (2003) examine composition of web services using CBR and present a model of web service composition. CBR has been successful in making recommendation of business activities such as in e-commerce to recommend different e-services with high quality of service (QoS) (Sun & Finnie, 2005; Wang & Zhang, 2007). However, how to discover, compose and recommend web services in a unified way remains open for CBR research. To address this issue, we first propose a case based web services reasoner: CWSR. The system architecture of the CWSR mainly consists of an interface agent, a global web service base (GWB), a WS base manager and a CBR inference engine (CBRIE), as shown in Figure 2. The interface agent consists of some kinds of natural language processing systems that allow the user to interact with the web service strategies (Sun & Lau, 2007). The GWB consists of all the WS cases that the system collects periodically and new web service cases discovered when the system is running. The WS base manager is responsible for WS case retrieval, reuse, revise and retention. The CBRIE consists of the mechanism for manipulating the WS cases in GWB to infer web service X based on CBR (where X denotes discovery, composition, recommendation, etc) requested by the user. In order to implement the system architecture of the CWSR, we discuss why CBR can be applied in web services in the next section.

### Web Services vs Case Based Reasoning

This section provides a correspondence relationship between the main activities of CBR and those of web services.

A case in CBR can be denoted as $c = (p, q)$, where $p$ is the structured problem description and $q$ is the solution description (Sun & Finnie, 2005). In web services, a service case base stores the collection of service cases (Limthanmaphon & Zhang, 2003). A service case, $w = (d, s)$, consists of the service description $d$ and its service solution $s$ as well as other information including functionally dependency among web services (Kwon, 2003).

*Figure 2. A general architecture of the CWSR*




The service description corresponds to the requirement of the service user, while the service solution corresponds to the answer to the requirement. In this way, a WS case in web services corresponds to a case in CBR.

When service definitions change or new providers and services are registered within the web services platform such as CWSR, the services need to be adaptive to the change in the environment with minimal user intervention, in order to manage and even take advantage of the frequent changes in the service environment (Dustdar & Schreiner, 2005). In other words, WS adaptation is necessary for web services. In fact, case retrieval, reuse, revise (adaptation) and retention constitute the basic activities of CBR (Sun & Finnie, 2005). WS retrieval (search), reuse, adaptation, and retention in web services can then correspond to the activities of CBR. Therefore, CBR can be used for processing WS retrieval, reuse, adaptation, and retention. This implies that CBR is naturally applicable to web services. This is why CBR has been successfully applied to WS discovery, search and matching (Ladner, 2008). It is significant to apply CBR to the activities of web services such as service discovery, composition and recommendation, which will be examined in the next section.

## A UNIFIED TREATMENT OF CASE BASED WEB SERVICES

This section provides a unified treatment for case based web services in a context of the CWSR, based on the previously mentioned requester's demand-driven WSLC.

The WS user's demand is normalized into a structured service description *p*'. Then the CWSR uses its similarity metric mechanism to retrieve from its GWB, which consists of service cases, each of them is denoted as $c=(p,q)$, where *p* is the structured service description and *q* is the service solution description. The inference engine of the CWSR performs similarity-based reasoning that can be formalized as (Finnie & Sun, 2004):

$$\frac{P', P' \approx P, P \to Q, Q \approx Q'}{\therefore Q'} \tag{1}$$

where *P*, *P'*, *Q*, and *Q'* represent fuzzy compound propositions, $P' \approx P$ means that *P* and *P'* are similar. *Q* and *Q'* are also similar.

The service case retrieval process from WS search and matching is used to discover the following service cases from the GWB in the CWSR (Finnie & Sun, 2005):

$$C(p')=\{c|c=(p,q),p\approx p'\}=\{c_1,c_2,\ldots,c_n\} \quad (2)$$

This is the result of *case based web service discovery*, where $n$ is a positive integer, $c_i$, $i = 1, 2, \ldots, n$ are all service cases with their demand description $p$ similar to the current demand description $p'$. Usually, $C(p')=\{c_1,c_2,\ldots,c_n\}$ satisfies the following property: for any integer $i$, $1\leq i<n$ and $c_i=(p_i,q_i)$,

$$s(p_i,p')\geq s(p_{i+1},p') \quad (3)$$

where $s(.)$ is a similarity metric, which measures the similarity between one service demand and another.

If $n$ is small, the CWSR will directly recommend the WS solutions of $\{c_1,c_2,\ldots,c_n\}$, $\{q_1,q_2,\ldots,q_m\}$, to the WS requester through the interface agent. If $n$ is very large, the CWSR will recommend the WS solutions of the first $m$ cases of $\{c_1,c_2,\ldots,c_n\}$; that is, $\{q_1,q_2,\ldots,q_m\}$, to the requester, where $1\leq m<n$. This process is *case-based web service recommendation* (Sun & Lau, 2007).

After obtaining the recommended web services from the CWSR, the WS requester will evaluate them and select one of the following:

1. Accept one of the recommended web services, $q_k$, and contract it, where $1\leq k\leq m$.
2. Adjust his demand descriptions $p'$ and then send them to the CWSR.
3. Reject the recommended e-services and leave the CWSR.

It is obvious that only the first two of these three choices require further discussion. For the first choice, the deal was successfully done and the CWSR routinely updates the service case $c_k=(p_k,q_k)$ in the GWB. At the same time, the CWSR has reused the service case successfully; that is, CWSR completes the process of *case-based web service use* and *reuse*. For the second choice, the demand adjustment is the process of demand adaptation that corresponds to problem adaptation (Sun & Finnie, 2005). After having adjusted the demand, the requester submits it to the CWSR, which will conduct WS retrieval, recommendation and reuse again. This process is *case-based web service adaptation*.

If the WS adaptation is unsuccessful, the CWSR has to conduct *case based web service composition*. Assume that the WS requester's demand is normalized into a structured service description and service solution description $c=(p',q')$, and the CWSR has discovered $m$ web services $\{c_1,c_2,\ldots,c_m\}$ (where $m$ is the least positive number) such that

$$p'\subseteq p_1\cup p_2\cup\ldots\cup p_m \text{ and } q'\subseteq q_1\cup q_2\cup\ldots\cup q_m \quad (4)$$

where $\cup$ is the union operation of the set theory. This is a necessary condition for case based web service composition. Based on (4), the composite web service case $c=(p,q)$ is obtained through *case based web service composition* of the CWSR:

$$p=p_1\oplus p_2\oplus\ldots\oplus p_m \text{ and } q=q_1\otimes q_2\otimes\ldots\otimes q_m \quad (5)$$

where $\oplus$ and $\otimes$ are composition operations for web services. For example, when they are replaced by the ordinary (or fuzzy) union operation of set theory, the composite web service is the same as that discussed in DIANE (Küster, 2007) or similar to the composite web service in (Kwon, 2003). When they are replaced by the "independence" operation taking into account interdependent relationships among the services, the composite service is similar to that discussed in (Limthanmaphon & Zhang, 2003). However, it is still a big issue for case based WS composition to use a more sophisticated composition operation to obtain a composite service case, although service composition can be either performed by composing elementary or composite services (Dustdar & Schreiner, 2005).

After obtaining a composite service case, the CWSR will recommend it to the WS requester for acceptance. This goes to the early mentioned process for acceptance, adaptation or rejection.

So far, we have discussed case-based WS retrieval, discovery, adaptation, reuse, composition and recommendation in a unified way.

## FUTURE RESEARCH DIRECTIONS

Applying intelligent techniques to web services is significant for the research and development of business intelligence, web services and service computing. We have argued that CBR as an intelligent technology can be applied to many activities of web services. There are at least four future research directions towards the engineering and management of case based web services. The first future research direction is how to engineer the web service cases and automate the process stages of the requester's demand-driven web service lifecycle based on the existing technologies of data engineering and case engineering. The second future research direction is how to manage huge, heterogeneous web service cases. One intelligent technology cannot be used to automate all activities of web services. Then, the third research direction is how to use hybrid intelligent techniques to provide an integrated solution to web services. The last research direction is how to develop a web based CBR system using the proposed architecture CWSR to improve the following: user satisfaction, finding more web services, better web services, faster web services, and/or more revenue for organizations that would offer it, or less abandoned transactions, etc. To this end, a case $c$ should consist of a problem $p$, its solution $s$, and its outcome $o$: $c = (p, s, o)$. $o$ can be considered as a metric that measures the quality of solution to solve the problem (Bridge, 2005).

## CONCLUSION

The article looked at web service lifecycle from a requester's demand perspective, proposed a system architecture of a case based web services reasoner, CWSR, examined the correspondence relationship between the main activities of CBR and those of web services, and explored a unified CBR treatment for the main activities of web services. The proposed approach will facilitate the development of web services, intelligent systems and business intelligence. Service oriented architecture (SOA) is fundamental for service oriented computing (SOC). Web services is an important application field of SOC. A WSLC can be considered as a logical implementation of SOA in web services. The CSWR architecture is a logical realization of the WSLC. These are key ideas behind the above-mentioned discussion in this article. In future work, we will implement a system prototype based on the proposed CWSR for e-solution of sleep deprivation, which can be considered as a part of web health services, and test the effectiveness of the above proposed approach in the context of user satisfaction, finding more web services, better web services, faster web services. We will also integrate web service discovery, composition and recommendation using the CWSR based on soft CBR.

## REFERENCES

Alonso, G., Casati, F., Kuno, H., & Machiraju, V. (2004). *Web Services: Concepts, Architectures and Applications*. Berlin: Springer-Verlag.

Bridge, D. (2005). *The Virtue of Reward.* Retrieved May 30, 2009, from www.cs.ucc.ie/~dgb/iccbr05/iccbr05-slides.ppt

Deitel, H. M., Deitel, P. J., DuWadt, B., & Trees, L. K. (2004). *Web Services: A Technical Introduction*. Upper Saddle River, NJ: Prentice Hall.

Dustdar, S., & Schreiner, W. (2005). A survey on web services composition. *International Journal Web and Grid Services*, *1*(1), 1–30. doi:10.1504/IJWGS.2005.007545

Finnie, G., & Sun, Z. (2003). A logical foundation for the CBR cycle. *International Journal of Intelligent Systems*, *18*(4), 367–382. doi:10.1002/int.10093

He, H., Potts, M., & Sedukhin, I. (2004). *Web service management: Service life cycle*. Retrieved May 28, 2009, from http://www.w3.org/TR/wslc/

Hoffman, K. D. (2003). Marketing + MIS = E-Services. *Communications of the ACM*, *46*(6), 53–55. doi:10.1145/777313.777340

*ICWS*. (2009). Retrieved from http://conferences.computer.org/icws/2009/

Jackson, J., & Mclver, R. (2004). *Microeconomics* (7th Ed.). Brisbane, Australia: McGraw-Hill.

Kolodner, J. (1993). *Case Based Reasoning*. San Mateo: Morgan-Kaufmann Publishers.

Küster, U., König-Ries, B., Stern, M., & Klein, M. (2007). DIANE: An integrated approach to automated service discovery, matchmaking and composition. In *Intl Conf. on World Wide Web (WWW2007),* May 8–12, Alberta, Canada, (pp. 1033-1041).

Kwon, O. B. (2003). Meta web service: building web-based open decision support system based on web services. *Expert Systems with Applications*, *24*, 375–389. doi:10.1016/S0957-4174(02)00187-2

Ladner, R. (2008). Soft computing techniques for web service brokering. *Soft Computing*, *12*, 1089–1098. doi:10.1007/s00500-008-0277-0

Limthanmaphon, B., & Zhang, Y. (2003). Web service composition with case-based reasoning. In *ACM Intl Conf Proc Series; Vol. 143, Proc. 14th Australasian Database Conf, Adelaide*, Australia, (pp. 201-208).

Lorenzi, F., & Ricci, F. (2005). Case-based recommender systems: A unifying view. In Mobasher, B., & Anand, S.S. (Eds.), *ITWP 2003*, (LNAI 3169, pp. 89–113). Berlin: Springer-Verlag.

Lu, J., Ruan, D., & Zhang, G. (2007). E-service Intelligence: An introduction. In J. Lu, D. Ruan, & G. Zhang, (Eds.) *E-Service Intelligence: Methodologies, Technologies and Applications* (pp. 1-33). Berlin: Springer.

Narendra, N. C., & Orriens, B. (2006). Requirements-driven modeling of the web service execution and adaptation lifecycle. In S. Madria, et al, (eds.), *ICDCIT*, (LNCS 4317, pp. 314-324). Berlin: Springer.

Papazoglou, M. P. (2003). Service -Oriented Computing: Concepts, Characteristics and Directions. In *Proceedings of 4th Intl Conf on Web Information Systems Engineering (WISE2003),* (pp. 3-12).

Pfleeger, S. L., & Atlee, J. M. (2006). *Software Engineering: Theory and Practice* (3rd Ed.). Beijing: Pearson Education, Inc.

Pressman, R. S. (2001). *Software Engineering: A Practitioner's Approach,* (5th Ed.). Boston: McGraw-Hill.

Rust, R. T., & Kannan, P. K. (2003). E-service: A new paradigm for business in the electronic environment. *Communications of the ACM*, *46*(6), 37–42. doi:10.1145/777313.777336

Sheth, A. (2003). *Semantic web process lifecycle: Role of Semantics in Annotation, Discovery, Composition and Orchestration*. Invited Talk, WWW 2003 Workshop on E-Services and the Semantic Web, Budapest, Hungary, May 20.

Singh, M. P., & Huhns, M. N. (2005). *Service-Oriented Computing: Semantics, Processes, and Agents*. Chichester, UK: John Wiley & Sons, Ltd.

Sun, Z., & Finnie, G. (2004). *Intelligent Techniques in E-Commerce: A Case-based Reasoning Perspective.* Berlin: Springer-Verlag.

Sun, Z., & Finnie, G. (2005). A unified logical model for CBR-based e-commerce systems. *International Journal of Intelligent Systems*, *20*(1), 29–46. doi:10.1002/int.20052

Sun, Z., Han, J., & Dong, D. (2008). Five Perspectives on Case Based Reasoning. In D.-S. Huang, et al, (Ed.), *ICIC 2008*, (LNAI 5227, pp. 410–419). Berlin: Springer-Verlag.

Sun, Z., & Lau, S. K. (2007). Customer experience management in e-services. In J. Lu, D. Ruan & G. Zhang (Eds.), *E-Service Intelligence: Methodologies, Technologies and Applications,* (pp. 365-388). Berlin: Springer-Verlag.

Tang, X. F., Jiang, C. J., Ding, Z. J., & Wang, C. (2007). A Petri net-based semantic web services automatic composition method. [in Chinese]. *Journal of Software*, *18*(12), 2991–3000.

Tsalgatidou, A., & Pilioura, T. (2002). An Overview of Standards and Related Technology in Web Services. *Distributed and Parallel Databases*, *12*, 135–162. doi:10.1023/A:1016599017660

Wang, H., Zhang, Y. Q., & Sunderraman, R. (2006). Extensible soft semantic web services agent. *Soft Computing*, *10*, 1021–1029. doi:10.1007/s00500-005-0029-3

Wang, M., Cheung, W. K., Liu, J., Xie, X., & Lou, Z. (2006). E-service/process composition through multi-agent constraint management. In *Intl Conf on Business Process Management (BPM 2006)*, Vienna, Austria, (LNCS 4102, pp. 274-289). Berlin: Springer.

Yao, Y., Yang, F., & Su, S. (2006). Flexible decision making in web services negotiation. In J. Euzenat & J. Domingue, (Eds.), *AIMSA 2006*, (LNAI 4183, pp. 108-117).

Zhang, L. J., & Jeckle, M. (2003). The next big thing: Web services composition. In M. Jeckle & L.J. Zhang, (Eds.), *ICWS-Europe*, (LNCS 2853, pp. 1-10).

## ADDITIONAL READING

Bell, M. (2008). *Service-Oriented Modeling (SOA): Service Analysis, Design, and Architecture*. Chichester, England: John Wiley and Sons Ltd.

Breu, R. Breu1, M., Hafner, M., & Nowak, A. (2005). Web service engineering – advancing a new software engineering discipline. In Lowe, D. and Gaedke, M. (Eds.): ICWE 2005, LNCS 3579, pp. 8-18, Berlin Heidelberg: Springer-Verlag.

Chen, L., & Tao, F. (2008). An intelligent recommender system for web resource discovery and selection. In Ruan, D., Hardeman F., & van der Meer, K. (Eds). Intelligent Decision and Policy Making Support Systems. Berlin Heidelberg: Springer, pp. 113-140

Cheng, M.-Y., Tsai, H.-C., & Chiu, Y.-H. (2009). Fuzzy case-based reasoning for coping with construction disputes. *Expert Systems with Applications*, *36*(2), 4106–4113. doi:10.1016/j.eswa.2008.03.025

Cheng, R., & Su, S. Yang, F., & Li, Y. (2006). Using case-based reasoning to support web service composition. In Alexandrov, V.N., et al. (Eds.): ICCS 2006, Part IV, LNCS 3994, pp. 87 – 94, Berlin Heidelberg: Springer-Verlag.

Chung, J. Y., Lin, K. J., & Mathieu, R. G. (2003). Web services computing: Advancing software interoperability. *Computer*, *36*(10), 35–37. doi:10.1109/MC.2003.1236469

Costantini, S. (2008). Agents and Web Services. Retrieved April 04, 2009, from http://www.cs.nmsu.edu/~epontell/backbone/aug08/content/Articles/sadri2/paper.pdf

Hammond, K. J. (1989). Case-based Planning: Viewing Planning as a Memory Task. San Diego, CA: Academic Press Professional, Inc.

Han, W., Shi, X., & Chen, R. (2008). Process-context aware matchmaking for web service composition. *Journal of Network and Computer Applications*, *31*(4), 559–576. doi:10.1016/j.jnca.2007.11.008

Jeong, B., Cho, H., & Lee, C. (2009). On the functional quality of service (FQoS) to discover and compose interoperable web services. *Expert Systems with Applications*, *36*(3), 5411–5418. doi:10.1016/j.eswa.2008.06.087

Küster, U., König-Ries, B., Stern, M., & Klein, M. (2007). DIANE: An integrated approach to automated service discovery, matchmaking and composition. In: Intl Conf on World Wide Web (WWW2007), May 8–12, 2007, Alberta, Canada, pp. 1033-1041.

Lau, R. Y. K. (2007). Towards a web services and intelligent agents-based negotiation system for B2B eCommerce. *Electronic Commerce Research and Applications*, *6*(3), 260–273. doi:10.1016/j.elerap.2006.06.007

Lawler, J. P. (2007). Service-Oriented Architecture: SOA Strategy, Methodology, and Technology. Hoboken: Taylor & Francis Ltd.

Lu, J., Ruan, D., & Zhang, G. (Eds.). (2006). E-Service Intelligence. Berlin Heidelberg: Springer Verlag.

Madhusudan, T., & Uttamsingh, N. (2006). A declarative approach to composing web services in dynamic environments. *Journal of Decision Support Systems*, *41*(2), 325–357. doi:10.1016/j.dss.2004.07.003

Park, C.-S., & Park, S. (2008). Efficient execution of composite Web services exchanging intensional data. *Journal of Information Science*, *178*(2), 317–339. doi:10.1016/j.ins.2007.08.021

Psaila, G., & Wagner, R. R. (Eds.). (2008). E-Commerce and Web Technologies: 9th International Conference, EC-Web 2008 Turin, Italy, September 3-4, 2008, Proceedings (LNCS), Berlin Heidelberg: Springer Verlag.

Richter, M. M. (2009). The search for knowledge, contexts, and Case-Based Reasoning. *Engineering Applications of Artificial Intelligence*, *22*(1), 3–9. doi:10.1016/j.engappai.2008.04.021

Rust, R. T., & Kannan, P. K. (Eds.). (2002). E-Service: New Directions in Theory and Practice. Armonk, NY: M.E. Sharpe.

Sahai, A., & Graupner, S. (2005). Web Services in the Enterprise: Concepts, Standards, Solutions, and Management (Network and Systems Management). New York, NY: Springer.

Schank, R. C., & Riesbeck, C. (1989) Inside Case-Based Reasoning. Hillsdale, NJ: Lawrence Erlbaum Associates.

Song, R., Korba, L., & Yee, G. (Eds.). (2007). Trust in E-services: Technologies, Practices and Challenges. Hershey, PA: IgI-Global.

Talukder, A. K., & Yavagal, R. R. (2007). Mobile Computing: Technology, Applications and Service Creation. New York, NY: McGraw-Hill Inc.

Tatemura, J., & Hsiung, W. P. (2006). Web service decomposition: Edge computing architecture for cache-friendly e-commerce applications. *Electronic Commerce Research and Applications*, *5*(1), 57–65. doi:10.1016/j.elerap.2005.08.001

Ting, I.-H., & Wu, H. J. (Eds.). (2009). Web Mining Applications in E-commerce and E-services. Berlin Heidelberg: Springer Verlag.

Web services. Retrieved April 3, 2009, from http://en.wikipedia.org/wiki/Web_service.

Web Services Activity. Retrieved April 3, 2009, from http://www.w3.org/2002/ws/arch/.

Wooldridge, M. (2002). An Introduction to Multiagent Systems. Chichester, England: John Wiley & Sons Ltd.

Zhao, J. L., & Cheng, H. K. (2005). Web services and process management: a union of convenience or a new area of research? *Journal of Decision Support Systems*, *40*(1), 1–8. doi:10.1016/j.dss.2004.04.002

## KEY TERMS AND DEFINITIONS

**Case-Based Reasoning (CBR):** CBR is a reasoning paradigm based on previous experiences or cases; that is: a CBR system solves new problems by adapting solutions that were used to successfully solve old problems. Therefore, CBR is a kind of experience based reasoning. Case-based management, case-based engineering and case-based computing are more general paradigms than CBR.

**Intelligent System:** An intelligent system is a system that can imitate, automate some intelligent behaviors of human being. Expert systems and knowledge based systems are examples of intelligent systems. Currently, intelligent systems is a discipline that studies intelligent behaviors and their implementations as well as their impacts on human society.

**Multiagent Systems:** A multiagent system is an intelligent system consisting of many intelligent agents. An intelligent agent can be considered as a counterpart of a human agent in intelligent systems. Google can be considered as an intelligent search agent.

**Service Oriented Computing (SOC):** SOC is a research field about service science: service intelligence, service technology, service engineering, service management, and service applications. It is the most general form of studying service in computing discipline.

**Web Service Architecture:** A web service architecture is a high level description for web services, which is free of concrete implementation of a web service system but it is necessary for any implementation of a web service system.

**Web Service Discovery:** The process of searching, matching a machine-processable description of a Web service. It aims to find appropriate web services to meet the requirement of the customers.

**Web Service Lifecycle (WSLC):** It consists of the start of a web service request, the end of web service transaction and its evolutionary stages that transform the web service from the start of the request to the end of transaction. Many activities are included in a WSLC such as web service discovery, composition, recommendation and management.

**Web Services:** General speaking, web services are all the services available on the Web or the Internet from a business perspective. The first web services were information sources (Schneider, 2003). From a technological perspective, web services are Internet-based application components published using standard interface description languages and universally available via uniform communication protocols. Web services is an important application field of service intelligence and service-oriented computing.

# Chapter 88
# Web Services E-Contract and Reuse

**Marcelo Fantinato**
*University of São Paulo, Brazil*

**Maria Beatriz Felgar de Toledo**
*State University of Campinas, Brazil*

**Itana Maria de Souza Gimenes**
*State University of Maringá, Brazil*

## INTRODUCTION

The Internet and the Service-oriented Computing (SOC) paradigm (Papazoglou, Traverso & Dustdar, 2008) made the electronic interchange of services possible. Consequently, the scope of Business Process Management (BPM) (Khalaf, Keller & Leymann, 2006) has broadened from intra-organizational service interchange to inter-organizational cooperation. In this new scenario, organizations are concentrating efforts on their main business and subcontracting electronic services (e-services) from partners. Business processes that cross organizational borders are more complex, thus a simple definition of the process is no longer enough to ensure trust. An electronic contract (e-contract) is necessary to define the rights and obligations of each involved party and monitoring of business process execution becomes mandatory.

The current complexity involved in e-contract establishment may hinder new business partnerships. Major issues involved are: the great amount of information necessary for e-contract establishment; the increasing number of parameters to be considered; the potential long-duration of electronic negotiations; and, the involvement of different profiles (business and development teams) of distinct organizations. Solutions involving information structuring and reuse are required to tackle these issues. This chapter aims at: (i) providing an overview on e-contracts and WS-contracts; (ii) pointing out existing problems related to contract negotiation and establishment; and (iii) presenting existent solutions for e-contract establishment, mainly related to information reuse.

DOI: 10.4018/978-1-61520-611-7.ch088

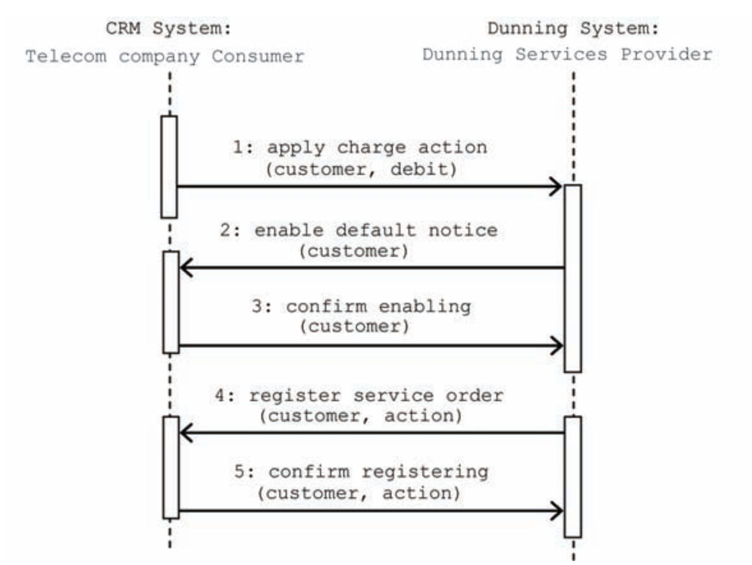
This chapter presents a two-level e-contract metamodel. The first level represents the e-contract at a higher level of abstraction, including common contract parts such as: parties, e-services, business process and QoS attributes; and the relationships between them. The second level represents a possible WS-contract implementation which uses specification languages as WSDL, WS-BPEL and WS-Agreement (Fantinato, Toledo & Gimenes, 2008). This metamodel is designed to promote the reuse of e-contracts during e-contract negotiation and establishment taking into account contract templates.

## BACKGROUND

An ordinary contract is an agreement between two or more parties interested in creating mutual relationships on business or legal obligations. It defines an activity set to be carried out by each party, which must satisfy a set of terms and conditions – the contractual clauses. An e-contract is an electronic document (Marjanovic & Milosevic, 2001; Hoffner et al., 2001) used to represent an agreement between partner organizations carrying out business using the Internet, in which the negotiated services are e-services. The e-contracts are therefore used to describe details of the supply and the consumption of e-services within a business process, including Quality of Services (QoS) (Sahai, 2002; Menasce, 2002) levels agreed between the parties.

A telecommunication company, for instance, would need an e-contract as it may use e-services from partner organizations such as collection or dunning companies. To provide services to its final customers, a telecom company, through its telecom system, needs to use e-services provided by partner organizations systems, thus creating an inter-organizational business process. Each party provides a set of e-services to be used by another party. The terms of an e-contract are negotiated and then established to define the details about the business agreement. A dunning company can provide a series of e-services to a telecom company, such as services related to: applying charge action, reverting charge action application, irregular checks management, debts controlling, and charges and discounts applications. On the other hand, the telecom company can also provide some e-services to the dunning company, such as

*Figure 1. Business scenario for the telecom context*



the services related to: service order registering and cancellations, default notice management, and customer information updates.

An excerpt of a supposed business process involving a telecom company and a dunning company is presented, as a UML sequence diagram, in Figure 1. Having a debit from a customer, the telecom company, through its Customer Relationship Management (CRM) system, asks a charge action application to the system of the dunning company. The dunning system becomes responsible for receiving the debit from the telecom company customer, having a set of charge actions to be applied. The first action is usually the default notice by the CRM system, which must be ordered by the dunning system and confirmed by the CRM system. Afterwards, other charge actions can be taken, such as the service supply suspension, which also must be mediated by the CRM system. In this case, the dunning system asks a Service Order registering to the CRM system. The process continues until the debit is received by the dunning company and the telecom company is notified.

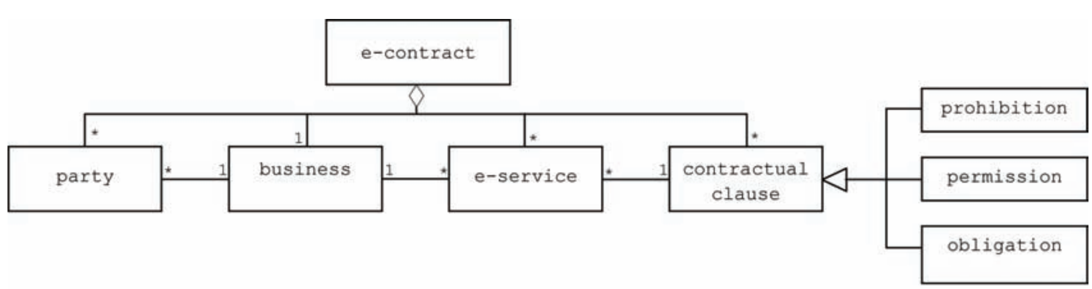
The elements involved in an e-contract are shown as a Class Diagram in Figure 2, which represents an "analysis pattern" targeted toward the e-services domain (Fowler, 1996). An e-contract is composed by: (i) involved parties; (ii) e-services representing the activities that compose the business process between the parties; and (iii) contractual clauses. The numbers and asterisks in the figure represent the cardinalities in the relationships between the classes in the diagram. The business process can involve e-services from any party of the cooperation. Contractual clauses represent three different types of constraints on e-services: prohibitions, permissions and obligations. These constraints are described in this context by QoS attributes and levels, which are related to non-functional properties. QoS attributes affect the definition and execution of an e-service, with respect to, for example: availability, integrity, reliability, performance, security and reply time (Sahai, 2002; Menasce, 2002). For each QoS attribute, a value must be defined to be used as a tolerable level (e.g. a minimum, a maximum or an exact value).

## E-CONTRACT LIFECYCLE AND METAMODEL

The lifecycle of an e-contract includes phases related to: (i) the implementation of e-services; (ii) the deployment of e-services to be provided; (iii) the negotiation between companies and the definition of business agreements; and, (iv) the contract enactment including monitoring. These phases are described as follows:

- **e-services implementation**: corresponds to the e-services implementation by the provider organizations. This implementation

*Figure 2. E-contract metamodel*



can be started by the organization which offers generic services or by requests of some organizations interested in specific services;

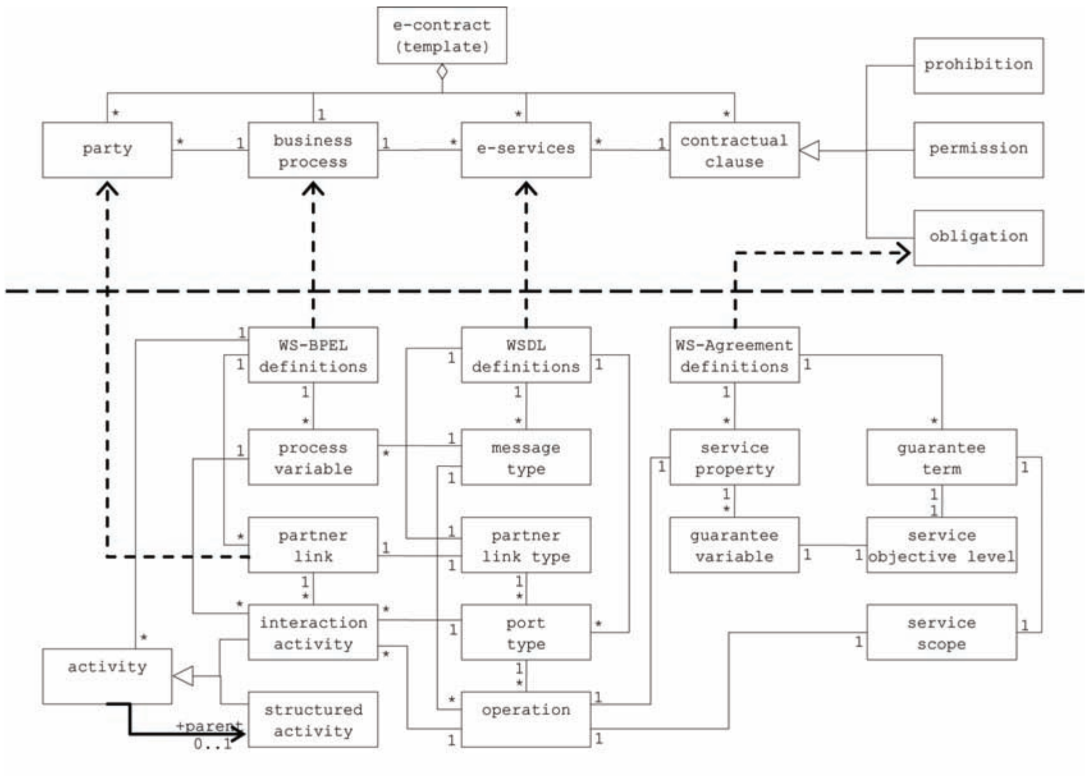
- **e-services deployment, search and discovery**: corresponds to the information exchange between provider and consumer organizations in virtual markets. Service publishing is done by the providers, while the consumers perform service searches and comparisons between them. Information on QoS guarantees can be, for example, presented by the provider. The discovery of partnerships occurs when there is compatibility between published and searched services. These activities should be implemented with the support of matchmaking facilities;
- **e-contract negotiation and establishment**: corresponds to the decision making issues that defines how the business process involving the provider and consumer organizations should be conducted to establish a business partnership. During the negotiation, the parties, the services to be used, and the clauses are defined. The clauses possibly include the QoS guarantee terms;
- **e-contract enactment**: corresponds to the execution of the business process and the fulfillment of the established e-contract, throughout the execution of the provided e-services and the compliance of the contractual clauses. To ensure compliance with the clauses, e-contracts should be monitored, possibly by a third-party organization, during the services execution.

Current corporative world requires dynamic IT infrastructures in order to provide technical solutions to business demand. To achieve their goals, organizations need to use efficient BPM techniques, which can be enhanced by the SOC – in particular, the Web services technology. Process management needs to be dynamic and flexible, so that organizations become competitive in their field of work. However, some challenges must be addressed so that these technologies can fulfill their role in providing the desired computing environment for organizations. An important requirement is to enable reuse throughout the different stages of the processes and their artifacts.

Initiatives have to be taken to promote reuse throughout the phases of an e-contract lifecycle (Gimenes, Fantinato & Toledo, 2008). One of them is the use of e-contracts templates – partially-filled e-contracts that have empty fields to be completed with some value during WS-contract establishment. Several e-contracts can be instantiated from a core template conceived for a specific business domain. Templates are usually based on e-contract metamodels that represent reuse issues of e-contracts. E-contract metamodels formalize the rules to be followed during the creation of a new e-contract template and hence new e-contract instantiations. They capture the details, at the conceptual level, about the possible elements that can be involved in a specific WS-contract, and the possible types of relationship between these elements. Usually, e-contracts metamodels are basically defined only in terms of generic e-services, similar to the presented in Figure 2. The e-contract metamodel presented in Figure 3, consists of two-levels: (i) the upper level where the e-contract is represented in terms of generic e-services; (ii) the lower level where the e-contract is represented in terms of specific Web services, the most used specific type of e-services. More specifically, the Class Diagram from Figure 3 also represents an "analysis pattern", now targeted toward the Web services domain (Fowler, 1996).

E-contracts concerned with Web services are called Web services e-contracts (WS-contracts). Different specification languages can be used to describe each part of a WS-contract. The Web services representing the activities must have their interfaces and other high-level information described by the WSDL (Web Service Descrip-

*Figure 3. Two-level e-contract and WS-contract metamodel*




tion Language) standard language. Involved parts and the business process (formed by the composed Web services) can be specified in different languages. Two current examples are: WS-BPEL (Web Services Business Process Execution Language), used to represent orchestrations, when one of the involved parties is responsible for process coordination; and WS-CDL (Web Services Choreography Description Language), used to represent choreographies, when all the involved parties are co-responsible for process coordination. Similarly, different languages can be used to specify the QoS attributes and levels, including WS-Agreement and WS-Policy.

In Figure 3, the WS-contract metamodel is represented using WSDL, WS-BPEL and WS-Agreement. E-contracts template examples are presented by Fantinato, Toledo & Gimenes (2008). According to the metamodel, a concrete *WS-contract (template)* is composed of three sections: *WSDL definitions*, *WS-BPEL definitions* and *WS-Agreement definitions*, as follows:

- **WSDL definitions**: it contains the base elements *Message Types*, *Partner Link Types*, *Port Types* and *Operations* — the last two describe the Web services. These elements are used in the next sections;
- **WS-BPEL definitions**: it is used to describe the business process that composes the Web services. The business process is described in terms of: *Process Variables*, *Partner Links*, *Activities* (including *Interaction Activities* and *Structured Activities* types). The WS-BPEL handler elements (i.e., fault handler, compensation handler, termination handler and event handler) are not included in this metamodel in order to make it simpler;
- **WS-Agreement definitions**: it describes the QoS attributes and levels regarding

the involved Web services. The QoS attributes and levels are described in terms of: *Service Properties* (including *Guarantee Variables*) and *Guarantee Terms* (including *Service Scope* and *Service Level Objectives*). The WS-Agreement Name, Context and Service Description Terms elements are not included in this metamodel since they are similar to the WS-BPEL sections representing this information.

## FUTURE RESEARCH DIRECTIONS

The use of e-contract metamodels and templates is an important step towards reuse on e-contract domain, but not enough. There are several challenges that must be overcome so that e-contracts fully support the organizations willing to conduct inter-organizational business on the Internet (Papazoglou, Traverso & Dustdar, 2008). Complementary approaches are required to improve reuse in the e-contract domain. One of these approaches is the use of Software Product Line (SPL) in the e-contract context (Fantinato, Toledo & Gimenes, 2008). SPL is a software engineering approach which promotes the generation of specific software products from a product family based on the reuse of a well–defined infrastructure. SPL exploits common points among systems in the same domain and manages variabilities among them in a systematic way.

Moreover, it is important to enable dynamic management of electronic contracts. Static approaches where decisions are taken at design-time are not satisfactory to a dynamic business world. Some decisions needs be taken at run-time such as: postponing some actions as the selection of services to compose a process; making it possible to easily reverse actions previously taken; or, including contract clauses for renegotiation. Another issue to be dealt with is treating e-contract management as a complete software engineering approach, including all the phases of the e-contract lifecycle. Such an approach should exploit the SOC, in order to define a set of service-oriented engineering techniques and practices. Traditional software engineering techniques can be reused, such as those ones related to component-based development, however new approaches are required to capture the service-orientation essence.

## CONCLUSION

This chapter presents a general discussion about e-contracts, a key element for enacting a business process involving more than one organization. In particular, a specific type of e-contract was presented – the Web Services E-contract (WS-contracts), for which a contract metamodel was defined with the purpose of facilitating reuse between different but similar contracts based on e-contract templates. Some future research directions presented show that the progress beyond the state of the art should be related to systematic reuse on e-contract domain, dynamic management of e-contracts and service-oriented engineering.

## REFERENCES

Fantinato, M., Toledo, M. B. F., & Gimenes, I. M. S. (2008). WS-contract establishment with QoS: An approach based on feature modeling. *Int. Journal on Cooperative Information Systems*, *17*(3), 373–407. doi:10.1142/S0218843008001889

Fowler, M. (1996). *Analysis Patterns: Reusable Object Models*. Reading, MA: Addison-Wesley Professional.

Gimenes, I. M. S., Fantinato, M., & Toledo, M. B. F. (2008). A Product Line for Business Process Management. In *12th Int. Software Product Lines Conference* (pp. 265-274). Limerick, Ireland: IEEE Computer Society.

Hoffner, Y., Field, S., & Grefen, P. W. P. J. (2001). Contract-driven creation and operation of virtual enterprises. *Computer Networks*, *37*, 111–136. doi:10.1016/S1389-1286(01)00210-9

Khalaf, R., Keller, A., & Leymann, F. (2006). Business Processes for Web Services: Principles and Applications. *IBM Systems Journal*, *45*(2), 425–446.

Marjanovic, O., & Milosevic, Z. (2001). Towards Formal Modeling of e-Contracts. In *5th Int. Enterprise Distributed Object Computing Conference* (pp. 59-68). Seattle: IEEE Computer Society.

Menasce, D. A. (2002). QoS issues in Web services. *IEEE Internet Computing*, *6*(6), 72–75. doi:10.1109/MIC.2002.1067740

Papazoglou, M. P., Traverso, P., & Dustdar, S. (2008). Service-oriented Computing: A Research Roadmap. *Int. Journal of Cooperative Information Systems*, *17*(2), 223–255. doi:10.1142/S0218843008001816

Sahai, A., Machiraju, V., & Sayal, M. (2002). Automated SLA monitoring for Web services. In M. Feridun, P. G. Kropf & G. Babin, (Eds.), *13th IFIP/IEEE Int. Workshop on Distributed Systems: Operations and Management,* (pp. 28-41). Berlin: Springer.

## ADDITIONAL READING

Angelov, S., & Grefen, P. W. P. J. (2002). A Conceptual Framework for B2B Electronic Contracting. *3rd Working Conference on Infrastructures for Virtual Enterprises.* Sesimbra: Kluwer.

Angelov, S., & Grefen, P. W. P. J. (2003). The 4W framework for B2B e-contracting. *Int. Journal Networking and Virtual Organisation*, *2*, 78–97. doi:10.1504/IJNVO.2003.003517

Angelov, S., & Grefen, P. W. P. J. (2008). An e-contracting reference architecture. *Journal of Systems and Software*, *81*, 1816–1844. doi:10.1016/j.jss.2008.02.023

Burgwinkel, D. (2002). Managing Contractual Relationships in Virtual Organizations with Electronic Contracting. *3rd Working Conference on Infrastructures* (pp. 101-108). Sesimbra: Kluwer.

Carpineti, S., & Laneve, C. (2006). A Basic Contract Language for Web Services. *15th European Symposium on Programming* (pp. 197-213). Vienna: Springer.

Cheung, S.-C., Chiu, D. K. W., & Till, S. (2002). A Three-Layer Framework for Cross-Organizational e-Contract Enactment. *1st Int. Workshop on Web Services, E-Business, and the Semantic Web* (pp. 78-92). Toronto: Springer.

Chieu, T. C., Nguyen, T., Maradugu, S., & Kwok, T. (2007). An Enterprise Electronic Contract Management System Based on Service-Oriented Architecture. *4th IEEE Int. Conference on Services Computing* (pp. 613-620). Salt Lake City: IEEE Computer Society.

Chiu, D. K. W., Cheung, S.-C., & Till, S. (2003). A Three-Layer Architecture for E-Contract Enforcement in an E-Service Environment. *36th Annual Hawaii Int. Conference on System Sciences* (p. 74).

Chiu, D. K. W., Karlapalem, K., Li, Q., & Kafeza, E. (2002). Workflow View Based E-Contracts in a Cross-Organizational E-Services Environment. *Distributed and Parallel Databases*, *12*, 193–216. doi:10.1023/A:1016503218569

Fantinato, M., Gimenes, I. M. S., & Toledo, M. B. F. (2006). Web Service E-Contract Establishment Using Features. *4th Int. Conference on Business Process Management* (pp. 290-305). Vienna: Springer.

Fantinato, M., Toledo, M. B. F., & Gimenes, I. M. S. (2006). A Feature-based Approach to Electronic Contracts. *8th IEEE Int. Conference on E-Commerce Technology & 3rd IEEE Int. Conference on Enterprise Computing, E-Commerce and E-Services* (p. 34). Palo Alto: IEEE Computer Society.

Jain, H. K., Pu, C., Iyengar, S., Blake, M. B., & Chang, C. K. (2007). State of the Art in Modeling and Deployment of Electronic Contracts. *4th IEEE Int. Conference on Services Computing*. Salt Lake City, Utah: IEEE Computer Society.

Jertila, A., & Schoop, M. (2005). Electronic Contracts in Negotiation Support Systems: Challenges, Design and Implementation. *7th IEEE Int. Conference on E-Commerce Technology* (pp. 396-399). München: IEEE Computer Society.

Kafeza, I., Kafeza, E., & Chiu, D. K. W. (2005). Legal Issues in Agents for Electronic Contracting. *38th Hawaii Int. Conference on System Sciences.* Big Island: IEEE Computer Society.

Karlapalem, K., & Krishna, P. R. (2007). State of the Art in Modeling and Deployment of Electronic Contracts. *6th IEEE Int. Conference on Web Services.* Salt Lake City: IEEE Computer Society.

Krishna, P. R., & Karlapalem, K. (2008). Electronic Contracts. *IEEE Internet Computing*, *12*, 60–68. doi:10.1109/MIC.2008.77

Krishna, P. R., Karlapalem, K., & Chiu, D. K. W. (2004). An ER^EC framework for e-contract modeling, enactment and monitoring. *Data & Knowledge Engineering*, *51*, 31–58. doi:10.1016/j.datak.2004.03.006

Lamparter, S., Luckner, S., & Mutschler, S. (2007). Formal Specification of Web Service Contracts for Automated Contracting and Monitoring. *40th Hawaii Int. Conference on Systems Science* (p. 63). Big Island: IEEE Computer Society.

Ludwig, H., & Hoffner, Y. (2003). The Role of Contract and Component Semantics in Dynamic E-Contract Enactment Configuration. *9th Working Conference on Database Semantics* (pp. 19-33). Hong Kong: Kluwer.

Merz, M., Griffel, F., Tu, M. T., Müller-Wilken, S., Weinreich, H., & Boger, M. (1998). Supporting Electronic Commerce Transactions with Contracting Services. *Int. Journal on Cooperative Information Systems*, *7*, 249–274. doi:10.1142/S021884309800012X

Milosevic, Z., Linington, P. F., Gibson, S., Kulkarni, S., & Cole, J. B. (2004). Inter-Organisational Collaborations Supported by E-Contracts. *IFIP 18th World Computer Congress on Building The E-Service Society: E-Commerce, E-Business, and E-Government & 4th Int. Conference on E-Commerce, E-Business, E-Government* (pp. 413-429). Toulouse: Kluwer.

Molina-Jiménez, C., Shrivastava, S. K., Solaiman, E., & Warne, J. P. (2004). Run-time monitoring and enforcement of electronic contracts. *Electronic Commerce Research and Applications*, *3*, 108–125. doi:10.1016/j.elerap.2004.02.003

Roman, D., & Kifer, M. (2008). Semantic Web Service Choreography: Contracting and Enactment. *7th Int. Semantic Web Conference* (pp. 550-566). Karlsruhe: Springer.

Tosic, V., & Pagurek, B. (2005). On Comprehensive Contractual Descriptions of Web Services. *2nd IEEE Int. Conference on e-Technology, e-Commerce, and e-Services* (pp. 444-449). Hong Kong: IEEE Computer Society.

Xu, L. (2003). Monitorable Electronic Contract. *5th IEEE Int. Conference on Electronic Commerce* (p. 92). Newport Beach, USA: IEEE Computer Society.

Xu, L., & Vrieze, P. (2007). Fundaments Of Virtual Organization E-Contracting. *Eighth IFIP Working Conference on Virtual Enterprises* (pp. 209-216). Guimarães: Springer.

## KEY TERMS AND DEFINITIONS

**E-Service:** Piece of software provisioned as an electronic service on a computer network to be used by different customers.

**Web Service:** A special type of e-services, based on a set of open XML-standards, provisioned on the Internet.

**E-Contract:** an electronic document used to represent an agreement between partner organizations carrying out business using a computer network, which describes details of the supply and the consumption of e-services within a business process including QoS attributes and levels.

**WS-Contract:** A specific type of e-contracts in which the provided and consumed e-services are Web services.

**Contract Template:** A partially-filled e-contract that has empty fields to be completed with some value during e-contract establishment, structured in a way to systematize reuse.

**Contract Metamodel:** A model that captures the details, in the conceptual level, about the possible elements to be involved in a contract and the possible types of relationship between them, formalizing thus the rules to be satisfied by a set of e-contract templates and their e-contract instantiations.

**BPM:** Set of techniques related to the Business Process Management, supporting the definition, execution, monitoring, controlling, analysis and improvement of business process.

# Chapter 89
# Situational Enterprise Services

**Paul de Vrieze**
*Bournemouth University, UK*

**Lai Xu**
*Bournemouth University, UK*

**Li Xie**
*GuangDong Polytechnic Normal University, China*

## ABSTRACT

*The ability to rapidly find potential business partners as well as rapidly set up a collaborative business process is desirable in the face of market turbulence. Collaborative business processes are increasingly dependent on the integration of business information systems. Traditional linking of business processes has a large ad hoc character. Implementing situational enterprise services in an appropriate way will deliver the business more flexibility, adaptability and agility. Service-oriented architectures (SOA) are rapidly becoming the dominant computing paradigm. SOA is now being embraced by organizations everywhere as the key to business agility. Web 2.0 technologies such as AJAX on the other hand provide good user interactions for successful service discovery, selection, adaptation, invocation and service construction. They also balance automatic integration of services and human interactions, disconnecting content from presentation in the delivery of the service. Another Web technology, such as semantic Web, makes automatic service discovery, mediation and composition possible. Integrating SOA, Web 2.0 Technologies and Semantic Web into a service-oriented virtual enterprise connects business processes in a much more horizontal fashion. To be able run these services consistently across the enterprise, an enterprise infrastructure that provides enterprise architecture and security foundation is necessary. The world is constantly changing. So does the business environment. An agile enterprise needs to be able to quickly and cost-effectively change how it does business and who it does business with. Knowing, adapting to diffident situations is an important aspect of today's business environment. The changes in an operating environment can happen implicitly and explicitly. The changes can be caused by different factors in the application domain. Changes can also happen for the purpose of organizing information in a better way. Changes can be further made according to the users' needs such as incorporating additional functionalities. Handling and managing diffident situations of service-oriented enterprises are important aspects of business environment. In the chapter, we will investigate how to apply new Web technologies to develop, deploy and executing enterprise services.*

DOI: 10.4018/978-1-61520-611-7.ch089

## INTRODUCTION

The Service-oriented computing paradigm is transforming traditional enterprise systems from a close, centrally controled system into a dynamic information exchange and flexible business process system. Traditional enterprise applications are defined as software designed to integrate all aspects of a company's operations and processes such as accounting, finance, human resources, inventory control, manufacturing, marketing, sales, and distribution, and resource planning. Advanced enterprise applications provide linkages with customers, business partners, and suppliers (Markus & Tanis, 2000). Normally enterprise applications are complex. There are mission critical applications which are developed and deployed by central IT with long development deployment cycle and dedicated IT budget.

Currently, there is increased pressure to build enterprise applications quickly in order to respond to situational needs of the business. Many of these applications for reflecting situational business needs never get delivered because they are too difficult to write, too costly to implement, and too brittle to customize and maintain once deployed. As a result, many of the needs are addressed by business people who have some knowledge on IT techniques creating often inadequate solutions using tools like Excel, Access and Visual Basic.

With a growing number of services on the Web, these needs can now be satisfied more easily and effectively. These development and deployment services, combined with a "situational" mindset and methodology, can offer significant advantages. Unlike traditional enterprise applications, situational enterprise applications are relatively simple. There are not mission critical for organizations. Lots of them developed at the point of need short development cycle under central IT control with little or no recognized budget.

The situational enterprise applications being addressed will not replace core business applications, such as ERP (Enterprise Resource Planning), SCM (Supply Chain Management), CRM (Customer Relationship Management) etc. They address different needs which are built for just a handful of users, situational enterprise applications that are used for only a few weeks or months, or situational applications address a small piece of functionality. For example, within the perimeter ERP applications, departmental operation solutions, such as vacation scheduling, seminar and presentation management, purchase procedure management within a work unit, etc, normally are not included in a organization ERP system. However, they can be desired by department staffs. These are typical situational applications for the department staffs who manage those matters on a daily basis.

Types of situational enterprise applications can be divided into data-oriented applications and process-oriented applications. Enterprise widgets, gadgets, pipes and mash-ups belong to data-oriented applications. Lightweight process-oriented applications are currently under research, the EU project SOA4All (http://www.soa4all.eu/) aims to provide a platform to build process-oriented applications for end users (non-technical users).

The target audience for situational enterprise applications/services is an educated professional (e.g., accountant, HR personnel) with modest computer literacy (and interest) that mostly includes the Web and MS Office. They have basic computer experience like using a wizard to generate something new; interacting with spreadsheets, documents, and forms; and using drag and drop to rearrange items on the screen.

These solutions on demand will help businesses slash expenses and reduce cycle times by more effectively supporting how people work, address challenges and make business decisions. Situational enterprise applications/ services will allow also the business to be more innovative and competitive by supporting new processes more effectively, increasing overall productivity, and facilitating new ways for sharing information.

In this chapter, we introduce background information of situational enterprise applications, general description of Service-Oriented Architecture (SOA), Web services, and enterprise services in Section 2. The needs and benefits of situational enterprise services describe in Section 3. Design principles of situational enterprise services present in Section 4. Section 5 explains applying issues of situational enterprise services. Conclusions and future research direction are depicted in Section 6.

## BACKGROUND

### Relation among SOA, Web Services, and Enterprise Services

Service-oriented architecture (SOA) is a design paradigm which designers use loosely coupled services for building complex services or for incorporating them into applications. An ideal level of abstraction is required for aligning business needs and technical capabilities, to create reusable, coarse-grain business functionalities. SOA is not just architecture of services seen from a technology perspective, but the policies, practices, and frameworks by which it is ensured that the right services are provided and consumed. Enterprise SOA has revolutionized the design of business applications, enabling the rapid composition of business solution.

A Web Service is a software service designed to support interoperable XML based machine-to-machine interaction over the Internet. It has an interface described in a machine-processable format specifically Web Service Definition Language (WSDL). (W3C, 2004). Web Services are self contained and self describing application functionalities that can be processed through open Internet standards. SOA is currently adopted massively by many enterprise software vendors (Cardwell, 2007).

Enterprise services as smaller functionality components are introduced by different enterprise software vendors. Enterprise services are highly-integrated web services combined with business logic and semantics that can be accessed and used repeatedly to support a particular business process (Fremantle, Weerawarana, & Khalaf, 2002). The following characteristics differentiate enterprise services from regular web services. First enterprise service contains business semantics. For regular/general Web services, business semantics are not required. Enterprise services are structured according to a harmonized enterprise model based on business objects, process components, and data types. They are defined using common business rules. Second, enterprise services require quality and stability for future using. Regular/general Web services do not need to have such strict rules. Enterprise services safeguard a stable interface for backward compatibility. Their behavior, prerequisites, dependencies of usage and configuration possibilities need to be documented. Third, enterprise services are based on open standards according their application areas, i.e. B2B enterprise services are defined in compliance with e-business standards. Regular/general Web services for different purposes will either follow certain standards or do not have any standard that needs to be followed. The interfaces of enterprise services are described in a language such as WSDL and use e.g. SOAP or REST.

A semantic annotation in a document is additional information that identifies or defines a concept in a semantic model in order to describe part of that document. The annotation links the concept to an ontology that is described externally to the document and is used to describe the semantics of concepts for broad use. The Semantic Annotations for WSDL (SAWSDL) standard how semantic annotations are added to a WSDL document using XML attributes. Semantic annotations are of two kinds: explicit identifiers of concepts, or identifiers of mappings from WSDL to concepts or vice versa (W3C, 2007).

## Difference between Enterprise Services and Situational Enterprise Services

Situational enterprise services can be web services, enterprise services, widgets, gadgets, pipes, feeds, or mash-ups which can support to build situational enterprise applications. There are not a strict line between Web services, enterprise services and situational enterprise services. Enterprise services are certainly Web services. Situational enterprise applications can be perimeter enterprise applications. Being able to build a perimeter enterprise application, situation enterprise application could consume some related enterprise services. Ideally, situational enterprise applications are supported by an end user programming environment. In the programming environment, situational enterprise services are defined not only including semantic annotated Web services and enterprise services, but also involving semantically annotated widgets, gadgets, pipes, feeds and mash-ups. These web-based resources are also important resources for building situational enterprise applications. Business users should easily express their need using a lightweight business process language. Discovery, selection, composition resources such as web services, widgets can be done (semi-) automatically.

## Definition of Situational Enterprise Services

We define situational enterprise services as semantic annotated web services, enterprise services and semantic annotated web-based resources, such as annotated widgets, gadgets, pipes, feeds and mash-ups. The situational enterprise services are used to build situational enterprise applications in an end user programming environment.

## The Needs of Situational Enterprise Services

### Motivating Scenario and Issues

As a motivational scenario take the setting of a small work unit (small company or department of a larger one) that performs specialized work. As part of the specialized work, there is a frequent need for specialized material purchases. The quantities are not sufficient for a complete purchasing process to be followed, so currently the materials are ordered ad hoc. As these materials are ordered on a regular basis by all team members, the manager wants to integrate the various suppliers' catalogs into the purchasing process whereby the team members can easily order items from an up-to-date catalog of all the offerings of a supplier. At the same time, the manager wants to achieve a better usage of resources by blocking the purchase of small quantities of items that are regularly used.

The scenario described above is a straightforward case of supplier integration and is generally supported within enterprises for large suppliers. As in the traditional way of integration the effort required to integrate a catalog is not insignificant, smaller suppliers, or needs of small parts of an organization are often not attended to. It is a typical process-oriented situational perimeter ERP application which we mentioned in Introduction section.

On www.programableweb.com, a leading mashup directory, there are about 4100 registered mashups. Every month, about 100 new mashups are added. Descriptions of feeds can be obtained, for example, from social bookmarking web sites like www.syndic8.com (Barr & Kearney, 2001), which lists about 562,488 feeds. There are too many web-based resources for end users to manually discover, select or compose. There are needs to provide a common platform beyond current mashup environment to facilitate end users to build their applications which are not only data-oriented, but also process-oriented.

### Requirements of Building Situational Enterprise Applications

The key requirement of situational enterprise applications is that their initial development until in a working stage is reasonably simple and cheap. This means that little time must be spend in the development, and the knowledge of the "developer" on the framework is limited. The developer is often someone in the line of business with a certain degree of computer skills, but mostly significant knowledge of the actual business processes.

For the developers of situational enterprise applications the development is not their main professional activity. As such for when combining services, it must be easy to find and use the component services. It cannot be expected that the developers have prior knowledge of available components or their proper usage, or are willing to invest significant time in learning about this. The retrieval and usage of the components is generally facilitated by rich descriptions using semantic technologies.

## Design Principles of Situational Enterprise Services

### Service-Oriented Architecture (SOA) and Service-Orientation Principles

Service oriented architecture is primarily an approach to information system design. Within the SOA approach the information system consists of loosely coupled components that are interconnected through (Web-) services (Papazoglou & Georgakopoulos). SOA has a number of goals and characteristics:

- **Module independence**: The individual modules can be independently modified or deployed.
- **Alternatives**: Service interfaces can be provided by different components, allowing for a choice based on criteria outside the service definition.
- **Distribution**: As service technologies are naturally decoupled, each component of an SOA system can trivially be deployed on a different computer.
- **Clear separation**: Individual modules are independent processes with clear interfaces. This allows easy access enforcement and parallelism.

### Enhancing SOA with Semantic Technologies

Web services, the enabling technology of SOA are the latest evolution of remote procedure calls (RPC) (Birrell & Nelson, 1984).Web service interfaces are generally described using the Web Service Description Language (WSDL). WSDL, while being based on Web services is only a limited extension to traditional Interface Definition Languages (IDL). WSDL as well as other IDL languages describe the available functions and their parameter and return types. These descriptions, while providing sufficient information for the correct syntax for the invocation of the services, do not describe the semantics of the services.

Traditionally semantic information has been provided by means of textual documentation. This textual information however has disadvantages when used as exclusive source of semantic information. Textual information is generally not machine readable, therefore the information system cannot use this information.

Semantic descriptions of Web services, such as provided through SA-WSDL or WSML, can be used for various purposes. Semantics can be used to strengthen the description of services and have stronger verification of correct invocation. Semantics can also be used for service matching, allowing services to be automatically selected for use. A third use is to use the semantic description of the services to facilitate the authoring of information system components that use the services.

## Enhancing SOA with the Web Principles

### Services as Web Resources

The Web has had a big impact on information system design. Many information systems are now provided as Web applications, providing access without requiring a specific client on the user computer. The user interface is further universally provided by the browser, providing a high degree of consistency and platform independence.

The Web is characterized by the fact that it is very easy to get access to the original information through the source view (and easy editing), easy linkage between systems through URLs, as well as easy access to related information through URL editing. Although SOAP, the most used Web services technology, is generally provided over HTTP, it is far from straightforward. The SOAP HTTP binding basically uses HTTP as a tunnel through which an information system is accessed. This conflicts with the design philosophy of HTTP and has a number of caveats. Lately this conflict in philosophy, as well as the general complexity of SOAP, have lead to the growing popularity of the RESTfull approach to Web services (Fielding, 2000). The REST approach follows the HTTP philosophy which allows for example easy access by Web browsers and scripts without a translation layer. This also eases debugging of systems that use Web services as the services themselves can be easily invoked with a browser and their results verified.

**Services for the Web**

Web services, especially RESTfull Web services, are based on Web technology. Web browsers, as well as technologies for server side Web programming such as PHP, ASP and Servlets provide easy access to Web resources. Given this good match between services access technologies it is not surprising that Web mash-ups have become popular as a means to expose services, or a combination of services, to end users.

**Integrating SOA with the Web2.0 and Semantic Web**

Web 2.0 is a label put to recent developments on the Web. In Web 2.0, the Web is participatory. The information is created collaboratively. The experience of a Web 2.0 site improves with user participation.

## The Application of Situational Enterprise Services

Situational enterprise services can be used to address the issues of the motivational scenario. In the solution, a number of components come together that contribute to a sufficient solution for the work unit:

- The supplier provides electronic access to his information. The product catalog is available for electronic querying. Ideally this is in the form of a Web service (SOAP or REST based), but most traditional Web pages would suffice when coupled with a Web-scraping (Pan, 2002) module. For simplicity we assume that the catalog is exposed as Web service.

The second part is electronic ordering. The supplier allows electronic ordering of items from the catalog. The business unit has an account with the supplier that allows for proper authentication of purchase orders with a fixed delivery address. A Web service (or if need be, a fax) is used to submit the orders accompanied by an authentication token. The supplier receives the order and optionally provides an order confirmation by email to the department head and / or the employee ordering the item.

- The company has a workflow system that allows for machine interaction through Web services. When an employee creates an order through the situational purchasing portal, the order, complete with links to Web pages describing the ordered items is submitted to the workflow system.

The workflow system allows for locally specified workflows, and the manager of the work unit has created a lightweight workflow that is used for the approval of purchases. Some purchases are automatically approved or rejected, while some are sent to the manager for approval. The workflow system verifies that these procedures do not violate corporate policy by for example going above the approval limit of the manager.

- The Web interface of the workflow system allows the manager to review the pending approval requests. The requests are accompanied by all information about the goods to be purchased. The approval request contains sufficient information for subsequent ordering by the purchasing situational application. When the request is approved, the request is send to the purchasing situational application, which then executes the purchase by invoking the Web service of the supplier with the information in the request.
- The situational purchasing application connects all aspects together. There are two parts of the application. The first part is the catalog access. Using the Web service that exposes the catalog information from the supplier, a custom catalog is created that exposes the items for purchase. Some items or quantities may have been blocked from purchase and will not be available. An employee can select which items he wants to purchase in which quantities. When the employee then confirms his selection, the application composes a purchasing request and submits it to the existing workflow system for execution with the custom workflow for the application.

When the purchase request is approved, the workflow system then forwards the approved request to the situational purchasing application. The situational purchasing application takes the information in the request and uses it to submit a purchase request using the appropriate Web service of the supplier.

The easy creation of this application has a number of requirements. The fulfillment of these requirements needs the various composite technologies and defines the nature of the system as a situational enterprise service. First of all, the catalog actually needs to be semantically annotated to allow a generic catalog framework to make use of it. This semantic annotation comes in the place of a standard protocol where the semantics have been predefined. It is difficult to expect services from external partners to implement a standard. The advantages of a semantic annotation are that the semantic technology can help to map between various notions in the protocols, as well as the fact that annotations can be provided by parties other than the supplier.

The ordering web service submits orders to the workflow system. The interface to the workflow system is specified semantically (to account for different workflow system interfaces). The submission is also semantically annotated such that the request is recognized as a purchase request and the system can handle the request appropriately and still enforce corporate policy. Similarly, the custom workflow for the system is semantically annotated (and probably derived from a standard template) such that its correctness and fitting with corporate policy is ensured.

The workflow system uses the workflow description leading to an automatic or manual approval or rejection. The system must have some level of support for custom requests. Basically this means that the system is able to display custom documents.

## FUTURE RESEARCH DIRECTIONS

The area of situational enterprise services is very new. There are lots of topics that still remain to be researched. Below we sketch a number of the topics that are particular importance.

An important question is how web services, enterprise services, widgets, gadgets, pipes, feeds and mashups can be annotated in a unified way. Can all web resources be seen as services? How is a mechanism designed that glues services together automatically and enhances interoperability?

What is the right way to abstract processes (mapping between an activity and a service). When activities are too abstract they do not provide sufficient information for mapping a service onto them, and when activities are too detailed they do not allow flexibility, and the usage of the detailed activities is highly complex.

As situational enterprise applications are flexible and easy to extend, it is interesting to see how well the technology supports scientific workflows, for example to support genome research.

## CONCLUSION

The topic of situational enterprise services encompasses concepts such as semantically annotated web services and enterprise services, as well as more lightweight concepts such as widgets, gadgets, pipes, feeds and mashups. Within the moniker of situational enterprise services service concepts are applied to all web resources.

Situational enterprise services includes semantic annotated web services, enterprise services and other web-based resources such as widgets, gadgets, pips, feeds and mashups. It is applying service concepts to all web-resources. Situational enterprise services can extend current data-oriented applications into process-oriented applications.

## REFERENCES

Barr, J., & Kearney, B. (2001). Retrieved from http://www.syndic8.com

Birrell, A. D., & Nelson, B. J. (1984). Implementing remote procedure calls. *ACM Transactions on Computer Systems*, *2*(1), 39–59. doi:. doi:10.1145/2080.357392

Cardwell, G. (2008). The inuence of enterprise architecture and process hierarchies on company success. *Total Quality Management & Business Excellence*, *19*(1–2), 47. doi:10.1080/14783360701601959

Fielding, R. T. (2000). *Architectural styles and the design of network-based software architectures*. Unpublished doctoral dissertation, University of California, Irvine.

Fremantle, P., Weerawarana, S., & Khalaf, R. (2002). Enterprise services. *Communications of the ACM*, *45*(10), 77–82. doi:. doi:10.1145/570907.570935

Markus, M., & Tanis, C. (2000). The enterprise systems experience-from adoption to success. In R. W. Zmud & M. F. Price (Eds.), *Framing the domains of it management: Projecting the future through the past* (pp. 1–46). Cincinnati, OH: Pinna ex Educational Resources, Inc.

Pan, A., Raposo, J., Álvarez, M., Hidalgo, J., & Viña, Á. (2002). Semiautomatic wrapper generation for commercial web sources. In *Proceedings of the ifip tc8 / wg8.1 working conference on engineering information systems in the internet context* (pp. 265–283). Deventer, The Netherlands: Kluwer, B.V.

Papazoglou, M. P., & Georgakopoulos, D. (2003). Service-oriented computing. *Communications of the ACM*, *46*(10), 24–28. doi:. doi:10.1145/944217.944233

W3C. (2004). *Web Services Glossary*. Retrieved from http://www.w3.org/TR/ws-gloss/

W3C. (2007). *Semantic Annotations for WSDL and XML Schema – Terminology*. Retrieved from http://www.w3.org/2002/ws/sawsdl/spec/#Terminology

## ADDITIONAL READING

Alonso, G., Casati, F., Kuno, H., & Machiraju, V. (2004). *Web Services Concepts, Architectures and Applications*. Springer, 2004

Anderson, C.(2006). *The Long Tail, Why the Future of Business is Selling Less of More*. Hyperion. July 2006.

Benslimane, D., Dustdar, S., & Sheth, A. (2008). Services Mashups: The New Generation of Web Applications. *IEEE Internet Computing*, *5*(12), 13–15. doi:10.1109/MIC.2008.110

Bouguettaya, A., Krueger, I., & Margaria, T. (Eds.). Lecture Notes In Computer Science, vol. 5364. Springer-Verlag, Berlin, Heidelberg, 422-437.

Braga, D., Ceri, S., Daniel, F., & Martinenghi, D. (2008, Sep.). Mashing Up Search Services. *IEEE Internet Computing*, *12*(5), 16–23. doi:10.1109/MIC.2008.105

Bravery, A., Cherbakov, L. and Pandya, A, (2008) *SOA meets situational applications, Part 2: Building the IBM Situational Applications Environment*, IBM Developer Works, 10 January 2008.

Cherbakov, L., Bravery, A., Goodman, B. D., Pandya, A., & Baggett, J. (2007). Changing the corporate IT development model: Tapping the power of grassroots computing . *IBM Systems Journal*, 2007.

Cherbakov, L., Bravery, A., & Pandya, A. (2007) *SOA meets situational applications, part 1: Changing computing in the enterprise, IBM Developer Works.*

de Vrieze, P., Xu, L., & Bouguettaya, A. Yang J. and Chen J. (2009) *Process-oriented Enterprise Mashups*. 4th International Workshop on Workflow Management (ICWM2009), Geneva, Switzerland, 4-8 May 2009.

Ennals, R. J., & Garofalakis, M. N. (2007). MashMaker: mashups for the masses. In *Proceedings of the 2007 ACM SIGMOD international Conference on Management of Data* (Beijing, China, June 11 - 14, 2007). SIGMOD '07. ACM, New York, NY, 1116-1118.

Högg, R., Meckel, M., Stanoevska-Slabeva, K., & Martignoni, R. (2006). *Overview of business models for Web 2.0 communities*, Proceedings of GeNeMe 2006, p. 23-37, Dresden, 2006

Maximilien, E. M., Ranabahu, A., & Gomadam, K. (2008, Sep.). An Online Platform for Web APIs and Service Mashups. *IEEE Internet Computing*, *12*(5), 32–43. doi:10.1109/MIC.2008.92

McAfee, A. (2006, Spring). Enterprise 2.0: The Dawn of Emergent Collaboration. *MIT Sloan Management Review*, *47*(3), 21–28.

Nigam, A., & Caswell, N. S. (2003). Business artifacts: An approach to operational specification. *IBM Systems Journal*, *42*(3), 428–445.

O'Reilly, T. & Musser, J.(2006). Web 2.0 Principles and Best Practices. *O'Reilly radar*, November 2006.

O'Reilly, T. (2005). *What is Web 2.0: Design Patterns and Business Models for the Next Generation of Software*. http://www.oreillynet.com/pub/a/oreilly/tim/news/2005/09/30/what-is-web-20.html

Rosenberg, F., Curbera, F., Duftler, M. J., & Khalaf, R. (2008, Sep.). Composing RESTful Services and Collaborative Workflows: A Lightweight Approach. *IEEE Internet Computing*, *12*, 5. doi:10.1109/MIC.2008.98

Silva-Lepe, I., Subramanian, R., Rouvellou, I., Mikalsen, T., Diament, J., & Iyengar, A. (2008). SOAlive Service Catalog: A Simplified Approach to Describing, Discovering and Composing Situational Enterprise Services. In *Proceedings of the 6th international Conference on Service-Oriented Computing* (Sydney, Australia, December 01 - 05, 2008).

Smith, R. (2006). *Enterprise Mashups: An Industry Case Study*. Keynote at the New York PHP Conference & Expo, Manhattan, New York, USA, 14-16 June 2006

Tuchinda, R., Szekely, P., & Knoblock, C. A. (2008). Building Mashups by example. In *Proceedings of the 13th international Conference on intelligent User interfaces*. IUI '08. ACM, New York.

Wong, J., & Hong, J. (2008). What do we "mashup" when we make mashups? In *Proceedings of the 4th international Workshop on End-User Software Engineering* (Leipzig, Germany, May 12, 2008). WEUSE '08. ACM, New York, NY, 35-39.

Yu, J., Benatallah, B., Casati, F., & Daniel, F. (2008). Understanding Mashup Development. *IEEE Internet Computing*, *5*(12), 44–52. doi:10.1109/MIC.2008.114

Zang, N., Rosson, M., & Nasser, V. (2008). Mashups: who? what? why? In *CHI '08 Extended Abstracts on Human Factors in Computing Systems*. Florence, Italy, April 05 - 10, 2008. CHI '08. ACM, New York.

## KEY TERMS AND DEFINITIONS

**Mashup:** A mini application that is primarily created by composing independent components from various sources. Information and functionality from one source is combined with information or functionality from other sources to create added value. After combination the result is visualized.

**Web Service:** A web service allows remote systems to interact with each other.

**Semantic Annotation:** The annotation of an object, relating its concepts to well defined semantics. This allows computer reasoning about the object. A simple example would be to provide a US zip code as a general zip code. On a higher level, the semantic annotation could express information about the functionality of the service.

**Semantic Web Service:** A web service that is semantically annotated. This allows for machine assisted or automatic usage of web services.

**Enterprise Service:** An enterprise service is a highly integrated web service that combines business logic and semantics that is used to support a particular business process.

**Service Oriented Architecture:** Service oriented architecture is an approach to the design of information systems. Within this approach an information system consists of various independent modules that interact through exposing service interfaces.

**ERP System:** An ERP system is a system that supports the running of a business by maintaining shared data and functionality for a broad range of business functions, ranging from human resources to production planning and sales.

# Chapter 90
# Social Networks and Web Services-Based Systems

**Zakaria Maamar**
*Zayed University, Dubai, UAE*

**Leandro Krug Wives**
*UFRGS, Porto Alegre, Brazil*

## INTRODUCTION

Web services are paving the way for a new type of business applications. This can be noticed from the large number of standards and initiatives related to Web services (Margaria, 2007; Papazoglou et al., 2007; Yu et al., 2008), which tackle a variety of issues such as security, fault tolerance, and substitution. These issues hinder the automatic composition of Web services. Composition handles the situation of a user's request that cannot be satisfied by any single, available Web service, whereas a composite Web service obtained by combining available Web services may be used.

Despite the tremendous capabilities that empower Web services, they still lack some capabilities that would propel them to a higher level of adoption by the IT community and make them compete with other integration middleware like CORBA and .Net. As a result, Web services adoption could be slowed down if some issues such as the complexity of their discovery are not properly addressed (Langdom, 2003). For this particular issue of discovery, we examine in this chapter the use of social networks (Ethier, visited in 2008; Wasserman and Glaskiewics, 1994). Such networks permit to establish between people relationships of different types like friendship, kinship, and conflict. These relationships are dynamic and, hence, adjusted over time depending on different factors like outcomes of previous interaction experiences, and natures of partners dealt with. Replacing people with Web services is doable since Web services constantly engage in different types of interaction sessions with users and peers as well (Manuel Serra da Cruz et al., 2003).

DOI: 10.4018/978-1-61520-611-7.ch090

The purpose of the discovery process is to find a suitable Web service for a given consumer's request. A consumer could be a user or another Web service. This process relies a lot on the Web Services Description Language (WSDL) documents that providers of Web services post on registries like Universal Description, Discovery and Integration (UDDI) and Electronic Business using eXtensible Markup Language (ebXML). Unfortunately, the current registries still struggle with different limitations (e.g., lack of semantics, consistency, and security) despite the extensions that are reported in the literature. A social network could help address some of these limitations by making Web services for instance take into account the previous composition scenarios in which they took part, so they can establish relationships with the peers that were in these composition scenarios.

In this chapter we define a social network in the context of Web services and show how this network is build and then used to discover Web services. Different initiatives embrace social networks but a few examine Web services discovery.

## BRIEF LITERATURE REVIEW

Social networks have been used in different domains ranging from social sciences to artificial intelligence and e-business. According to Ethier, "the study of social networks is important since it helps us to better understand how and why we interact with each other, as well as how technology can alter this interaction. The field of social network theory has grown considerably during the past few years as advanced computing technology has opened the door for new research" (Ethier, visited in 2008).

Generally, a network consists of nodes and edges. The nodes refer to any type of object or entity like individuals or organizations, and the edges refer to relationships (or associations) between these nodes like degree of friendship between two persons or distance between two cities. Relationships are sometimes directional, bidirectional, with weight, or a mixture of all of these. Research in a number of academic fields has revealed that social networks operate on many levels, from families up to the level of nations, and play a critical role in determining the way problems are solved, organizations are run, and the degree to which individuals succeed in achieving their goals (Jackson and Wolinsky, 1996; Moody and White, 2003). In the field of recommender systems, O'Donovan and Smyth propose two computational models of trust and show how these models could be incorporated into collaborative-based recommender systems (O'Donovan and Smyth, 2005). The authors report that users tend to ask friends (i.e., persons that they normally trust and are part of their social networks) for advices prior to taking actions or making decisions. To address the reliability problem that could undermine the provided recommendations, O'Donovan and Smyth consider historical evaluations that users give to these recommendations. Therefore, if a user is behind a good number of accurate recommendations over time, her level of trust as a reliable partner increases compared to the one who makes poor (or misleading) recommendations.

## SOCIAL NETWORKS AND WEB SERVICES

### How to Build a Network?

Building a social network means identifying the type of nodes and edges that will constitute this network. In terms of nodes, Web services would be the sole constituents. In terms of edges, we would suggest three types of associations namely Recommendation (R), Similarity (S), and Collaboration (C) with focus on the recommendation association in this chapter.

Formally, a Social Network SN of a Web Service WS is a couple: $SN_{WS} = (N, E)$ where N and

E are the set of Nodes and Edges, respectively. Each edge e that belongs to E is a tuple of the form <$WS_i$, t, w, $WS_j$>, where the edge is directed from $WS_i$ to $WS_j$, t denotes the type of association (or name) between $WS_i$ and $WS_j$, and w denotes the weight affected to the association. This weight is a calculated numerical-value between 0 and 1. Our work on the recommendation-based association (R) relies on what recommender systems can do for Web services (Krug Wives et al., 2008). We identify two cases namely partnership and robustness that should help in specializing the recommendation-based association of the future social networks to build.

*Partnership case (Rp)*: a component Web service that participates in a composition scenario could propose to append new peers into this scenario. Though these new peers are not required in satisfying a user's request, they could yield extra responses for the user. For instance, a speaker attending an overseas conference could be interested in some sightseeing activities according to her profile, though this speaker did not explicitly express this interest. The new component Web services (or peers) are subject to the speaker's approval prior to their execution.

- Example: <RoomBookingWS, $t_{Rp}$, $wt_{Rp}$, SightSeeingWS>: if RoomBookingWS is part of a composition scenario, then this Web service will recommend that SightSeeingWS should be part of this scenario subject to checking and seeking the requestor's profile and approval, respectively.
- Properties: Rp is asymmetric and transitive (transitivity may be limited in terms of transition cycles/paths by a threshold that a Web service's owner could set).
- Association weight for recommendation based on partnership $wt_{Rp}$ is given by the following equation:

$$wt_{Rp(WSi,\ WSj)} = |WS_j \text{ selection}| \,/\, |WS_i \text{ participation}| \quad (1)$$

where $|WS_i$ participation$|$ and $|WS_j$ selection$|$ stand for number of times that $WS_i$ participated in composition scenarios and number of times that $WS_j$ accepted to participate in these composition scenarios based on the recommendation of $WS_i$. The higher the weight is, the better is for $WS_j$.

*Robustness case (Rr)*: a Web service could suggest peers that will substitute for it in case of failure. These peers are identified based on the functional and non-functional characteristics they have in common with the Web service to be made robust. Reasons for substitution include Web service failure to respond to a client's requests or inability of meeting a certain level of quality of service.

- Example: <RoomBookingWS, $t_{Rr}$, $wt_{Rr}$, HotelReservationWS>: If RoomBookingWS fails in a composition scenario at run-time, then HotelReservationWS will substitute for this Web service subject to the approval of the user.
- Properties: Rr is asymmetric and transitive (like Rp, Rr is limited in terms of transition cycles/paths by a threshold that a Web service's owner could set).
- Association weight for recommendation based on robustness $wt_{Rr}$ is given by the following equation:

$$wt_{Rr(WSi,\ WSj)} = |WS_j \text{ selection}| \,/\, |WS_i \text{ failure}| \quad (2)$$

where $|WS_i$ failure$|$ and $|WS_j$ selection$|$ stand for number of times that $WS_i$ failed in composition scenarios and number of times that $WS_j$ was called to substitute for $WS_i$ in these composition scenarios upon the recommendation of $WS_i$, and obviously did not fail as well. The higher the weight is, the better is for $WS_j$.

## How to Use a Network?

The purpose of a social network is to help first, identify additional Web services based on the Web services that are already selected and second, reinforce (or measure) the associations that connect all these Web services together based on the recommendation-based associations. The idea here is to combine traditional Web services discovery mechanisms (like UDDI) with the details that social networks carry on. Any Web service that is discovered using these discovery mechanisms constitutes an entry point to its own social network and probably to the social networks of other peers if navigation rights are granted to this Web service. We identify, hereafter, some cases where social networks could be used:

1. In case of composition, the recommendation-based association with focus on partnership permits to enrich a composition scenario with additional Web services that were not initially taken into consideration during the specification exercise of this scenario. Starting from a Web service that is already part of this scenario, this Web service could recommend a number of other Web services that have the highest weights $wt_{Rp}$ (equation 1). This number should be specified by the user or composition designer. If this number is set to zero, this means that the user and the designer are not interested in expanding or reviewing the specification of the established composition scenario. This could be motivated by the extra financial charges that the user does not want to bear, or the lack of computing resources upon which the recommended Web services will be deployed for performance. Otherwise (i.e., number not set to zero) and upon approval of user or composition designer, the additional Web services are appended into the composition scenario.
2. In case of failure, the recommendation-based association with focus on robustness permits to enable a direct (and probably automatic) selection of the Web service that will smoothly substitute for the failed Web service. Furthermore, to guarantee the success of this selection, the similarity-based association would ensure that this Web service is compatible with the peers (specially the next ones) that are supposed to interact with the failed Web service, but need now to interact with this Web service. In these two steps, the selection of the new Web service would depend on the weight for robustness ($wt_{Rr}$, equation 2).

## CONCLUSION

In this chapter we briefly discussed the use of social networks in Web services with emphasis on their discovery. Web services are poised to play a major role in the development of business applications that can now span over enterprises' boundaries. Unfortunately a good number of challenges still hinder the fulfillment of this role, which could simply downgrade and undermine Web services' capabilities and opportunities, respectively. Semantics, security, and trustability are samples of these challenges. Discovery is yet another challenge that could be added to this list of samples. To overcome the discovery challenge, we suggested the use of social networks.

## ACKNOWLEDGMENT

Leandro Krug Wives was supported by a grant from the CAPES-COFECUB project AdContext (057/07), and Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq), Brazil.

## REFERENCES


Ethier, J. (n.d.). *Current Research in Social Network Theory*. Retrieved September 2008 from http://www.ccs.neu.edu/home/perrolle/archive/Ethier-SocialNetworks.html

Jackson, M. O., & Wolinsky, A. (1996). A Strategic Model of Social and Economic Networks. *Journal of Economic Theory*, *71*(44), 44–74. doi:10.1006/jeth.1996.0108

Krug Wives, L., Maamar, Z., Tata, S., Sellami, M., Defude, B., & Moreira de Oliveira, J. P. (2008). *Towards A Marriage between Recommender Systems & Web Services*. Technical report, College of Information Technology, Zayed University, Dubai, U.A.E.

Langdom, C. (2003). The State of Web Services. *IEEE Computer, 36*(7), July.

Manuel Serra da Cruz, S., Maris Campos, L., Luiza Machado Campos, M., & Pires, P. F. (2003). A Data Mart Approach for Monitoring Web Services Usage and Evaluating Quality of Service. In *Proceedings of the XVIII Brazilian Symposium on Databases (SBBD'2003),* Manaus, Brazil.

Margaria, T. (2007). Service is in the Eyes of the Beholder. *IEEE Computer*, *40*(11), 33–37.

Moody, J., & White, D. R. (2003). Structural Cohesion and Embeddedness: A Hierarchical Concept of Social Groups. *American Sociological Review*, *68*(1). doi:10.2307/3088904

O'Donovan, J., & Smyth, B. (2005). Trust in recommender systems. In *Proceedings of the 10th International Conference on Intelligent User Interfaces (IUI'2005),* San Diego, CA.

Papazoglou, M., Traverso, P., Dustdar, S., & Leymann, F. (2007). Service-Oriented Computing: State of the Art and Research Challenges. *IEEE Computer*, *40*(11), 38–45.

Wasserman, S., & Glaskiewics, J. (1994). *Advances in Social Networks Analysis*. San Francisco: Sage Publications.

Yu, Q., Bouguettaya, A., & Medjahed, B. (2008). Deploying and Managing Web Services: Issues, Solutions, and Directions. *The VLDB Journal*, *17*(3), 537–572. doi:10.1007/s00778-006-0020-3


## KEY TERMS AND DEFINITIONS

**Web Service:** It is "*a software application identified by a URI, whose interfaces and binding are capable of being defined, described, and discovered by XML artifacts, and supports direct interactions with other software applications using XML-based messages via Internet-based applications*" (W3C). A Web service implements a functionality (e.g., BookOrder and WeatherForecast) that users and other peers invoke by submitting appropriate messages to this Web service. The life cycle of a Web service could be summarized with five stages namely description, publication, discovery, invocation, and composition. Briefly, providers describe their Web services and publish them on dedicated registries. Potential consumers (i.e., requesters) interact with these registries to discover relevant Web services, so they could invoke them. In case the discovery fails, i.e., requests cannot be satisfied by any single Web service, the available Web services may be composed to satisfy the consumer's request.

**Composite Web Service:** Composition targets users' requests that cannot be satisfied by any single, available Web service, whereas a composite Web service obtained by combining available Web services may be used. Several specification languages to compose Web services exist for example WS-BPEL (de facto standard), WSCDL, and XLANG. A composite Web service could be built either proactively or reactively. The former is an off-line process that gathers available component Web services in-advance to form a composite Web service. This one is pre-compiled and ready for execution upon users' requests. The latter creates a composite Web service on-the-fly upon users' requests. Because of the on-the fly property, a dedicated module is in charge of identifying the needed component Web services, making them collaborate, tracking their execution, and resolving their conflicts if they arise.

**Universal Description, Discovery, and Integration:** UDDI specifications define how Web services should be published and discovered by providers and users, respectively. At the conceptual level, information provided in an UDDI registry consists of three components. First, white pages include address, contact, and known identifiers of Web services. Second, yellow pages include industrial categories based on standardized taxonomies. Finally, green pages include the technical information that a provider would like to offer on its Web services. At the business level, an UDDI registry can be used for checking whether a given provider has particular Web services, finding companies in a certain industry with a given type of Web service, and locating information about how a provider has exposed a Web service.

**Recommender Systems:** They are designed to help users tackle the problem of information overload. They could be built upon three representative techniques namely content-based, collaborative-filtering, and hybrid.

**Electronic Business Using eXtensible Markup Language - ebXML:** A family of XML-based standards sponsored by OASIS and UN/CEFACT whose mission is to provide an open, XML-based infrastructure that enables the global use of electronic business information in an interoperable, secure, and consistent manner by all trading partners (http://en.wikipedia.org/wiki/EbXML).

# Chapter 91
# Interoperability Issues of Business Processes:
## Key Issues and Technological Drivers

**Ejub Kajan**
*State University of Novi Pazar, Serbia*

## INTRODUCTION

At the beginning of the third millennium, we are facing one of the most important transition challenges: to build an electronic society. In that movement, EC (Electronic Commerce) represents one of the major driving forces that survived two big failures in the past, represented by EDI (1980s) and "dotcom era" (1990s). Despite different network technologies, EDI (Electronic Data Interchange) over OSI (Open Systems Interconnections) vs. dotcom over the Internet both left out of the e-business too many companies (e.g. most of SMEs, Small-to-Medium Enterprises). After disillusionment and failure analysis, new expansion of EC is taking place, especially in the form of B2B. In such circumstances there is a lot of heterogeneity between business processes, supported applications and associated data on one side and different hardware, operating systems, database systems, network infrastructure, etc. on the other side, that make huge difficulties and barriers in achieving the full potential of EC (Medjahed et al., 2003; Kajan & Stoimenov, 2005; Hepp, 2006). Similar situation is taking place inside companies where A2A (Application-to-Application) costs for data integration and access software were about $2.5 billion in 2007 and are going to grow further (Bernstein & Hass, 2008).

In order to reach full interoperability inside business entities and between them as well, various technologies and frameworks are being proposed and deployed, but none of them has yet brought EC to its full potential. This chapter gives an overview of main obstacles, a critical assessment of existing approaches and recent research efforts in order to overcome interoperability problems.

DOI: 10.4018/978-1-61520-611-7.ch091

## INTEROPERABILITY ISSUES

At least three types of *interoperability* (according to the main task that should be performed), communication, syntactic, and semantic, are crucial. *Communication interoperability* must be able to bring the data from one place to another on time with the required quality. It relies on the infrastructure and standardized protocols where all the necessary data are precisely defined (e.g., encapsulation, frames, checksum algorithms, etc.). Despite the widespread and longtime use of TCP/IP protocol stack, new application requirements caused a flood of new protocols, thus the number of RFCs (Request for Comments) by the end of 2008 has grown over 5,400. However, this exciting research field does not endanger the main task of this level. The main obstacles that reduce communication interoperability are poor and/or expensive communication infrastructure, the situation existing in most countries outside the developed world making the so-called digital divide deeper than ever. There are many case studies that investigate particular country or region from that point of view, a good overview of which is available in (Roubiah, et al., 2009).

The main task of *syntactic interoperability* is to provide a data format understandable by peers. It should allow content exchange among multiple software components independently of their implementation languages, run-time environments and other technological differences.

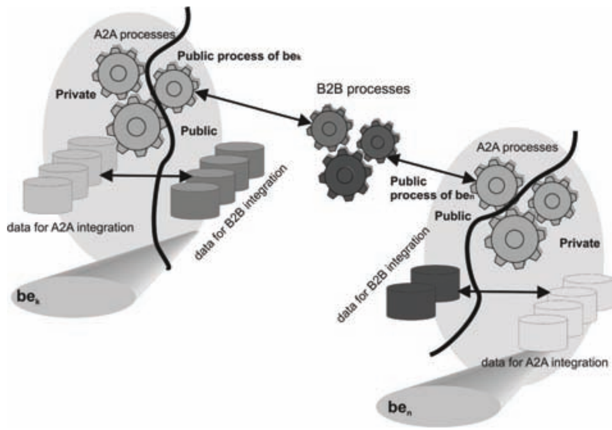
Unlike syntactic interoperability where the main issue focuses on data formats, s*emantic interoperability* focuses on data meaning. It provides peers with the ability to overcome semantic conflicts arising from differences in implicit meanings, perspectives, and assumptions in the data, business processes and so on. The sources of semantic conflicts are the subject of the next chapter.

The problem of interoperability exists in all application areas of information systems. In EC, there are two main fields of interoperability widely known as *A2A* and *B2B*. They have much in common, but they are also different. Business processes inside an enterprise (here and after business entity, *be*) have their private and public parts. The private part of a business process is visible only inside a business entity interacting with other internal business processes whilst the public part acts inside the business entity but also takes place in B2B processes interacting with the public parts of business processes that belong to the other *be*, as shown in Fig. 1. A2A serves as an important mechanism in order to achieve business goals, but also serves as a flywheel of B2B efforts of that *be*. As much as a *be* reaches full A2A, i.e. achieves ZLE, its chances to have successful B2B relationships with other *bes* are growing.

The main goal of B2B is to provide *bes* with the ability to establish business relationship in such a manner that their public business processes may interact with each other exchanging their data. In a business scenario, business entities are usually loosely coupled; that means business processes require ad hoc integration from time to time. Such integration on demand may experience many conflicts. Problems arise due to the huge heterogeneity between business processes and data involved, which are both different by nature on the one side and on the other side between underlying IT technologies, which are different by default.

Both, A2A and B2B interoperability are victims of heterogeneity mentioned above. From that point of view, the main difference between them is the ability to control heterogeneity, which is much easier in a single company. In B2B environment, where huge number of potential participants may exist, the autonomy of every *be* how to run own business and by which software is out of question. Thus B2B experiences many more difficulties in interoperability than A2A.

*Figure 1. The private and public parts of A2A and B2B*




## THE SOURCES OF CONFLICTS

Conflicts between data may appear either in data itself and/or in data schemas. At the data level, conflicts are caused by different representation and interpretation of the same or similar data (e.g. expressions, units and precision) (Kim & Seo, 1991). At the schema level, conflicts are characterized by differences in logical structures and/or inconsistencies of metadata in the same application domain. Examples include names, entity identifiers, schema isomorphism, and many other schema discrepancies, as follows.

Naming conflicts come from arbitrary assigning names to schema elements (e.g., entity classes, relationships, attributes, etc.). There are two types of such conflicts: synonyms and homonyms (Shet & Kashyap, 1992). Synonyms appear when two databases use different names for describing the same concepts such are entity set, entity relationships or their attributes. For example, in one database there is a customer, in other the same entity is referred to as a client. Homonyms appear when two schemas use the same name for two different concepts.

Entity identifiers cause conflicts when different primary keys are assigned to the same concepts in different databases. For example, one database may use a unique tax identifier as a primary key for a "Buyer", whilst the other data base it may be organized as an attribute pair (e.g., Buyer name, address). When the same concepts are described by different set of attributes they arise to schema isomorphism conflicts (Sheth & Kashyap, 1992). When the same real object is represented by two different concepts in two schemas then type conflicts appear, e.g. a gyro account may be assigned in one schema as an entity type, whilst in another schema it may appear as attribute. At least but no last, cardinality conflicts may be caused by different rules used by different business entities, thus the relationships between objects may have different extreme values.

Business data also suffers from semantic conflicts above. Nevertheless, there are also specific conflicts that may occur between business data caused by different business documents, products and services catalogues and classification schemas as well. There are several reasons for this including, but not limited to, different document names, different document structure, document elements and their representation, etc. These differences make business entities unable to establish collaboration between their business processes.

The discussion has focused on business data semantics. When we move toward business processes the situation there is characterized by non-standardized business terminology, lack of common acceptable and understandable processes (grammar) and lack of common dialog rules (protocols). The problem arises from incompatibility of B2B protocols, i.e. from the heterogeneity of atomic transactions that appear in public part of a business process.

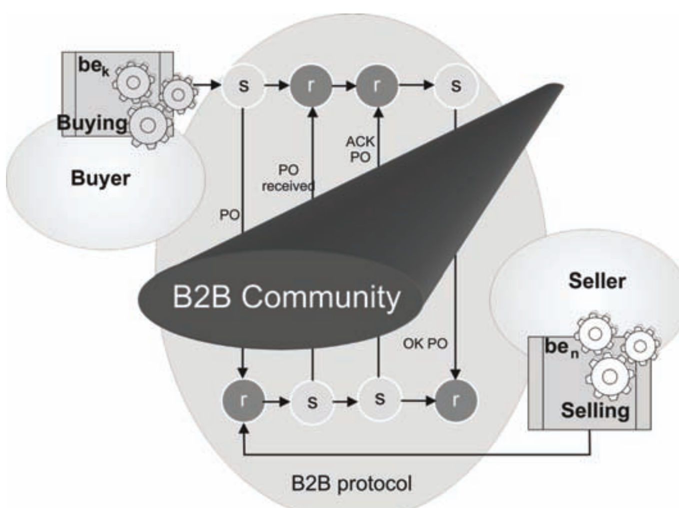
The business protocol is a protocol that defines duration, timing, sequence and purpose of each business collaboration and information exchange. In general, a B2B protocol scenario is simple. Every *be* has its own "half of the protocol" consisting of an amount of send (s) and receive (r) atomic transactions, such as PO (purchase order), ACK PO, etc., as shown in Fig 2. These atomic transactions have ACID properties, so if a B2B protocol is not able to finish its operation, all previous actions are going to be cancelled in reverse order. If both protocols have an equal number of send and receive transactions with adequate meanings for each pair the established business scenario may be successfully finished, as shown in Fig 2a. In practice, B2B protocols with conflicts (as in Fig. 2b) are more likely to occur. Example in Fig 2b shows that the business process PO (Purchase order) is not able to be performed, because $be_n$ will never receive either PO ACK or PO cancellation. On the other side, $be_k$ has lost two atomic transaction sent by $be_n$, because its protocol has fewer atomic transactions with completely different timing. In the real world, there are a number of such protocol discrepancies, the overview of some may be found in (Zhao, 2005). It requires some choreography and orchestration between business processes. This issue will be discussed later on.

## AN OVERVIEW OF EXISTING ENABLING TECHNOLOGIES AND FRAMEWORKS

On the way from a single computer to a distributed global network, computers were going to be more and more loose and distant. With the growth of loosely-coupled computers, the desire for data integration as well as for process interoperability has also grown. At the same time the required semantic that may satisfy integration requirements is getting stronger.

The first serous requirement for data integration appeared in big enterprises whose systems consisted of many LANs mutually connected by either private or public infrastructure. In 1980s, this requirement was satisfied by federated databases

*Figure 2. B2B protocol without conflicts*



(Sheth & Larson, 1990). The problem with that approach was price, because it used 1:1 relationship between every pair of databases involved in an integration process. Data warehouses (DWs) offered a cheaper solution (Chaudhury & Dayal, 1997). Problem with DWs is their potential size because they are accumulating all the data during their use. Next step was represented by datamarts, introducing an interface data layer between query technologies and DWs. All of these three database technologies may be implemented in A2A, whilst for B2B they have no particular importance.

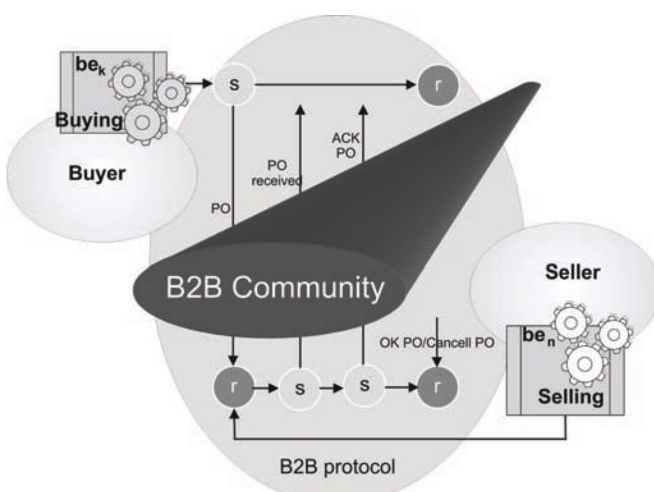
The big step forward for data integration in distributed environments has been made by XML. The power of XML is based on its extensibility that allows users to create own domain-specific tags using DTDs or XML schema languages such are XDR, Schematron, etc. (Lee & Chu, 2000). XML has not be developed to define data semantic, thus its power is limited to common data syntax.

Another axis for data integration is based on Semantic Web technologies (Berners-Lee, et al., 2001). The pool of human knowledge, as the Web was described by its inventor, has been transformed in recent years into a digital jungle with over three billions of documents at the beginning of 2000s (Ding et al., 2002). The idea behind the Semantic Web is machine-readable Web supported with knowledge-oriented technologies such are RDF (Resource Description Framework), (Manola & Miller, 2004), RDF schema (Brickley & Guha, 2004) and OWL (Ontology Web Language), (Dean & Schreiber, 2004). Although RDF and RDF schema are intended to give meaning to data by metadata and classes, respectively, they do not cover complete semantic requirements of interoperability. Here is the place where ontology deployment may play an important role.

In data integration, it is very common to use a combination of mediators and wrappers (Wiederhold, 1992), a three-layer architecture consisting of clients, middle tier and heterogeneous databases on the back layer. This integration architecture has been an active research area for almost twenty years. Examples include, but are not limited to, relational database integration (Papakonstantinou, et al., 1995; Yerneni et al., 1999), integration of data from heterogeneous GIS resources (Stoimenov & Djordjevic-Kajan, 2005), and B2B integration (Kajan & Stoimenov, 2005).

The requirements for interoperability between processes also caused the development of middleware technologies. The first of them is well-known RPC (Remote Procedure Call), the

*Figure 3. B2B protocol with conflicts*



technology that allows clients to invoke remote procedure at the same way as local calls do (Birell and Nelson, 1984). The second generation of middleware technologies is based on distributed objects, the typical representatives of which are CORBA, DCOM, and EJB (Lewandowski, 1998), the critical assessment on these technologies may be found in (Medjahed et al., 2003)

Very important improvement in process interoperability has been made by *Web Services*, which has been considered as a key technology for the development of dynamic EC (Chen et al., 2003). W3C defines Web Service (Austin et al., 2004) as a software application identified by a URI, whose interfaces and binding are capable of being defined, described and discovered by XML artifacts and supports direct interactions with other software applications using XML based messages via Internet-based protocols.

Middleware frameworks are used to solve heterogeneity problems of a different kind. If such middleware tends to reach full interoperability, it must cover both the content and semantics issues, as well as the required choreography. At the content layer *bes* should agree on data formats, data models and languages, and they should be able to bind their business messages to specific transport protocols either in advance (during the development) or dynamically, during execution.

During the last twenty years, various middleware frameworks were developed in order to meet A2A and B2B interoperability. All existing frameworks in use, such EDI-based, XML based (e.g. ebXML, RosettaNet, etc.), Web-services oriented, integrated vendor solutions, etc. are not capable to solve semantic conflicts mentioned earlier, resulting in uncovered area of business interoperability. An overview of these technologies, their strengths and weaknesses, and comparative analysis can be found elsewhere (Medjahed et al., 2003; Kajan & Stoimenov, 2005).

## TOWARD DYNAMIC SEMANTICALY-ENABLED FRAMEWORKS

Semantic conflicts between business data are very complicated and differ from data integration in distributed heterogeneous databases. Research on these problems (Ng et al. 2000) shows that typical product schema tree has two basic characteristics: shallowness (two or three levels) and bushiness (too many attributes, at the second level of a tree, most of them N:1 to the root of tree). There is also typically very limited knowledge about local schemas, a huge number of them, and fast evolution of these schemas.

Research focusing on business data integration is based on different approaches. In CODEX project (Guo, 2006) four levels of integrations are considered: communication via SOAP, documentation, semantic and automatic based on semiotic concept analyses. MEMO project (Jeusfield, 2004) requires business data structures consisting of customer, company and product profiles with many associated attributes. That approach is not compatible with existing widespread classification schemas such as UNSPCS, eCl@ss or RosetaNet RNTD, etc. Ontology-based representation of products and services (Hepp, 2006a) assumes several alternative approaches for product representation (ontologies based on classification schemas, descriptions by examples, and descriptions based on attributes).

Business processes interoperability is one of the hot research topics today. These include analysis of potential technologies (Kajan, 2004; Medjahed et al., 2003), semantically enabled service-oriented architectures (SESA) (Shafiq et al., 2007; Vitvar et al., 2007), and modeling of choreography components for business processes harmonization according to their structure and timing (Cimpian & Mocan 2005). Despite different approaches, all given research examples assume some kind of ontology deployment. There are several research prototypes of ontology-based middleware. Examples include, but not limited to

BUSTER (Visser, 2004), CREAM (Park & Ram, 2004), OBSERVER (Mena et al., 2000), etc. None of them does address either Web services or the problems of process choreography.

The most completed effort to define an ontology-based middleware, which takes care of the above issues is WSMX (Web Services Modeling Execution Environment), which allows discovering, selection, mediation, invocation and mutual work of semantic Web services (W3C, 2005). The WSMX consists of a number of pairs (wrapper/interface) each of which is specialized for a specific task. These tasks include communications, resources, discovering and selection of Web services, data mediation, process mediation, and finally Web services choreography and orchestration. In order to solve semantic conflicts mentioned in section two, WSMX uses four types of mediators (OO, GG, WG, and WW), where O, G and W stands for ontology, goals and Web services, respectively.

## CONCLUSION

This chapter shows several lessons that we learned, which may be summarized as follows. Many efforts have been devoted to overcoming interoperability problems of any kind, but they have not reached their promise yet. Instead of unlimited interoperability inside and between *bes*, the result was too many mutually incompatible "standards" that formed isolated areas of e-business seeking for new investments over and over again.

Recent research efforts are looking very promising. They are concentrating on two big goals: to provide middleware technologies and frameworks which are capable to act as self-acting dynamic artifacts at the time of invocation and to provide necessary semantic understanding between peers of any kind. Despite of well-defined goals and recent results, the whole thing is still under development. At least but not last, many business processes in use are still waiting to be defined and published as web services and too many catalogs and classification schemas need to be expressed in the form of ontologies, as well. The number of automated business processes and data which are outside any common standard is unknown. Furthermore, there are too many countries that are seeking for better national information infrastructure. The question here is that just yet another promising effort or it is a matter of time until full maturity of the concept, enabling technologies and necessary prerequisites is going to be reached.

We believe that the whole idea based on semantically-enabled self-acting artifacts is not yet another hip and that it will lead the Web and EC to their full potential. Let us finish this chapter with a vision of Tim Berners-Lee given in the foreword of the book about Semantic Web (Fensel et al., 2003): "Now we can imagine the world of people with active machines forming part of the infrastructure. We have only to express a request for bids, or make a bid, and machines will turn a small profit matching the two".

## REFERENCES

W3C. (2005). Retrieved from http://www.w3.org/Submission/WSMX/

Austin, D., Barbir, A., Ferris, C., & Garg, S. (Eds.). (2004). *Web Services Architecture Requirements*. Retrieved from http://www.w3.org/TR/2004/NOTE-wsa-reqs-20040211

Berners-Lee, T., Hendler, J., & Lassila, O. (2001). The Semantic Web. *Scientific American*, *284*(5), 34–43. doi:10.1038/scientificamerican0501-34

Bernestein, P. A., & Haas, L. M. (2008). Information Integration in the Enterprise. *Communications of the ACM*, *9*(51), 72–79. doi:10.1145/1378727.1378745

Birrell, A. D., & Nelson, B. J. (1984). Implementing Remote Procedure Calls. *ACM Transactions on Computer Systems*, *2*(1), 39–59. doi:10.1145/2080.357392

Brickley, D., & Guha, R. V. (2004). *RDF Vocabulary Description Language, 1.0: RDF Schema, W3C*. Retrieved from http://www.w3.org/TR/rdf-schema.

Chaudhuri, S., & Dayal, U. (1997). An overview of data warehousing and OLAP technology. *SIGMOD Record*, *26*(1), 65–74. doi:10.1145/248603.248616

Chen, M., Chen, A., & Shao, B. (2003). The Implications and Impacts of Web Services to Electronic Commerce Research and Practices. *Journal of Electronic Commerce Research*, *4*(4), 128–139.

Cimpian, E., & Mocan, A. (2005). WSMX Process Mediation Based on Choreographies. In *First Int'l WS on Web Services Choreography and Orchestration for BPM*, Nancy, France.

Dean, M., & Schreiber, G. (Eds.). (2004). *OWL Web Ontology Language Reference, W3C*. Retrieved from http://www.w3.org/REC-owl-ref-20040210/

Ding, Y., Fensel, D., Klain, M., & Omelayenko, B. (2002). The semantic web: yet another hip? *Data & Knowledge Engineering*, *41*, 205–227. doi:10.1016/S0169-023X(02)00041-1

Fensel, D., Hendler, J., Lieberman, H., & Wahlster, W. (Eds.). (2003). *Spinning the Semantic Web*. Cambridge, MA: MIT Press.

Guo, J. (2006). Inter-Enterprise Business Document Exchange. In *ICEC'06*, Fredericton, Canada, (pp. 427–437).

Hepp, M. (2006). The True Complexity of Product Representation in the Semantic Web. In *ECIS'06*, Gothenburg, Sweden.

Hepp, M. (2006a). Products and Services Ontologies: A Methodology for Deriving OWL Ontologies from Industrial Categorization Standards. *International Journal on Semantic Web and Information Systems*, *2*(1), 72–99.

Jeusfield, M. A. (2004). Integrating product catalogs via multi-language ontologies. In *EAI'04*, Olengsburg, Germany.

Kajan, E. (2004). The Maturity of Open Systems for B2B. *ACM SIGecom Exchanges*, *5*(2), 34–44. doi:10.1145/1120687.1120692

Kajan, E., & Stoimenov, L. (2005). Toward an Ontology-Driven Architectural Framework for B2B. *Communications of the ACM*, *48*(12), 60–66. doi:10.1145/1101779.1101810

Kim, W., & Seo, J. (1991). Classifying Schematic and Data Heterogeneity in Multidatabase Systems. *IEEE Computer*, *24*(12), 12–18.

Lee, D., & Chu, W. W. (2000). Comparative Analysis of Six XML Schema Languages. *SIGMOD Record*, *29*(3), 76–87. doi:10.1145/362084.362140

Lewandowski, S. M. (1998). Frameworks for Component-Based Client/Server Computing. *ACM Computing Surveys*, *30*(1), 3–27. doi:10.1145/274440.274441

Manola, F., & Miller, E. (2004). *RDF primer, W3C*. Retrieved from http://www.w3.org/TR/REC-rdf-synatx

Medjahed, B., Benetalah, B., Bouguettaya, A., Ngu, A. H., & Elmargamid, A. K. (2003). Business-to-business interactions: issues and enabling technologies. *The VLDB Journal*, *12*, 59–85. doi:10.1007/s00778-003-0087-z

Mena, E., Illarramendi, A., Kashyap, A., & Sheth, A. (2000). OBSERVER: An Approach for Query Processing in Global Information Systems based on Interoperation Across Pre-existing Ontologies. *Distributed and Parallel Databases*, *8*(2), 223–272. doi:10.1023/A:1008741824956

Ng, W. K., Yan, G., & Lim, E.-P. (2000). Heterogeneous Product Description in Electronic Commerce. *ACM SIGecom Exchanges*, *1*(1), 7–13. doi:10.1145/844302.844305

Papakonstantinou, Y., Gupta, A., Garcia-Molina, H., & Ullman, J. (1995). A query translation scheme for rapid implementation of wrappers. In *DOOD'95*, (pp. 161–186).

Park, J., & Ram, S. (2004). Information systems interoperability: What lies beneath? *ACM Transactions on Information Systems*, *22*(4), 595–632. doi:10.1145/1028099.1028103

Roubiah, K., Khalil, O., & Hassanien, A. E. (2009). *Emerging Markets and E-Commerce in Developing Economies*. Hershey, PA: IGI Global, Information Science Reference.

Shafiq, O., Zaremba, M., & Fensel, D. (2007). On communication and coordination issues of Semantic Web Services. In *ICWIS*, 2007.

Sheth, A. P., & Kashyap, V. (1992). So far (schematically), yet so near (semantically). In *IFIP WG2.6 Database Semantics Conference on Interoperable Database Systems*, Lorne, Australia, (pp. 283–312).

Sheth, A. P., & Larson, J. A. (1990). Federated database systems for managing distributed, heterogeneous and autonomous databases. *ACM Computing Surveys*, *22*(3), 183–236. doi:10.1145/96602.96604

Stoimenov, L., & Đorđević-Kajan, S. (2005). An Architecture for Interoperable GIS Use in Local Community Environment. *Computers & Geosciences*, *31*, 211–220. doi:10.1016/j.cageo.2004.09.017

Visser, U. (2004). *Genaral Approach of Buster,* (LNCS 3159). Berlin: Springer Verlag.

Vitvar, T., Moran, M., Zaremba, M., Haller, A., & Kotinurmi, P. (2007). *Semantic SOA to Promote Integration of Heterogeneous B2B Services*. Washington, DC: IEEE CEC-EEE.

Wiederhold, G. (1992). Mediators in the architecture of future information systems. *IEEE Computer*, *25*(3), 38–49.

Yerneni, R., Garcia-Molina, H., & Ullman, J. (1999). Computing capabilities of mediators. In *ACM SIGMOD99*, Philadelphia, (pp. 443–454).

Zhao, Y. (2005). Develop the Ontology for Internet Commerce by Reusing Existing Standards. In *SWAFT05*, Nara, Japan, (pp. 51–57).

## KEY TERMS AND DEFINITIONS

**A2A (Application-to-Application):** Process of data and application integration inside an enterprise in order to reach ZLE. Also known as EAI (Enterprise Application Integration) and EII (Enterprise Information Integration).

**BE (Business Entity):** An enterprise, a part of an enterprise and/or its application that participate in A2A or B2B.

**B2B (Business-to-Business):** Type of EC where participating entities are enterprises at both sides. Nowadays, it may be thought as a third wave of EC, where *bes* should be able to establish and handle their business relationship dynamically and seamlessly on demand.

**EC (Electronic Commerce):** An emerging concept that describes the process of buying, selling, or exchanging data, services and products over the Internet.

**Framework:** A common template that has well defined functionality in order to solve a problem, e.g. interoperability, and precisely defined inputs and outputs intended for its communication with the external world.

**Interoperability:** An attribute given to systems, applications and data that assigns their ability to communicate with another systems, applications and data in a manner that they may exchange and mutually use that data.

**Middleware:** A dynamic self-organized layer, usually acting on the top of the transport layer, that provides uniformity between the lower layers of the framework (hardware, operating systems, etc.), which are different by default, and hides serious, natural discrepancies that exist among applications.

**ZLE (Zero Latency Enterprise):** A *be* that has been reached the full A2A integration so that there is no data latency between its own business processes.

# Chapter 92

# Integrated Business Process Designs and Current Applications of Workflow Systems in e-Business

**Mabel T. Kung**
*California State University at Fullerton, USA*

**Jenny Yi Zhang**
*California State University at Fullerton, USA*

## INTRODUCTION

To enable effective cross-departmental automations and global transactions, business processes modeling offer external views on their infrastructure processes to all partners in the enterprise, such as product data, quality, costs and delivery requirements, quantity quotations, process plan efficiency, and interactions for meta-, macro-, and micro- distributed process planning (Livari & Livari, 2006; McKendrick, 2006; Siller, Estruch, Vila, Abellan, & Romero, 2008; Kuechler & Vaishnzvi, 2008).

Business process modeling is significant as E-Business and enterprise integration drive the need to deploy activities online (Tagg, 2001; Aissi, Malu, & Srinivasan, 2002; Weiss & Amyot, 2005; Sewing, Rosemann & Dumas, 2006; Chen, Zhang & Zhou, 2007). These management systems employ integrated productivity tools, specialized technical support systems, such as CAD systems, graphic packages, enterprise-wide integrated software applications, for example, ERP (Enterprise Resource Planning), CRM (Customer Relationship Management), mail and other communication systems. When the applications become more modulated and service oriented, stand-alone software will no longer be sufficient (Cimatti, Clarke, Giunchiglia & Roveri, 2000; Adner & Helfat, 2003; Andreescu, 2006).

The most common application for process modeling, control and management is Workflow Management Systems (WfMSs) (van der Aalst, Desel, & Oberwies, 2000; van der Aalst & van Hee, 2002; van der Aalst & Jablonski, 2000; Fischer, 2001; van

DOI: 10.4018/978-1-61520-611-7.ch092

der Aalst & van Dongen, 2002; Grigori, Casati, Dayal, & Shan, 2001; Herbst & Karagiannis, 2000; Cook & Wolf, 1999). Commercial WfMSs such as Staffware, IBM MQSeries, and COSA offer generic modeling and enactment capabilities. Besides stand-alone systems, WfMSs are becoming integral components of many enterprise-wide information systems (Leymann & Roller, 2000), for example, Enterprise Resource Planning (ERP) systems such as SAP, PeopleSoft, Baan and Oracle, Customer Relationship Management (CRM) software, Supply Chain Management (SCM) systems, Business to Business (B2B) applications embed workflow technology. These large scale systems enable collaborative customized computing using general-purpose scripting languages and platforms with tool-automation features (McPhillips, Bowers, Zinn, & Ludascher, 2008; Glatard, Montagnat, Emsellem & Lingrand, 2008).

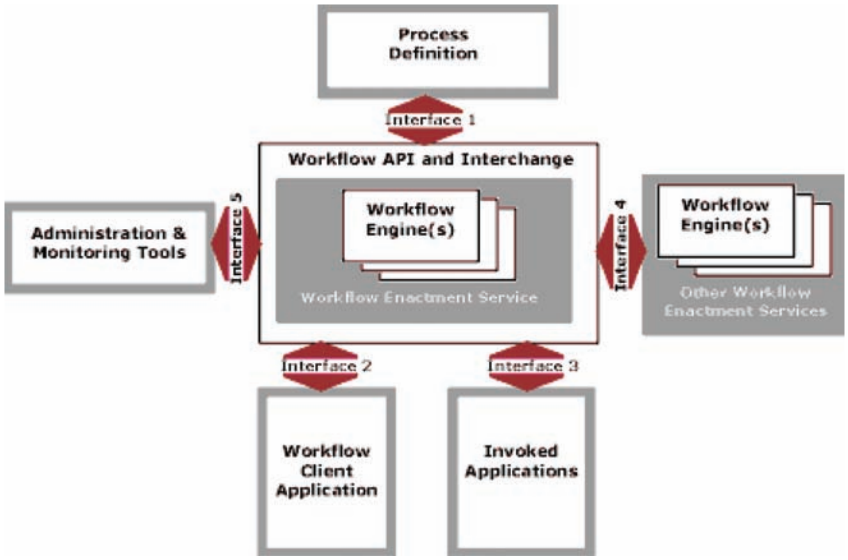
Software are currently composed of heterogeneous components, some which involve having the user in the loop, some which deal with streaming data, while some which require high-performance resources for their execution (Talon, Kraemer & Gurbaxani, 2000; Harris, 2000; Powell & Moore, 2002; Helfat & Peteraf, 2003; Sutcliff & Mehandjiev, 2004). This chapter focuses on the performances of a series of E-Business using enterprise software applications coupled with merging management technology in workflow systems to provide service-oriented architecture and on-demand business. A comparative study of workflow models for intra- and inter-organizational process control is presented. The study provides a resource list of successful implementations for practitioners in organizational management highlighting the motivation of market facilitation, expert sharing and collaboration that enable commercial applications to support complex heterogeneous, autonomous and distributed information systems (Kung & Zhang, 2008). The objective of this research shows a comprehensive list of structural integration of workflow models and designs that are currently applied to E-Business.

## BUSINESS PROCESS SYNTHESIS WITH WORKFLOW MODELS

Workflow technology has been widely recognized as the leading process-oriented coordination tool (Workflow Management Coordination, 2006). Figure 1 shows the technology that offers effective coordination support by allocating the right task to the right person at the right point of time along with the resources needed to perform the assigned task.

In Figure 1, Interface 1 is used at build-time to define the workflow process. Interface 2 defines the standard mechanism for interacting with the user of the WfMSs – the worklists that appear on user screens. Interface 3 is the API through which the WfMS interacts with other user applications such as ERP or CRM systems. Interface 4 is the standard API through which WfMSs provided by different vendors can interoperate. Interface 5 is the API through which administrators gather information from the log maintained by the WfMSs. Facilities such as e-meetings with electronic white-boards, instant messaging, webcasts, and task-oriented community tools supplement the existing synchronous communication facilities, such as teleconferences. Asynchronous communication is supported by specialized team rooms, project databases, interactive team portals and forums, and e-mail (Basu & Kumar, 2002; Sewing, Rosemann, & Dumas, 2006). The users then create digital interface by means of a common platform, such as Java 2JEE, Java Servlets, or using JSP, a process that requires minimal development time (van der Aalst, Weske, & Grunbauer, 2005). Workflow management systems such as Ensemble (FileNet) and InConcert (InConcert) support workflows by the end-user of the system under unexpected undesirable events (van der Aalst & Jablonski, 2000). Many enterprises select standardized commercial workflow management systems, such as COSA, Visual Workflow, Forte Conductor, Lotus Domino Workflow, Meteor, Mobile, MQSeries/Workflow, Staffware, Verve Workflow, I-Flow,

*Figure 1. Workflow reference model (Workflow Management Coalition, 2006)*




InConcert, Changengine, SAP R/3 Workflow, Eastman, and FLOWer (van der Aalst, ter Hofstede, Kiepuszewski, & Barros, 2003).

Mediation to link service requestors, providers and end users is supported by middleware such as the Enterprise Service Bus (ESB) (Robinson, 2004; Schmidt & Kalyana, 2004). The ESB is the infrastructure which integrates the user roles that involved in creating and managing the solutions, describing service endpoint requirements, capabilities, and relationships, including information describing the specific details of interaction contracts. The service registry assembles the runtime entities, dynamic adaptation components, multiple crosscutting configuration, connection, matchmaking, channel structures and event application domain for users (Kon, Costa, Blair & Campbell, 2002). These ESB usage patterns are realized through large-scale retail and brokerage applications. The ESB plays a central role in the implementation of the architecture for the IBM On Demand Operating Environment (Cox & Kreger, 2005; Schmidt, Hutchison, Lambros, & Phippen, 2005; Sadtler, Cotignola, Crabtree, & Michel, 2004).

In both intra-organizational and inter-organizational WfMSs, traditional workflow systems have limitations in support of flexibility and adaptability that result in restraint control, delegation, and coordination of processes and tasks for mid-level managers (van der Aalst, Weske, & Wirtz, 2003). In the next section new developments in WfMSs will be presented to overcome the limitations and to support flexible workflow control within one organization or over multiple organizations.

## COMPARISON OF DESIGNS IN PROCESS-BASED OPERATIONS

In order for a process model to operate coherently, not only the users need to know how each activity works, but they have to *manage* the dynamic changes in the processes so that the flow of work and information between participants is reasonable and efficient (Basu & Blanning, 2000; Bolton & Davis, 2000; Stohr & Zhao, 2001). Traditionally, WfMSs support process control within one organization – intra-organizational WfMSs. (Hevner, March, Park & Ram, 2004). However, with the evolution of the commercial internet, the trends for virtual corporations and e-commerce, increased global networking of economies have shifted from creation of tangible goods from one organization to the flow of information through the value chain that across multiple organizations (Basu & Kumar, 2002). Such open processed-based systems enable the employees at the operational level of companies to implement their ideas in the form of inherently distributed and inter-organizational design (Verbeek, Basten & van der Aalst, 2001; Basu & Kumar, 2002). Implementations using the Unified Modeling Language (UML) serve to be a useful technique in integrating this design (Fowler & Scott, 1997). Another analytic tool that users can develop company's views of the process is the bridging of the eXtensible Markup Language (XML) and supply chain modeling that define data elements in business documents. More recently, grid technologies have been used to optimize distributed workflow executions.

## INTRA-ORGANIZATIONAL PROCESS CONTROL

Intra-organizational WfMSs are implemented to support the modeling, analysis, and performance of routine business processes. Most available commercial workflow systems rely on a monolithic, single-schema architecture, which makes it difficult to fully capture the business process to be supported (Heinl, Horn, Jablonski, Need, Stein, & Teschke, 1999; Alvai & Leidner, 2001). These WfMSs provide little efficiency for exception handling at the process-conceptual and instance-execution layers (Casati & Pozzi, 1999).

Recently, research in intra-organizational WfMSs has been focused on providing solutions to the above problems so that WfMSs can offer the automation of the routine tasks, and help users deal with exceptional situations, breakdowns, or emerging new processes in a secured manner. Van der Aalst (1999) presented a generic model at the right aggregation level which offered adaptability. Kumar and Zhao (1999) implemented dynamic routing and operational controls in WfMSs. Faustmann (2000) proposed an approach to configure parts of a detailed process model with different ways of assigning tasks or support strategies to a worker. These support strategies allowed dynamic changes if the situation requires. Kumar, Van der Aalst, and Verbeek (2002) proposed an approach to dynamically distribute work in order to create a balance between quality and performance. Wang and Wang (2006) used a cognitive approach to take real-time decisions on activities into consideration so that the system was more adaptable. Adams, Edmond, and Hofstede (2003) demonstrated a method of handling flexibility by deriving principles for work practice from "Activity Theory". Klein and Dellarocas (2000) presented a notation – Ariadne to support different dimensions of process modeling to achieve adaptability. Hagen and Alonso (2000) presented an algorithm for improving fault tolerance of WfMSs based on exception handling from programming languages. Klein and Dellarocas (2000) proposed to use a knowledge management system for exception handling.

Another concern in WfMSs is security and authorization. Wainer, Barthelmass and Kumar (2003) proposed security models for WfMSs with a Role-Based Access Control (RBAC) model. With the advances of the internet technology, companies are becoming distributed and multinational. An extensive array of functions across the organization is being performed through the web services. The security concern is vital to the cyberspace (Gudes, Olivier, & Riet, 1999; Gudes & Tubman, 2002). Several studies address the organizational structure changes due to the decentralization and globalization of the companies (Tan & Harker, 1999; Klarmann, 2001; Muehlen, 2004). Other assessments in WfMSs involve monitoring business process performance (Thomas, Redmond, Yoon, & Singh, 2005), using incentive mechanisms to formulate organizational modeling (Raghu, Jayaraman, & Rao, 2004). Performance measures and metrics have been utilized to evaluate the quality of the WfMSs (Hwang, Wang, Tang & Srivastava, 2007; Truong, Dustdar, & Fahringer, 2008).

## INTER-ORGANIZATIONAL PROCESS CONTROL

The most important internal issues are *heterogeneity* which consists of the hardware, software, automation level and workflow control policies, and *autonomy* of the local systems which result in a lack of cross-company access to workflow resources and the missing of a complete view of the whole workflow (Zhao, 2002). In this area, research focus is in developing techniques for ensuring semantic integrity of the information and rules for mapping it correctly between any two partners. Currently, XML and Web services sustain major roles in inter-organizational workflow management. A major challenge in achieving the goal of Web services composition for process management is semantic interoperability. Communication among heterogeneous, independently developed Web services demands a well-defined mechanism for semantic description of services and their properties so as to make services semantically understandable by business process. Security is also a concern (Zhang, 2005).

Van der Aalst (1999) presented two possible process-oriented architectures for inter-organizational workflow systems. Other research focus on defining languages or schemas to support inter-organizational workflow (Van der Aalst & Kumar 2003; 2005; Workflow Management Coalition, 2006). Chiu, Cheung, Till, Karlapalem, Li, & Kafeza (2004) used workflow views for interoperability of multiple workflows across business organizations. Zhang (2005) evaluated the roles of web services in cross-organization process management. Cardoso and Sheth (2003) developed ways to discover web services in inter-organizational WfMSs. Kumar and Wainer (2005) explored the exception handling problem in inter-organizational setting. They used XML defined meta-workflow knowledge for control and coordination. Singh and Salam (2006) discussed the security aspect of inter-organizational process control. They deployed ontology analysis to identify central concept for E-Business process modeling. Table 1 gives a summary of the current workflow developments for both intra- and inter-organizations.

## CONCLUSION

Although WfMSs provide a promising solution to help understand the control processes and motivate communications among different levels of personnel in an organization, current commercial WfMSs still have limitations in supporting flexibility and adaptation, and lack of interoperability to support B2B workflow control. As the gap between academic and industry standards reduces, the above weakness can be overcome.

This chapter aims to address a guide to practitioners through a series of well-defined structural steps necessary to make informed, consistent and efficient changes to business processes. The research has also contributed to the new knowledge in web-based services with the collaborative workflow applications. The mechanisms of inter-organizational workflows coupled with the performance incentives of the process framework enable the users to integrate enterprise applications in a distributed environment. In order to gain a sustainable competitive advantage in the wide spectrum of e-services, workflow technologies coupled with cross-functional business processes offer fully automated coordination support. Future debates include the standardization to bridge between systems with an organizational boundary, where the internal systems meet the external web systems and other ways of using value-oriented patterns to improve performances.

*Table 1. A summary of current progress in workflow models*

| Author | Aspect | Solutions | Technology used |
|---|---|---|---|
| Intra-organizational WfMSs | | | |
| Van der Aalst (1999) | Capture management information; Adaptation | Present a generic model inspired by the techniques used in product configuration to aggregate management information and also support dynamic changes | Product configuration |
| Kumar & Zhao (1999) | Flexibility; Exception handling | A general framework to implement dynamic routing and operational controls | Workflow control tables; Sequence constraints; Event-based workflow management rules |
| Hagen & Alonso (2000) | Exception Handling | An algorithm for implementing more reliable processes based on exception handling in programming languages, and atomicity | Exception handling in programming languages; atomicity |
| Agostini & Michelis (2000) | Flexibility; Adaptation | Present the MILANO system which is highly flexible and adaptable. The system is built on the principle that workflow models must be as simple as possible | Elementary Net System |
| Faustmann (2000) | Flexibility; Adaptation | Proposed an approach that configures parts of a detailed process model with different support strategies (how a system assign tasks to a worker). The explicit modeling of these support strategies allows them to be changed if demanded by the situation. | Used in the WAM approach (Wide Area Multimedia Group Interaction) |
| Klein & Dellarocas (2000) | Exception Handling | Proposed an approach for exception handling that is based on exploiting a generic and reusable body of knowledge concerning what kinds exceptions can occur in collaborative work processes, and how these exceptions can be handled. | Artificial Intelligence |
| Divitini & Simone (2000) | Adaptability | Claims that adaptability involves different dimensions of process modeling. These dimensions concern the possibility to flexibly combine a rich set of basic categories in order to obtain the most suitable language for modeling the target business process and the work practices around it. | Ariadne, a notation providing a set of linguistic features suitable to model processes and their evolutions. |
| Kumar et al. (2002) | Dynamic work distribution | A systematic approach to dynamically create a balance between quality and performance issues. | Use metrics to represent work distribution |
| Adams, et al. (2003) | Flexibility; Exception Handling | Derive a set of principles for work practice from "Activity Theory" to create a set of criteria to provide adequate support for flexible work methods. | Activity Theory |
| Wang & Wang (2006) | Adapt to change | A cognitive approach to help manage complex business activities based on continuous awareness of situations and real-time decisions on activities. | Cognitive Process |
| Tan & Harker (1999) | Organizational structure: centralized vs. de-centralized | Use of mathematical modeling to compare the total expected costs of decentralized and centralized organizational designs. Coordinate the flows of information and work. | Mathematical modeling |
| Klarmann (2001) | Changes in organizational structure | Existing systems cannot cope with frequent structural change of organizational and process structure. Use of an organizational meta-model that describes meta information about organizational structures. | Meta Model |
| Muehlen (2004) | Organizational Management | Provide an overview of the organizational aspects of workflow technology in the context of the workflow life cycle | Meta model |

*continued on the following page*

*Table 1. continued*

| Author | Aspect | Solutions | Technology used |
|---|---|---|---|
| Thomas, et al.(2005) | Monitor business process performance | A loosely coupled semantic architecture overlaid upon a business process, where agents communicate and monitor business process performance.<br>The descriptive power of semantic languages can be used by agents to provide input for process reconfiguration decisions based on process performance measures. | BPEL,<br>Web Ontology Language |
| Raghu et al. (2004) | Economic incentives | An approach to organizational modeling that integrates both agent-centric and activity-centric approaches using incentive mechanisms. | Combine agent-centric and activity-centric to model organizational process |
| Gudes (1999) | Security | Present a three-level framework: modeling, specification and implementation. The participation of an Alter ego in each message enables the complete authentication and some specific individual based checks that are required in such environment. | Alter ego: one object in which all relevant of an individual person is kept and which can execute actions. |
| Gudes & Tubman (2002) | Security | A system AutoWF is presented for secured WfMS over the Web. | Autonomous objects |
| Wainer et al. (2003) | Security | Present a pair of role-based access control models for workflow systems known as W-RBAC models | The Role-Based Access Control (RBAC) model |
| Truong, et al. (2008) | Performance metrics for Grid workflows using ontology | Analyze performance metrics for evaluating the performance of Grid workflows. Develop an ontology to describe performance data of workflows and use it for analyzing and monitoring purpose. | Grid systems,<br>Ontology |
| Dang, et al. (2008) | Ontology for workflow system in healthcare | Provide an ontology knowledge framework for healthcare domain applying to machine intelligence. | Semantic Web,<br>SOA,<br>Ontology |
| Ly, et al. (2008) | Integration and verification of semantic constraints in adaptive PMS | Present a framework for defining constraints over processes which takes into consideration of both real-world domain knowledge and the maintenance and semantic process verification effort. | Adaptive PMS,<br>Semantic correctness,<br>Semantic constraints,<br>Semantic process verification |
| Zeng, et al. (2008) | Error detection and correction | Develop a conflict verification and resolution approach for workflow constrained by resources and non-determined duration. | Petri net |
| Sun et al. (2008) | Merging workflows | Describe the concept of merging workflows with business processes. Four types of merges with the corresponding algorithms, and issues related to the merge region to avoid invalid merges are discussed. | Petri net |
| Julia, et al. (2008) | Real time scheduling of WfMS with hybrid resources | Propose an approach based on a p-time Petri net model with hybrid resources to solve the real time scheduling problem of workflow management systems | P-time Petri net,<br>Activity diagram,<br>Token player algorithm |
| Hwang, et al. (2007) | QoS of web-service-based workflows | Propose a unified probabilistic model for describing QoS values web-service-based workflows. | Sample-space reduction technique: dynamic programming and greedy method |
| Mok et al. (2006) | Computability of workflow problems | Use theoretical computer and statecharts to prove that many workflow problems do not have pure computer-based solutions. Human intervention is inevitable for many problems. | Agent-based method,<br>statechart |

*continued on the following page*

*Table 1. continued*

| Author | Aspect | Solutions | Technology used |
|---|---|---|---|
| Hauser, et al. (2008) | Data structure for workflow analysis and transformation | The concept of region tree (RT) is introduced as the central data structure for both workflow analysis and transformation. RT performs the analysis and transformation incrementally. | Region tree, Region-growing rules |
| Montagut, et al. (2008) | Pervasive work-flow | Propose an adaptive transactional protocol for the pervasive workflow model to support executing business processes in the pervasive setting. | Web services, Transactional model, Composition algorithm |
| Choi, et al. (2008) | Terminality and compensatibility of cycles in business processes | Present an approach to seek the terminability of a cycle introduced by BPTrigger model. Determine whether a cycle is allowable in terms of compensatibility. | BPTrigger, Transactional work-flow |
| Zheng, et al. (2008) | Workflow simula-tion | Propose a workflow simulation method with the support of interactive events mechanism. An event sub-model is introduced in the workflow meta-model, then the simulation engine performs the event-based interaction at the run time | SOA, Workflow meta model, Workflow sub-model |
| Lee & Suh (2008) | Estimating the du-ration of stochastic workflow for product develop-ment process | Propose a method to estimate the completion time for a stochastic workflow in the product development process with both random activity durations and predefined resource constraint using Markovain model | Markovian model |
| Inter-organizational WfMSs | | | |
| Van der Aalst (1999) | Process-oriented architecture verification | Evaluate two approaches of inter-organizational workflow architecture with the concern of possibility to verify correct-ness of inter-organizational workflows | Case transfer archi-tecture; Loosely coupled architecture |
| Singh & Salam (2006) | Security aspect of inter-organization-al Business process | An ontological analysis of an eBusiness process and identify a set of central concepts that are essential to model the eBusi-ness process. Utilize this eBusiness process to develop a semantic architecture. | OWL-DL (description logics) |
| Van der Aalst & Kumar (2003) | Inter-organiza-tional information exchange | Develop process models of inter-organizational workflows and their coordination structures. Design an eXchangeable Routing Language (XRL) using XML | Petri nets, XML XRL |
| Kumar & Wainer (2005) | Exception handling | Control and coordination of inter-organizational workflow systems using meta-workflow knowledge of inter-organiza-tional eBusiness processes | XML |
| Zhang (2005) | Inter-organiza-tional process management | Discuss the role of web services in process management. Pro-pose an architecture for process workflow via web services composition. | Web services |
| Chiu et al. (2004) | Interoperability | Use of workflow views as a fundamental support mechanism for the interoperability of multiple workflow across business organizations. | XML, Web services |
| Cardoso & Sheth (2003) | Interoperability | Develop ways to efficiently discover web services – based on functional and operational requirements and to facilitate the interoperability of heterogeneous web services in e-services. Use of ontology to achieve service discovery and interoper-ability functions more efficiently. | Web services, Ontology-based systems |
| Tretola & Zimeo (2008) | Grid workflow | Use a technique that generates fine-grained concurrency with asynchronous invocation of services and continuation of execution to ensure pre-scheduling activities at run-time to improve performances. | Asynchronous calls and symbolic refer-ence in concurrent language |

*continued on the following page*

*Table 1. continued*

| Author | Aspect | Solutions | Technology used |
|---|---|---|---|
| Kuechler Jr. & Vaishnavi (2008) | Dynamically re-coordinate distributed workflows | Present a model using expert system to dynamically re-coordinate workflow processes when one organization changes its process based on workflow goals. | Expert system, Distributed workflows |
| Siller et al. (2008) | Modeling workflows for collaborative process planning | Propose a workflow model for collaborative process planning with the support of Product LifeCycle Management and CAD/CAM tools. | CAPP and PLM systems<br>CSCW groupware tool<br>CAD/CAM tools |
| Eshuis & Grefen, (2008) | Customized process views | Describe an approach to construct customized process views on process models to hide confidential or irrelevant for the partners. | Logistics |
| Glatard, et al. (2008) | Service oriented architecture for optimizing distributed workflow execution | Use the service-oriented approach based on grid architecture to help dynamically group services which reduce gird overhead on the execution and help optimizing the application execution time. | Grid technologies, Web services |
| Deelman, et al. (2008) | Use workflows in scientific settings | Provide a summary of features and examples that scientists apply the existing workflow systems. | Grid computing, Web services |
| Cao et al. (2008) | Service-oriented workflow mapping | Use Contract Net Protocol (CNP) to implement service-oriented workflow mapping in ShanghaiGrid workflow management system, including Abstract workflow, Concrete workflow, and Executable workflow | Grid technology, Contract Net Protocol, Belief-Desire-Intension agent technology |
| De Roure, et al. (2008) | Social sharing of workflows | Use social web approach to design and build a system for scientists to share and collaborate through workflows. | Social web approach, Experiment Virtual Research environment |

## REFERENCES

Adams, M., Edmond, D., & Hofstede, A. H. M. (2003). *The Application of Activity Theory to Dynamic Workflow Adaptation Issues.* Paper presented at the 7th Pacific Asia Conference on Information Systems, Adelaide, South Australia.

Adner, R., & Helfat, C. (2003). Corporate Effects and Dynamic Managerial Capabilities. *Strategic Management Journal*, *24*, 1011–1025. doi:10.1002/smj.331

Agostini, A., & de Michelis, G. (2000). A Light Workflow Management System Using Simple Process Models. *Computer Supported Cooperative Work: The Journal of Collaborative Computing*, *9*(3-4), 335–363. doi:10.1023/A:1008703327801

Aissi, S., Malu, P. & Srinivasan. (2002). E-business Process Modeling: The Next Big Step. *IEEE Computer, 35*(5), 55-62.

Alavi, M., & Leidner, D. E. (2001). Review: Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues. *MIS Quarterly*, *25*(1), 107–136. doi:10.2307/3250961

Andreescu, F. (2006). Organisational Challenges of Implementing E-Business in the Public Services: The Case of Britain's National Mapping Agency. *International Journal of E-Business Research*, *2*(4), 39–60.

Basu, A., & Blanning, R. B. (2000). A formal Approach to Workflow Analysis. *Information Systems Research*, *11*(1), 17–36. doi:10.1287/isre.11.1.17.11787

Basu, A., & Kumar, A. (2002). Research Commentary: Workflow Management Issues in e-Business. *Information Systems Research*, *13*(1), 1–14. doi:10.1287/isre.13.1.1.94

Bolton, C., & Davies, J. (2000). Activity graphs and Processes. In W. Grieskamp, T. Santen, & B. Stoddart, (eds.), *Proceedings Integrated Formal Methods 2000,* (LNCS 1945). Berlin: Springer.

Cao, L., Li, M. L., Cao, J., & Huang, J. S. (2008). CNP-based implementation of service-oriented workflow mapping in SHGWMS. *World Wide Web-Internet and Web Information Systems*, *11*(2), 199–226.

Cardoso, J., & Sheth, A. (2003). Semantic E-Workflow Composition. *Journal of Integrated Design and Process Science*, *21*(3), 191–225.

Casati, F., & Pozzi, G. (1999). *Modeling Exceptional Behaviours in Commercial Workflow Management Systems.* Paper presented at the 1999 IFCIS International Conference on Cooperative Information Systems, Edinburgh, Scotland.

Chen, M., Zhang, D., & Zhou, L. (2007). Empowering Collaborative Commerce with Web Services enabled Business Process Management Systems. *Decision Support Systems*, *43*, 530–546. doi:10.1016/j.dss.2005.05.014

Chiu, D. K. W., Cheung, S. C., Till, S., Karlapalem, K., Li, Q., & Kafeza, E. (2004). Workflow View Driven Cross-Organizational Interoperability in a Web Service Environment. *Information Technology and Management*, *5*, 221–250. doi:10.1023/B:ITEM.0000031580.57966.d4

Choi, I., Jung, J., Mannino, M., & Park, C. (2008). Terminability and compensatibility of cycles in business processes with a process-oriented trigger. *Data & Knowledge Engineering*, *66*(2), 243–263. doi:10.1016/j.datak.2008.03.002

Cimatti, A., Clarke, E., Giunchiglia, F., & Roveri, M. (2000). NUSMV: A New Symbolic Model Checker. *International Journal on Software Tools for Technology Transfer*, *2*(4), 410–425. doi:10.1007/s100090050046

Cook, J. E., & Wolf, A. L. (1999). Software Process Validation: Quantitatively Measuring the Correspondence of a Process to a Model. *ACM Transactions on Software Engineering and Methodology*, *8*(2), 147–176. doi:10.1145/304399.304401

Cox, D., & Kreger, H. (2005). Management of the Service-Oriented-Architecture Life Cycle. *IBM Systems Journal*, *44*, 709–726.

Dang, J., Hedayati, A., Hampel, K., & Toklu, C. (2008). An ontological knowledge framework for adaptive medical workflow. *Journal of Biomedical Informatics*, *41*(5), 829–836. doi:10.1016/j.jbi.2008.05.012

De Roure, D., Goble, C., & Stevens, R. (2008). The design and realisation of the Experiment Virtual Research Environment for social sharing of workflows. *Future Generation Computer Systems*. doi:.doi:10.1016/j.future.2008.06.010

Deelman, E., Gannon, D., Shields, M., & Taylor, I. (2008). Workflow and e-Science: An overview of workflow system features and capabilities. *Future Generation Computer Systems*. doi:.doi:10.1016/j.future.2008.06.012

Divitini, M., & Simone, C. (2000). Supporting different dimensions of adaptability in workflow modeling. *Computer Supported Cooperative Work: The Journal of Collaborative Computing*, *9*(3-4), 365–397. doi:10.1023/A:1008751210054

Eshuis, R., & Grefen, P. (2008). Constructing customized process views. *Data & Knowledge Engineering*, *64*(2), 419–438. doi:10.1016/j.datak.2007.07.003

Faustmann, G. (2000). Configuration for Adaptation - A Human-centered Approach to Flexible Workflow Enactment. *Computer Supported Cooperative Work: The Journal of Collaborative Computing*, *9*(3-4), 413–434. doi:10.1023/A:1008719831436

Fischer, G., Giaccardi, E., Ye, Y., Sutcliffe, A. G., & Mehandjiev, N. (2004). Meta-Design: A Manifesto For End-User Development. *Communications of the ACM*, *47*(9), 33–37. doi:10.1145/1015864.1015884

Fischer, L. (Ed.). (2001). *Workflow Handbook 2001, Workflow Management Coalition, Future Strategies*. Lighthouse Point, FL.

Fowler, M., & Scott, K. (1997). *UML Distilled*. Reading, MA: Addison-Wesley.

Glatard, T., Montagnat, J., Emsellem, D., & Lingrand, D. (2008). A Service-Oriented Architecture enabling dynamic service grouping for optimizing distributed workflow execution. *Future Generation Computer Systems*, *24*, 720–730. doi:10.1016/j.future.2008.02.011

Grigori, D., Casati, F., Dayal, U., & Shan, M. C. (2001). Improving Business Process Quality through Exception Understanding, Prediction, and Prevention. In P. Apers, P. Atzeni, S. Ceri, S. Paraboschi, K. Ramamohanarao, & R. Snodgrass (eds.*), Proceedings of 27th International Conference on Very Large Data Bases, VLDB01,* (pp. 159-168). San Francisco: Morgan Kaufmann.

Gudes, E., Olivier, M. S., & van der Riet, R. P. (1999). Modeling, Specifying and Implementing Workflow Security in Cyberspace. *Journal of Computer Security*, *7*(4), 287–315.

Gudes, E., & Tubman, A. (2002). AutoWF: A Secure Web Workflow System Using Autonomous Objects. *Data & Knowledge Engineering*, *43*(1), 1–27. doi:10.1016/S0169-023X(02)00058-7

Hagen, C., & Alonso, G. (2000). Exception Handling in Workflow Management Systems. *IEEE Transactions on Software Engineering*, *26*(10), 943–958. doi:10.1109/32.879818

Harris, R. W. (2000). Schools of thought in research into end-user computing success. *Journal of End User Computing*, *12*(1), 24–34.

Hauser, R. F., Friess, M., Kuster, J. M., & Vanhatalo, J. (2008). An incremental approach to the analysis and transformation of workflows using region trees. *IEEE Transactions on Systems, Man and Cybernetics. Part C, Applications and Reviews*, *38*(3), 347–359. doi:10.1109/TSMCC.2008.919178

Heinl, P., Horn, S., Jablonski, S., Need, J., Stein, K., & Teschke, M. (1999). *A Comprehensive Approach to Flexibility in Workflow Management Systems.* Paper presented at the WACC'99, San Francisco, CA.

Helfat, C., & Peteraf, M. A. (2003). The Dynamic Resource-Based View: Capability Lifecycles . *Strategic Management Journal*, *24*, 997–1010. doi:10.1002/smj.332

Herbst, J., & Karagiannis, D. (2000). Integrating Machine Learning and Workflow Management to support Acquisition and Adaptation of Workflow Models. *International Journal of Intelligent Systems in Accounting Finance & Management*, *9*(1), 67–92. doi:10.1002/1099-1174(200006)9:2<67::AID-ISAF186>3.0.CO;2-7

Hevner, A., March, S. T., Park, J., & Ram, S. (2004). Design Science in Information Systems Research. *MIS Quarterly*, *28*(1), 75–105.

Hwang, S., Wang, H., Tang, J., & Srivastava, J. (2007). A probabilistic approach to modeling and estimating the QoS of web-services-based workflows. *Information Sciences*, *177*, 5484–5503. doi:10.1016/j.ins.2007.07.011

Julia, S., de Oliveira, F. F., & Valette, R. (2008). Real time scheduling of Workflow Management Systems based on a p-time Petri net model with hybrid resources. *Simulation Modelling Practice and Theory*, *16*(4), 462–482. doi:10.1016/j.simpat.2008.01.006

Klarmann, J. (2001). *A Comprehensive Support for Changes in Organizational Models of Workflow Management Systems.* Paper presented at the 4th International Conference on Information Systems Modeling ({ISM} ‘01).

Klein, M., & Dellarocas, C. (2000). A Knowledge-based Approach to Handling Exceptions in Workflow Systems. *Computer Supported Cooperative Work: The Journal of Collaborative Computing*, *9*(3-4), 399–412. doi:10.1023/A:1008759413689

Kon, F., Costa, F., Blair, G., & Campbell, R. H. (2002). The Case for Relective Middleware. *Communications of the ACM*, *45*(6), 33–38. doi:10.1145/508448.508470

Kuechler, W. L., & Vaishnavi, V. K. (2008). An expert system for dynamic re-coordination of distributed workflows. *Expert Systems with Applications*, *34*(1), 551–563. doi:10.1016/j.eswa.2006.09.014

Kumar, A., van der Aalst, W. M. P., & Verbeek, H. M. W. (2002). Dynamic Work Distribution in Workflow Management Systems: How to Balance Quality and Performance? *Journal of Management Information Systems*, *18*(3), 157–193.

Kumar, A., & Wainer, J. (2005). Meta Workflows as a control and coordination mechanism for exception handling in workflow systems. *Decision Support Systems*, *40*(1), 89–105. doi:10.1016/j.dss.2004.04.006

Kumar, A., & Zhao, J. L. (1999). Dynamic routing and operational controls in workflow management systems. *Management Science*, *45*(2), 253–272. doi:10.1287/mnsc.45.2.253

Kung, M. T., & Zhang, J. Y. (2008). Analysis of Business Process Models in Enterprise Web Services. *International Journal of E-Business Research*, *4*(2), 69–87.

Lee, H., & Suh, H. W. (2008). Estimating the duration of stochastic workflow for product development process. *International Journal of Production Economics*, *111*(1), 105–117. doi:10.1016/j.ijpe.2007.01.003

Leymann, H., & Roller, D. (2000). *Production Workflow: Concepts and Techniques.* Upper Saddle River, NJ: Prentice Hall.

Livari, J., & Livari, N. (2006). *Varieties of User-Centeredness.* Paper presented at the 39th Annual Hawaii International Conference on System Sciences, Hawaii.

Ly, L. T., Rinderle, S., & Dadam, P. (2008). Integration and verification of semantic constraints in adaptive process management systems. *Data & Knowledge Engineering*, *64*(1), 3–23. doi:10.1016/j.datak.2007.06.007

McKendrick, J. (2006, March 2). Will there be a ‘Dell’ of software? *ZDNet*, (pp. 559).

McPhillips, T., Bowers, S., Zinn, D., & Ludascher, B. (2008). Scientific workflow design for mere mortals. *Future Generation Computer Systems*. doi:.doi:10.1016/j.future.2008.06.013

Melville, M., Kraemer, K., & Gurbaxani, V. (2004). Information Technology and Organizational Performance: An Integrative Model of IT Business Value. *MIS Quarterly*, *28*(2), 283–322.

Mok, W. Y., Palvia, P., & Paper, D. (2006). On the computability of agent-based workflows. *Decision Support Systems*, *42*(3), 1239–1253. doi:10.1016/j.dss.2005.10.010

Montagut, F., Molva, R., & Golega, S. T. (2008). The pervasive workflow: A decentralized workflow system supporting long-running transactions. *IEEE Transactions on Systems, Man and Cybernetics. Part C, Applications and Reviews*, *38*(3), 319–333. doi:10.1109/TSMCC.2008.919184

Muehlen, M. Z. (2004). Organizational Management in Workflow Applications - Issues and Perspectives. *Information Technology and Management*, *5*, 271–291. doi:10.1023/B:ITEM.0000031582.55219.2b

Powell, A., & Moore, J. E. (2002). The Focus of Research in End User Computing: Where Have We Come Since the 1980s? *Journal of End User Computing*, *14*(1), 3–22.

Raghu, T. S., Jayaraman, B., & Rao, H. R. (2004). Towards an integration of agent and activity-centric approaches in organization process modeling: Incorporating incentive mechanisms. *Information Systems Research*, *15*(4), 316–335. doi:10.1287/isre.1040.0031

Robinson, R. (2004). *Understand Enterprise Service Bus Scenarios and Solutions in Service-Oriented Architecture.* Armonk, NY: IBM developerWorks. Retrieved from http://www-106.ibm.com/developerworks/webservices/library/ws-esbscen/

Sadtler, C., Cotignola, D., Crabtree, B., & Michel, P. (2004). Patterns: Broker Interactions for Intra- and Inter-Enterprise. *IBM Redbooks*, SG24-6075. Retrieved from http://www.redbooks.ibm.com/redbooks.nsf/0/532fca172da15c6c85256d6d6d0046192e?openDocument

Schmidt, M. T., Hutchison, B., Lambros, P., & Phippen, R. (2005). The Enterprise Service Bus: Making Service-Oriented Architecture Real. *IBM Systems Journal*, *44*, 727–744.

Schmidt, M. T., & Kalyana, S. (2004). The On Demand Operating Environment – Architectural Overview. *IBM developerWorks*. Retrieved from http://www-106.ibm.com/developerworks/ibm/library/i-odoe1/

Sewing, J., Rosemann, M., & Dumas, M. (2006). Process-Oriented Assessment of Web Services. *International Journal of E-Business Research*, *2*(1), 19–44.

Shah, S.K. (2001). Improving Information System Performance through Client Value Assessment: A Case Study. *Review of Business*, (Spring), 37-42.

Siller, H. R., Estruch, A., Vila, C., Abellan, J. V., & Romero, F. (2008). Modeling workflow activities for collaborative process planning with product lifecycle management tools. *Journal of Intelligent Manufacturing*, *19*(6), 689–700. doi:10.1007/s10845-008-0120-6

Singh, R., & Salam, A. F. (2006). Semantic information assurance for secure distributed knowledge management: a business process perspective. *IEEE Transactions on Systems, Man, and Cybernetics*, *36*(3), 472–486. doi:10.1109/TSMCA.2006.871792

Stohr, E. A., & Zhao, J. L. (2001). Workflow Automation: Overview and Research Issues. *Information Systems Frontiers*, *3*(3), 281–296. doi:10.1023/A:1011457324641

Sun, S., Kumar, A., & Yen, J. (2008). Merging workflows: A new perspective on connecting business processes. *Decision Support Systems*, *42*(2), 844–858. doi:10.1016/j.dss.2005.07.001

Sutcliffe, A., & Mehandjiev, N. (2004). End-user development: Introduction. *Communications of the ACM*, *47*(9), 31–32. doi:10.1145/1015864.1015883

Tagg, R. (2001). Workflow in Different Styles of Virtual Enterprise. In *Proceedings, Workshop in Information Technology for Virtual Enterprises*, (pp. 21-28).

Tallon, P. P., Kraemer, K., & Gurbaxani, V. (2000). Executives' perception of the business value of informaiton technology: A process-oriented approach. *Journal of Management Information Systems*, *16*(4), 145–173.

Tan, J. C., & Harker, P. T. (1999). Designing Workflow Coordination: Centralized Versus Market-Based Mechanisms. *Information Systems Research*, *10*(4), 328–342. doi:10.1287/isre.10.4.328

Thomas, M., Redmond, R., Yoon, V., & Singh, R. (2005). A Semantic Approach to Monitor Business Process Performance. *Communications of the ACM*, *48*(12), 55–59. doi:10.1145/1101779.1101809

Tretola, G., & Zimeo, E. (2008). Activity pre-scheduling for run-time optimizationof grid workflows. *Journal of Systems Architecture*, *54*, 883–892. doi:10.1016/j.sysarc.2008.01.009

Truong, H., Dustdar, S., & Fahringer, T. (2008). Performance metrics and ontologies for Grid workflows . *Future Generation Computer Systems*, *23*, 760–772. doi:10.1016/j.future.2007.01.003

van der Aalst, W. M. P. (1999). Process-oriented Architectures for Electronic Commerce and Interorganizational Workflow . *Information Systems*, *24*(8), 639–671. doi:10.1016/S0306-4379(00)00003-X

van der Aalst, W. M. P., Desel, J., & Oberweis, A. (Eds.). (2000). *Business Process Management: Models, Techniques, and Empirical Studies*, (LNCS Volume 1806). Berlin: Springer-Verlag.

van der Aalst, W. M. P., & Jablonski, S. (2000). Dealing with Workflow Change: Identification of Issues and Solutions. *International Journal of Computer Systems, Science, and Engineering*, *15*(5), 267–276.

van der Aalst, W. M. P., & Kumar, A. (2003). XML based schema definition for support of inter-organizational workflow. *Information Systems Research*, *14*(1), 23–46. doi:10.1287/isre.14.1.23.14768

van der Aalst, W. M. P., ter Hofstede, A. H. M., Kiepuszewski, B., & Barros, A. P. (2003). Workflow Patterns. *Distributed and Parallel Databases*, *14*(3), 5–51. doi:10.1023/A:1022883727209

van der Aalst, W. M. P., & van Dongen, B. F. (2002). Discovering Workflow Performance Models from Timed Logs. In Y. Han, S. Tai, & D. Wikarski, (eds.), *International Conference on Engineering and Deployment of Cooperative Information Systems, EDCIS2002,* (LNCS Vol. 2480). Berlin: Springer-Verlag.

van der Aalst, W. M. P., & van Hee, K. M. (2002). *Workflow Management: Models, Methods, and Systems*. Cambridge, MA: MIT Press.

van der Aalst, W. M. P., Weske, M., & Grunbauer, D. (2005). Case Handling: A New Paradigm for Business Process Support. *Data & Knowledge Engineering*, *53*, 129–162. doi:10.1016/j.datak.2004.07.003

van der Aalst, W. M. P., Weske, M., & Wirtz, G. (2003). Advanced Topics in Workflow Management: Issues, Requirements, and Solutions. *Journal of Integrated Design and Process Science*, *7*(3), 49–77.

Verbeek, H. M. W., Basten, T., & van der Aalst, W. M. P. (2001). Diagnosing Workflow Processes using Woflan. *The Computer Journal*, *44*(4), 246–279. doi:10.1093/comjnl/44.4.246

Wainer, J., Barthelmess, P., & Kumar, A. (2003). W-RBC - A Workflow Security Model Incorporating Controlled Overriding of Constraints. *International Journal of Cooperative Information Systems*, *12*(4), 455–485. doi:10.1142/S0218843003000814

Wang, M., & Wang, H. (2006). From Process logic to business logic - A cognitive approach to business process management. *Information & Management*, *43*, 179–193. doi:10.1016/j.im.2005.06.001

Weiss, M., & Amyot, D. (2005). Business Process Modeling with URN. *International Journal of E-Business Research*, *1*(3), 63–90.

Workflow Management Coalition. (2006). Retrieved from http://www.e-workflow.org/standards/index.htm

Zeng, Q., Wang, H., Xu, D., Duan, H., & Han, Y. (2008). Conflict detection and resolution for workflows constrained by resources and non-determined durations. *Journal of Systems and Software*, *81*, 1491–1504. doi:10.1016/j.jss.2007.09.004

Zhang, D. (2005). Web Services Composition for Process Management in E-Business. *Journal of Computer Information Systems*, *45*(2), 83–91.

Zhao, J. L. (2002). *Interorganizational Workflow and E-Commerce Applications*. Presentation at HICSS-35, http://attila.stevens-tech.edu/sigpam/publications/tutorial/HICSS-35/Interorganizational_Workflow.pdf

Zheng, Y. C., Fan, Y. S., & Tan, W. (2008). Towards workflow simulation in service-oriented architecture: an event-based approach. *Concurrency and Computation*, *20*, 315–330. doi:10.1002/cpe.1221

## KEY TERMS AND DEFINITIONS

**E-Business:** The use of the Internet and other information technologies to support commerce and improve business performance.

**Enterprise System:** A system that supports enterprise-wide or cross-functional requirements, rather than a single department or group within the organization.

**Workflow:** A workflow is a sequence of operations, declared as work of a person, work of a simple or complex mechanism, work of group of persons, work of an organization of staff, or machines.

**Workflow Management Systems (WfMSs):** A system of overseeing the process of passing information, documents, and tasks from one employee or machine within a business to another.

**Intra-Organizational Process Control:** Intra-organizational WfMSs are implemented to support the modeling, analysis, and performance of routine business processes.

**Inter-Organizational Process Control:** Inter-organizational WfMSs are implemented to support the modeling, analysis, and performance among different organizations.

**Process Control:** A statistics and engineering discipline that deals with architectures, mechanisms, and algorithms for controlling the output of a specific process.

# Section 10
# E-Business System Development

# Chapter 93
# Facilitating Interaction between Virtual Agents by Changing Ontological Representation

**Fiona McNeill**
*University of Edinburgh, UK*

**Alan Bundy**
*University of Edinburgh, UK*

## ABSTRACT

*Fluent, effortless and diverse e-business transactions depend on the ability of automated agents to interact. The difficulties of tailoring representation and information to be consistent and therefore interoperable needs to fall not on human users but on these automated agents. In this chapter, the authors present our system, ORS (Ontology Repair System), which is designed to be a tool for automated agents, acting on behalf of people or systems, which need to interact, to enable them to understand one another, despite the fact that they are not centrally or consistently designed.*

## BACKGROUND

It is universally acknowledged that the problem of integration of information across large communities is a difficult and pressing one, particularly when these communities are disparate, wide-spread and not under centralised control, such as in the Semantic Web (Berners-Lee et al, 2001). The simplest solution to this problem is the enforcement of a single ontology: a single view of the world. However, if the agents interacting are from different organisations or fields, attempting to use a single ontology is usually neither practical nor desirable. Users need to develop a representation that is best suited to their own problems and they need to maintain and update that representation locally. Even if all users do subscribe to a single ontology, integration problems still exist, as changes and updates are made and users tune their ontologies to fit their own needs.

The problem of ontology matching has been widely studied and powerful solutions are available (see (Shvaiko and Euzenat, 2005) and (Euzenat and Shvaiko, 2007) for a comprehensive survey. However, the ontologies considered are almost always taxonomies, and the problem of ontology matching

DOI: 10.4018/978-1-61520-611-7.ch093

is concerned with relating a single term in one ontology to one or more terms in another ontology: for example, a term *car* in one ontology may relate to a term *automobile* or a term *carriage* in another ontology. Much less considered is the problem of relating compound terms: such as first-order terms or database entries with multiple fields: for example, a term *car(make,model)* in one ontology relating to a term *automobile(model,year,brand)* in another. In such situations we still have the problem of relating the single terms contained within these compound terms – e.g., this matching depends on knowing that *car* may be related to *automobile* and that *make* may be related to *brand*. But we must also consider the overall relation of the compound terms, which requires not only semantic but also structural matching.

Another drawback of traditional ontology matching in an online environment is that it tends to assume full knowledge of all relevant ontologies and is generally performed off-line, prior to interaction. These are the assumptions made by the main evaluation processes for Ontology Matching, such as the Ontology Alignment Evaluation Initiative (OAEI[1]). But in large, fast-moving agent communities, or situations where some information may be confidential, we cannot assume that we can have full knowledge of any agent or service we may interact with, nor is it possible to perform the matching off-line if we may not know prior to interaction which agents will need to interact.

In this chapter, we introduce our theory of on-the-fly, structured matching and briefly describe the ORS system, which we have developed to implement this theory. Our central hypothesis is that representation – as well as vocabulary and beliefs – must be treated as a fluent and that automated, dynamic, matching techniques that can map between structured terms are necessary for full integration of disparate ontologies (Bundy et al, 2006).

## FOCUS OF APPROACH

In a system such as the Semantic Web, where there is no centralised control, we cannot have a complete global overview of the agents and data in the system. Agents may join and leave the system freely and they will all have their own ontologies and data that may be large and complex and may be confidential. We cannot hope for a complete description of the relations between every agent in the system. Our approach is therefore not to consider how such a system can be controlled but how an individual agent can successful make its way in such a system, interacting with the agents that it needs to interact with, even if these agents are not using the same ontological terms or representations, and even if it is not known in advance of the interaction which agents these will be.

Although many existing ontologies are simple taxonomies, and matching these ontologies is a crucial task, we believe that this kind of matching cannot be sufficient. Agents that are capable of interacting in complex and unpredictable environments need to be able to plan, and planning agents need far richer descriptions of the world: not only taxonomies of classes but also relations and functions between these classes, and planning rules describing how to influence the world. Uniformity of these relations, functions and rules can no more be assumed than uniformity of terms within taxonomies, and therefore matching between these structured objects is just as crucial as the more frequently addressed problem of matching between simple terms within a taxonomy.

Matching large ontologies at run-time, particular ones that contain structured terms, is generally not feasible, but we make this problem tractable by only fixing mismatches when this is demonstrated to be necessary. Since interactions may be frequent and fleeting, there may not be much value in matching the full ontologies, since the interaction that is desired may only require a very small part of the ontologies, and even if inconsistencies exist between the ontologies, these may not lead to communication breakdown between agents during a particular interaction. Our approach is therefore to diagnose mismatches and refine the ontologies accordingly only when these mismatches directly cause communication breakdown.

To this end, we developed ORS (the Ontology Repair System)[2]. This is a tool that an individual agent (which we name PA – the planning agent) can make use of as an aid when communication breaks down. ORS tracks the course of the communication between PA and any agents it may be interacting with (we name these SPA – service providing agents). If communication proceeds successfully then ORS does not need to be utilised. However, if communication breaks down, ORS begins the diagnostic process, analysing the communication so far and prompting PA to ask further questions in order to pin down a specific mismatch between the ontologies of PA and SPA, which is then corrected.

The benefit of ORS is therefore that it allows an agent to interact successfully with other agents, even when their ontologies are mismatched in important ways, and even when this mismatch is between complex, structured ontological objects as well as when this mismatch is between simple terms. It works on-the-fly and fully automatically even when interactions are unpredictable and unforeseen.

## ONTOLOGICAL MISMATCH

Planning agents require ontologies that contain three different kinds of objects, which entail three different kinds of mismatches:

1. purely semantic mismatch, where the mismatch is between words or phrases – for example, *car* is matched to *auto*: this is the problem that is covered by conventional ontology matching.
2. structural mismatch, where the mismatch is between structured terms (such as relations and functions) – for example, *car(Make,Model)* is matched to *car(Make),* or *car(Make,Model,Year)* is matched to *car(Make,Model,Date)*.
3. Mismatches of planning rules, where one agent has a different idea of the conditions and effects of performing an action to another – for example,

BuyTicketAction: wants_to_travel(Me,Destination) → has_ticket(Me,Destination)

matched to

BuyTicketAction: wants_to_travel(Me,Destination) and has_money(Me) → has_ticket(Me,Destination)[3].

Of these, the first point is only considered incidentally, due to the large body of work that already addresses this issue; our emphasis is strongly on the second and third points. Although the current implementation of ORS takes a naive approach to purely semantic matching and does not make much use of the existing techniques, it would be straightforward to build one or more of these existing matchers in to address this issue, and we intend to implement this shortly.

### Structured Matching

The problem of structural mismatch within ontological mismatch is very rarely addressed. However, we believe it to be crucial to successful interaction of agents or services. Not only are the utterances of agents usually structured, but service invocations are also necessarily structured, and their automatic interaction requires structured matching of just the type our work addresses; therefore, semantic matching alone cannot be sufficient.

In our work, we consider quantifier-free, first-order terms; that is, predicates with some number of arguments $\geq 0$. Most common service invocations, such as those expressed in BPEL[4], as well as most types of database entries, can be expressed in such a way. Our techniques are therefore very widely applicable.

The space of possible mismatches between one first-order term and another, more general, first-order term is described by the theory of abstraction (Giunchiglia and Walsh, 1992). They describe four kinds of mismatch:

- **Propositional abstraction:** A term is matched to one with fewer arguments – for example, *car(Make,Model)* maps to *car(Make)*.
- **Predicate abstraction:** A term is matched to one with a more general predicate – for example, *car(Make)* maps to *vehicle(Make)*.
- **Domain abstraction:** A term is matched to one with a more general type of argument – for example, *car(Make,Second-hand-dealer)* maps to *car(Make,Dealer)*.
- **Precondition abstraction:** A term is removed from a rule – for example, *has(money,Me)* $\rightarrow$ *owns(car(Make),Me)* maps to *has(money,Me) & has(id,Me)* $\rightarrow$ *owns(car(Make),Me)*.

By inverting these relationships, we obtain four dual refinement operators. These abstraction and refinement operations are sufficient for describing most ways in which quantifier-free, first-order terms can be related. Non-identical terms must be either synonymous, more general, less general or unrelated. The case where they are synonymous is dealt with by semantic matching. There are a limited number of attributes of first-order terms: they have predicate names, numbers of arguments, orders of arguments and types of arguments. Variations in these attributes gives the above classification of how first-order terms may be mismatched.

## WORKED EXAMPLE

Consider the interaction between a planning agent (PA) which wishes to buy a ticket, and an agent acting as the front-end to a ticket-selling service (the service providing agent – SPA). PA contacts SPA with the following message:

PA: *buy(pa,london,edinburgh)*[5]

This indicates that PA wishes to buy a ticket between London and Edinburgh. It is likely that SPA will have some conditions on selling tickets, for example that the buyer has money, and must verify that these conditions hold. SPA will therefore respond with a question:

SPA: *money(pa,Amount)?*

This indicates that SPA wishes PA to find a suitable instantiation of the variable *Amount* such that the relation *money(pa,Amount)* becomes true. But imagine that PA has money represented as a predicate *money(Agent,Amount,Currency),* and can instantiate this to *money(pa,100,dollars)*. Perhaps this agent is used to operating in many different currency zones, whereas SPA only operates in one currency zone, so their designers chose different representations.

PA must therefore respond negatively to SPA's enquiry:

PA: *no*

SPA: *fail: buy(pa,london,edinburgh)*

However, PA is able to analyse the problem and alter its ontology appropriately. In this instance, it is obvious that the problem is that *money/2* is mismatched to *money/3.* PA can determine that the two arguments of SPA's *money/2* match the first two arguments of its *money/3,* and hence the third argument – *Currency* – is redundant. It therefore alters its definition of *money* from *money(Agent,Amount,Currency)* to *money(Agent,Amount)*, and alters all instantiations of this predicate accordingly. This means that it is removing information (that the currency is dollars) that may be important in subsequent interactions. This could be resolved by retaining a copy of the old *money/3*, whilst using the updated *money/2* in the current interaction.

The interaction can then be resumed and this time PA will be able to respond appropriately.

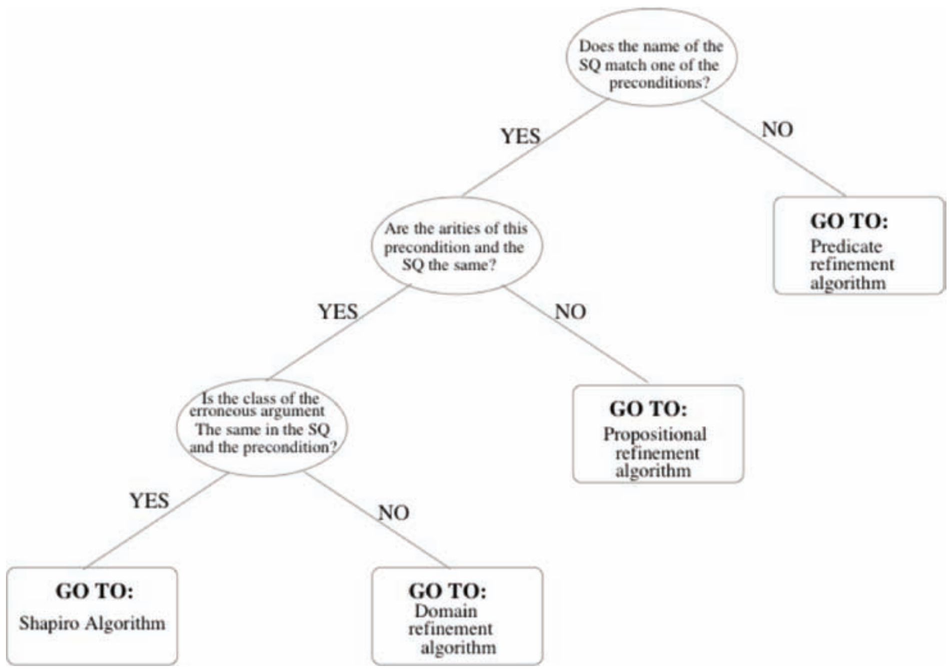
(Note that several important steps, such as discussion of price, have been omitted from this simplified example).

## THE ONTOLOGY REPAIR SYSTEM

In this section, we describe the role of ORS through giving a step-by-step description of how it is used by an agent (PA) within a multi-agent, semantic-web-like environment.

1. PA has a goal, or is provided by the user with a goal, and uses its ontology to form a plan to achieve this goal. The steps of this plan will normally involve interaction with other agents. For example, if PA has to organise a journey, it will need to interact with (among others) a ticket-selling agent. Each of PA's planning rules will describe the circumstances under which it believes these other agents (SPAs) will perform their roles (e.g., a ticket-selling agent will sell a ticket if it is provided with an appropriate destination and sufficient money). If there are no mismatches, the PA's rule will be compatible with the SPA's rule which the SPA is actually using to perform the task.
2. In order to achieve the goal, PA will execute each step by communicating with the appropriate SPA.
3. PA will request the service it requires from the agent, and then wait for a response. This could be an indication that the service has been performed, but it will usually be further questioning from the SPA, which is trying to establish whether or not the preconditions are satisfied, to confirm that it can perform the service.
4. If this process results in the service being successfully performed, PA proceeds to the next step of the plan and the functionality of ORS is not required at this step. However, if failure occurs, PA invokes ORS to attempt to track down the cause of this failure.
5. ORS will analyse all the questioning that has occurred so far, giving particular attention to questions the SPA asked that were not expected. Expected questions would tie in with the preconditions of PA's rule for the relevant service; any questions deviating from these, either substantially or through a structural difference, would be a *surprising question (SQ)*. An example from the previous section is the question *money(pa,Amount)?* being asked when the question *money(pa,Amount,dollars)?* was expected; alternatively, a completely unexpected question might be asked.
6. ORS's diagnostic algorithms (briefly described below) use this information, prompting the PA to ask for further information if necessary, to diagnose the problem and to repair PA's ontology accordingly. Occasionally, the fault can be tracked down to a particular ontological object (in the worst case, the whole rule), but an appropriate fix cannot be found (we know there is a mismatch but do not have enough information to determine exactly what it is). This ontological object is then marked as unusable.
7. PA uses its updated ontology to replan from its current state (so earlier successful plan steps will not be repeated) and the process begins again. This time, it is hoped that the problematic interaction will be more successful, though it may, of course, fail again due to other mismatches, which in their turn must be identified and diagnosed.

*Figure 1. Flow chart illustrating part of the diagnostic algorithm*




## FAULT REPAIR AND DIAGNOSIS

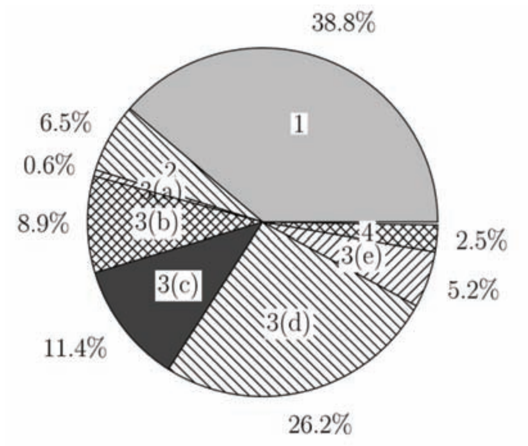
The diagnostic process works through a series of algorithms. The flow chart in Figure 1 describes one of these algorithms; this particular flow chart is invoked when the diagnostic process has already determined that a precondition of a rule is at fault. This algorithm determines exactly how it is at fault – is it incorrectly named? is one of the arguments wrong? is the number of arguments wrong? When the diagnostic process has narrowed down what kind of mismatch it is, it next needs to determine the details of the mismatch. Predicate, propositional and domain refinement mentioned in Figure 1 all refer to types of mismatches outlined above; the Shapiro algorithm[6] is used when there is no structural mismatch but an incorrectly instantiated fact. It determines how this incorrect fact came to be believed. Further details of these processes and the other diagnostic algorithms can be found in (McNeill and Bundy, 2007).

## EVALUATION

The standard approach to evaluation of ontology matching, outlined in the OAEI[7] is to input two full ontologies and evaluate how many of the mismatches between them are correctly or incorrectly diagnosed, or are missed. Such evaluation makes no sense for ORS, since ORS is designed not to discover and patch all mismatches but only those that are impeding interaction. A better metric for ORS, therefore, is to evaluate how frequently it can facilitate interaction which would have failed without access to its functionality.

We examined mismatches between several large ontologies and analysed which of these mismatches were described by mismatches ORS could diagnose and refine, and which were not. The pie chart below illustrates the results. Although this highlights that there is much ORS cannot currently do, we believe these results to be encouraging. This is the first step towards a new approach to ontology mismatch and ORS is a prototype system, so the fact that it can already

*Figure 2.*




tackle 38.8% of mismatches bodes well. Full details of our evaluation can be found on the ORS website[8].

The pie chart in Figure 2 illustrates the percentage of mismatches that fall into the following categories[9]:

1. ORS could refine the mismatch
2. ORS could not refine the mismatch but straightforward improvements to ORS would allow it to solve it.
3. ORS could not refine the mismatch because:
    a. ORS did not have sufficient functionality;
    b. This mismatch is outside the current scope of ORS;
    c. This mismatch is irrelevant to an automated system – this is usually a change to commenting or formatting;
    d. This mismatch could not occur in the representation ORS currently deals with;
    e. This mismatch could not be highlighted in a planning context.
4. The information we had about the mismatch was insufficient to determine which category it would fall into.

## CONCLUSION

In this chapter, we have introduced ORS, a new approach to ontology mismatch which aims to resolve miscommunication between agents, where this occurs due to ontology mismatch. ORS works by diagnosing mismatches and repairing ontologies during runtime, but only where this is demonstrated to be necessary. ORS is designed to be a tool that an agent interacting in an uncertain world can rely on to assist it when communication breaks down due to misunderstandings.

We have described the kinds of mismatches ORS can diagnose and refine and have briefly outlined promising evaluation results. We have many ideas for increasing the functionality of ORS which should greatly improve these evaluation results, including broadening the scope of the kinds of ontologies ORS can deal with and building in improved semantic matching techniques by incorporating existing semantic matches. Further details of all aspects of ORS, together with full information about our plans for future work, can be found in (McNeill and Bundy, 2007).

## REFERENCES

Berners-Lee, T., Hendler, J., & Lassila, O. (2001). The Semantic Web. *Scientific American*, *284*(5), 34–43. doi:10.1038/scientificamerican0501-34

Bundy, A., McNeill, F., & Walton, C. (2006, May). On repairing reasoning reversals via representational refinements. In *Proceedings of FLAIRS 2006 (The Florida AI Research Society Conference)*, (pp. 3–12). Cambridge, MA: AAAI Press.

Euzenat, J., & Shvaiko, P. (2007). *Ontology matching*. Berlin: Springer.

Giunchiglia, F., & Walsh, T. (1992). A theory of abstraction. *Artificial Intelligence*, *57*(2-3). doi:10.1016/0004-3702(92)90021-O

McNeill, F. & Bundy, A. (2007). Dynamic, automatic, first-order ontology repair by diagnosis of failed plan execution. *IJSWIS (International Journal on Semantic Web and Information Systems) special issue on Ontology Matching, 3*, 1–35.

Shvaiko, P. & Euzenat, J. (2005). A survey of schema-based matching approaches. *Journal on Data Semantics, IV*.

## KEY TERMS AND DEFINITIONS

**Ontology:** Formal representation of domain knowledge, containing a class hierarchy and possibly relations and functions between these classes.

**Planning Agent (PA):** An agent which responds to goals through forming plans to achieve them and then enacting these plans through interaction within a domain.

**Service Providing Agent (SPA):** An agent which is able to provide a service to a planning agent, providing the correct conditions are met.

**ORS:** Ontology repair system which equips a planning agent to proceed successfully with problematic interaction by identifying and repairing any ontological problems which may have led to the difficulties.

**Structured Ontological Term:** An ontological term, such as a relation or function, the meaning of which is determined not only by the meanings of the words in the term but also by their structure.

**Semantic Mismatch:** Mismatch between two ontological terms where the structure is the same but the meanings of the words within the terms is not.

**Structural Mismatch:** Mismatch between two ontological terms where the meanings of the words within the terms is the same but their structure is not (two ontological objects may be mismatched both semantically and structurally).

**Surprising Questions:** When two agents are communicating with a particular goal in mind, a question that is posed by one agent which is not thought to be pertinent to the situation by the other agent is considered by that agent to be a surprising question.

## ENDNOTES

1 http://oaei.ontologymatching.org/

2 http://dream.inf.ed.ac.uk/projects/dor/

3 Note that the → in these rules implies the performance of an action: the predicates on the left hand side must be true before the action is performed; the predicates on the right hand side are made true after the action is performed.

4 Web Services Business Process Execution Language Version 2.0, http://docs.oasis-open.org/wsbpel/2.0/wsbpel-v2.0.pdf

5 Note that we use a lower case initial letter to indicate a constant and an upper case initial letter to indicate a variable. In theory, the name of the variable can be anything, but we use the convention of using the type name so that the type information is immediately apparent. Thus *money(pa,Amount)* indicates that the predicate *money* relates a specific agent named pa has an unknown value which must be of type *Amount.*

6 This is so named as it is loosely inspired by Shapiro's procedure for debugging programs by tracing back to find the original source of the problem.

7 http://oaei.ontologymatching.org/

8 http://dream.inf.ed.ac.uk/projects/dor/

9 The differences between these categories and the process by which we determine how to categorise mismatches are not obvious at first glance. Full details of how this categorisation is done can be found on the ORS website (above).

# Chapter 94
# Modeling Collaborative Design Competence with Ontologies

**Vladimir Tarasov**
*Jönköping University, Sweden*

**Kurt Sandkuhl**
*Jönköping University, Sweden*

**Magnus Lundqvist**
*Jönköping University, Sweden*

## INTRODUCTION

Collaborative design in dispersed groups of engineers creates various kinds of challenges to technology, organization and social environment. Selected examples are knowledge sharing, coordination support or secure tool integration (Jacucci, Pawlak, & Sandkuhl, 2005). Work presented in this chapter is located in the area of formation of teams for collaborative design. The challenge addressed is how to describe and represent the competences needed for a planned collaborative design project in a way that those individuals best suited for the collaboration can be identified. The proposed approach is to apply ontology engineering to modeling competences of individuals, including different competence areas like cultural competences, professional competences or occupational competences.

The next section will present some related work in competence modeling and provide background for our work. The second section describes selected results from an empirical investigation in the field of information use, which confirms the importance of competence when selecting partners for collaboration activities. The forth section will introduce the structure of competence models with focus on specific elements for collaborative design. The representation of competence models with ontologies and the results of modeling of a software design team are described in the next section. The two last sections present an outlook on future work and a summary of the results.

DOI: 10.4018/978-1-61520-611-7.ch094

## BACKGROUND

This chapter is a condensed and enhanced version of the paper published in International Journal of e-Collaboration (Tarasov & Lundqvist, 2007). The presented approach is based on earlier work in the field of competence modeling, both of enterprise competences (Henoch & Sandkuhl, 2002) and of individual competences (Tarassov, Sandkuhl, & Henoch, 2006). Furthermore, earlier work has addressed formation of networks for collaborative engineering (Blomqvist, Levashova, Öhgren, Sandkuhl, & Smirnov, 2005), flexible supply chains (Sandkuhl, Smirnov, & Shilov) or business community creation (Kashevnik, Sandkuhl, Shilov, Smirnov, & Tarasov, 2008), but with a focus on identifying suitable enterprises for a given task description.

Analyzing and structuring competences has been addressed in many papers. Genevi, ve, Blaize Horner, & Izak (1997) examined competences of business managers and structured them into two groups: IT knowledge and IT experience. The former represents acquired knowledge and the latter reflects skills obtained through work. Another work (Giardino & Pearce, 1993) describes core competences needed for information development. They comprise general competences including design and analysis abilities, technical expertise in the IT area, and business skills like knowledge of the market. Structuring competences as well as indicators for analysis of individual and enterprise competences are also addressed in (Jussupova-Mariethoz & Probst, 2007). The identified individual competences are knowledge gained through education, skills mastered with experience, and behavioral characteristics. Competences are also grouped according to level and importance.

The identified competences can be analyzed to drive competence development and business improvement (Giardino & Pearce, 1993). If competences are formalized in the form of an ontology, it can be used as part of a competence retrieval system (Jussupova-Mariethoz & Probst, 2007). It allows for analysis, planning and control of business performance of an enterprise. Another example of using an ontology-based competence model is given in (Paquette, 2007). The author describes an ontology-driven e-learning system that supports evaluation of competencies by determining competency gaps. The evaluation result is used to plan activities to achieve learning goals.

Despite much work has been done in competence modeling, competences for collaborative design were not addressed explicitly and described in a detailed manner. The approach proposed in this chapter analyses and formalizes specifically skills and abilities required for collaborative design. Moreover, our approach proposes to use ontology matching to support team composition for a collaborative design task. This kind of tasks is important for companies producing complex products and needing to find competence unavailable at home. The existing work describes many solutions to automatic competence retrieval and competence analysis based on ontologies but design team creation is not considered to a needed extent.

## IMPORTANCE OF COMPETENCE: FINDINGS FROM AN EMPIRICAL INVESTIGATION

During March – June 2005, an empirical investigation was carried out in Sweden aimed at studying how information is used in Swedish authorities and small- and medium sized enterprises. The investigation comprised 27 interviews with individuals from three different organizations, The Swedish Board of Agriculture, Kongsberg Automotive, and Proton Engineering, the last two being suppliers within the automotive industry. The individuals constituted a sample of all levels staff in the investigated organizations, i.e. from top-level management via middle management down to production- and administrative personnel. It was performed as a series of semi-structured interviews. The investigation resulted in some interesting findings regarding the importance of competence in the creation of informal information exchange channels.

The 27 interviewees answered the question: *to what extent do you rely on colleagues for information*? The replies suggested that informal information exchange channels are an important issue to consider. The informants had a large number of motivations for choosing to talk to other individuals rather than retrieving information from readily available systems. Answers that are even more interesting were those received on the question: *on what do you base your choice of colleague to talk to when you need information?* While in some cases career strategies come into play when choosing, the aspect identified by most informants as the main factor was competence. We believe that when having some information demand, individuals unconsciously do a competence assessment and choose a colleague that is perceived knowledgeable and informed in the relevant subject or area. In some cases, the choice is also based on such aspects as geographical location. It is simply convenient to ask people in the immediate vicinity, especially when it comes to information demands of a more general nature[1]. However, it can be claimed that this also relates to competence since in most organizations individuals with similar work tasks are usually grouped together for this very reason.

## COMPETENCE MODEL FOR COLLABORATIVE DESIGN

An individual usually acquires a wide range of different capabilities during his/her life experience. Most of them can be considered as competences possessed by the individual, which can be applied in work situations. More specifically, Bjurklo and Kardemark (1998) define a competence as a set of all knowledge forms and personal abilities that are required for performing tasks. A competence model is a well-defined formal structure allowing for representation of these knowledge forms and abilities for an individual. Collaborative design can be defined as design task performed in a dispersed group of workers with a joint collaboration objective. Although different areas of collaborative design have been thoroughly researched, a systematic analysis of competences required is not available. Our analysis of competences required for collaborative design focuses on engineering design, i.e. the design task within engineering disciplines like mechanical, electrical or computer engineering.

Following Pahl and Beitz (Pahl & Beitz, 1996), a general process for problem solving in an engineering context consists of confrontation with the problem, information about constraints, definition of the essential tasks to solve, creation of potential solutions, evaluation of solutions and different variants, and finally decision for the best variant. Pahl and Beitz (1996) propose to use plans and procedures for supporting the problem solving process, i.e. they consider planning and designing as closely interlinked elements of engineering design. Comparing the way of solving design problems, Ullman (1997) explains that individuals and teams work quite similar. The main difference is that a team integrates different problem-solving styles of the individuals involved and needs an agreement on team roles supporting the problem solving process and to some extend even supporting the social activity in the team.

Distributing design work and design team on different locations creates a number of additional challenges, like for example to provide adequate support for communication between the distributed groups, coordination of their work activities or support of collaboration in dispersed groups. Work in the field of knowledge co-production shows different organization styles, like teams, communities and networks, which have implications for roles distribution, tool support and organizational environment (Fuchs-Kittowski, 2007). Furthermore, new issues related to the social

*Table 1. Overview to competence perspectives*

| Competence from the previous subsection | Represented by perspective | Based on work from |
|---|---|---|
| Problem solving competence | General Competences | Bjurklo and Kardemark (1998), Pahl and Beitz (1996) |
| Planning and designing competences | General Competences | Bjurklo and Kardemark (1998), Pahl and Beitz (1996) |
| Competences in the field of engineering in question | Occupational Competences | FOET-99 (Andersson & Olsson, 1999) and ISCO-88 (International Labour Organization, 2004) |
| Different technical competences in this engineering area | Occupational Competences | FOET-99 (Andersson & Olsson, 1999) and ISCO-88 (International Labour Organization, 2004) |
| Competence for team work and different roles | General Competences | Bjurklo and Kardemark (1998), Ullman (1997), Grudin (1994) |
| Language competences, competences in integrating different social backgrounds | Cultural Competences | Hammer et al. (2003) |

activity in the team have to be tackled. In design teams spread over several countries, an obvious issue is to agree on a joint working language mastered by every team member. Another issue is to build trust within these distributed groups (Jones & Marsh, 1997).

Summarizing the analysis, we see the following competences as important for collaborative design:

- Problem solving competence, including analysis and synthesis
- Planning and designing competences in general
- Competences in the field of engineering in question
- Different technical competences in this engineering area
- Competence for team work, including different roles
- Language competences and competences in integrating different social backgrounds

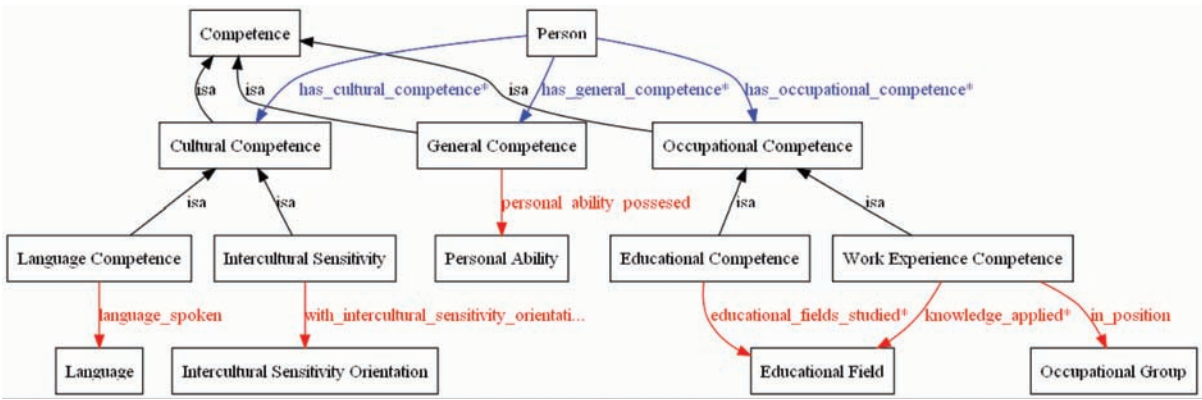
The main intention of a competence model is to provide a formally defined way to represent competences of individuals. A competence model for collaborative design should include the different competences listed above. Table 1 gives an overview to competence perspectives, we propose to distinguish between, and the corresponding competences identified in this section.

The first perspective is general competences as proposed by Bjurklo and Kardemark (1998). They concern abilities general in nature and applicable in different situations, e.g. ability to plan, ability to form teams, creativity, ability to provide support and guidance, etc. The general competences perspective also encompasses design skills identified in (Pahl & Beitz, 1996) and teamwork abilities pointed out in (Grudin, 1994; Ullman, 1997). The second perspective considers cultural competences that are based on the concept of intercultural sensitivity described by Hammer et al. (2003). They are important for representation of expertise of individuals of different cultural origin acting as a bridge between groups in a geographically distributed design. The third perspective is to show what knowledge and skills the person has acquired during his/her work and education. This perspective is based on several statistical classifications.

## USING ONTOLOGIES TO REPRESENT COMPETENCE MODELS

The main question for competence model implementation is which formal representation to use for

*Figure 1. Different parts of the collaborative design competence model*

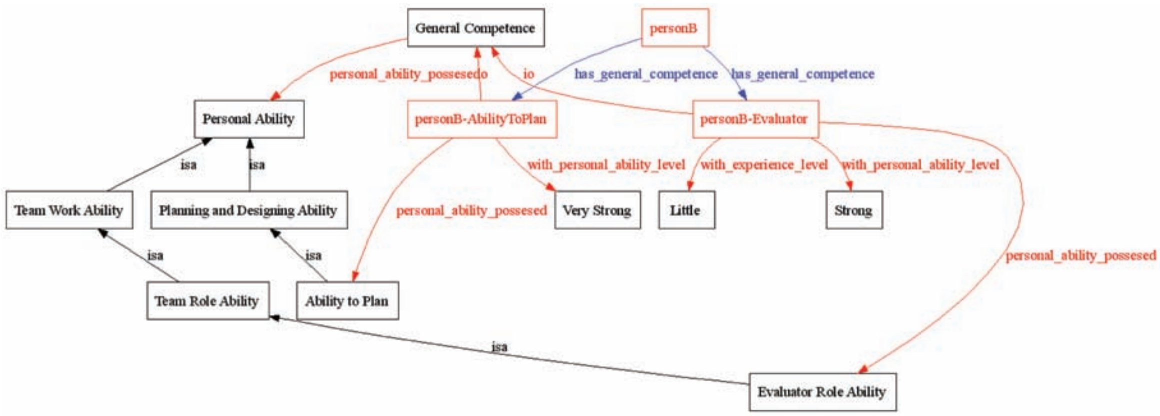



competence models in order to make competence models available for computer-supported retrieval or matching. We propose to utilize ontologies to represent competence models. An ontology is defined as "an explicit specification of a conceptualization" (Gruber, 1993) and allows for description of a problem domain using concepts, their properties, relations between concepts, and axioms expressing constraints. In our opinion, this method is well suited for formalization of competence models because it allows for capture of the rich semantics of competence and accommodation of the results obtained in the areas of human resource management and statistics. An ontology can be stored in a digital form using an ontology language, which provides for further computerized processing of competence models, e.g. for searching or matching. We have created our ontology in Protégé 3.2. The ontology includes 494 concepts, 17 relationships, and 59 instances (including instances of competence profiles).

The ontology implementing the collaborative design competence model is built to include three major parts described in the previous section: General Competence, Cultural Competence, and Occupational Competence that are shown in figure 1. For the first part, we have chosen 11 competence factors relevant for collaborative design from the ones described in (Bjurklo & Kardemark, 1998), added two new factors, ability to analyze and ability to synthesize based on (Pahl & Beitz, 1996), and organized them in a hierarchy. The factors are subdivided into problem solving abilities, planning and designing abilities, and teamwork abilities. The team role competences are also included in the model and placed under the Team Work Ability concept. Each factor is to be graded against a scale Very Weak/Weak/Average/Strong/Very Strong when creating competence profiles. The scale is implemented as a set of concepts and each competence factor can be related to any of these concepts (points on the scale) to specify grading.

The Cultural Competence part is composed of language competence and intercultural sensitivity to take into consideration abilities to act in a multicultural environment. The language competence includes languages, spoken by a person, which can be related to a language level ranging from a beginner to a native speaker. The Intercultural Sensitivity concept can be related to the intercultural sensitivity orientation described in (Hammer et al., 2003): ethnocentric orientations – denial, defense (reversal), minimization, and ethnorelative ones – acceptance, adaptation, integration. Occupational competences are the major part of a person's abilities and may turn out to be the most important ones in a collaborative design situation. These abilities reflect competences in the field of engineering in question and different

*Figure 2. Relations between some concepts and instances of the general competence part of person B's profile*




technical competences in this engineering area. Diverse working and educational backgrounds of team members are represented based on the Classification of fields of education and training, 1999 (FOET 1999), (Andersson & Olsson, 1999) and International Standard Classification of Occupations, 1988 (ISCO-88) (International Labour Organization, 2004). Educational programs/ subjects studied by the person are represented by educational fields that are related to an educational level and country where the education took place. The person's present and past jobs that are represented with occupational group that are related to a fixed skill level, which in turn is related to a corresponding fixed educational level.

We have modeled two persons who have worked as a collaborative software design team in a short-term software development project. After interviewing, the answers were analyzed and we built two particular instances of the collaborative design competence model using Protégé 3.2. These instances are called competence profiles and they describe competences of the software design team members.

As an example, we describe creation of the general competence part of the competence profile. During the creation, each ability was graded against the scale described in the previous section. Experience level of team role abilities was also graded. The experience grading was based on the amount of time when the person acted in the corresponding role. Figure 2 shows how one team role and one competence factor (the rest is not shown for brevity) with related grades can be represented by creating two instances of the General Competence concept and setting up appropriate relationships to the personal abilities concepts and their levels. This is part of the competence profile for person B.

## FUTURE RESEARCH DIRECTIONS

One of the first tasks for future research is to refine and verify the constructed competence model. The developed model together with its ontological representation should be refined in a wider study. This especially concerns the general competence part. Other areas of collaborative design need to be considered too. They may introduce additional competences in the model. Another interesting issue is to investigate how well required competences will be represented in a newly formed design team. This will require cooperation with researchers in the psychological field, in particular to provide for a well-balanced team with respect to both technical and social skills. Ongoing work includes an application of the competence modeling experiences in the defense sector. Focus here is on integrating knowledge about relations between individuals into competence models and on combining ontologies and enterprise models.

The accomplished interviews in this study and in the project described in (Tarassov et al., 2006) showed that capturing general abilities of an individual is a laborious task, which might introduce inaccuracy in competence profiles. One approach to automate profile creation is to use behavioral modeling with Markov chains. We currently investigate how behavioral modeling can be used to update dynamically profiles of digital library users in another project. Additionally, further investigation is needed on how to increase accuracy of competence assessment.

Investigation of different ontology matching techniques enabling computer-based search and selection of individuals possessing needed collaborative design competences is one more needed step in our future work, which so far concentrated on principal matching strategies and how to combine them (Lin & Sandkuhl, 2007). When a competence profile for a potential team member is defined, it can be matched against the collaborative design task represented with another ontology (or part of it). The latter ontology may be a task ontology. The process of establishing similarity between two ontologies or parts of ontologies (ontology matching) can be used to find appropriate team members covering each part of the task.

Competence-based team formation can be applied not only to collaborative design. Using the same method to support other tasks is an interesting direction. For example, the same approach may support finding business partners (Tarassov et al., 2006) or business community creation (Kashevnik et al., 2008). One of the questions here is how to describe competence demand.

## CONCLUSION

Based on the findings from an empirical investigation and literature from CSCW, we consider competence as essential factor when selecting members for a collaborative design team. The most important competence areas were identified starting from the nature of engineering design work, problem solving in design teams and working in distributed groups. These competence areas were matched on competence perspectives, which reflect existing work for structuring capabilities or education profiles of individuals. An ontological representation was proposed to implement the described model for collaborative design competence. Finally, a software design team consisting of two persons was interviewed and two collaborative design competence profiles were created using the developed ontological representation of the model. Our contribution is detailed analysis and formal specification of collaborative design competences in the form of an ontology. The latter was created with an ontology language, which provides for (semi-)automatic support for composing teams for collaborative design through ontology matching.

Ontologies as representation technique for competence models and the different competence perspectives have already been successfully applied in a research project for the Swedish International Development Agency aiming at capturing competences of migrants in Sweden (Tarassov et al., 2006). The modeling of the software design team members done in this study has proved that the proposed approach can also be applied to modeling competences needed for collaborative design in engineering fields. The results presented in this chapter corroborate this statement. The similar approach for competence modelling may be applied to other design areas. Competences can be structured along the same competence perspectives. General and cultural competences will not require many changes. At the same time, occupational competences will most probably need some adjustment because of another design field, e.g. clothes design will introduce different professional competences in the field. As soon as this part of the model is based on the international classification (Andersson & Olsson, 1999), it can be reused to represent other design areas.

Team formation for collaborative design can be supported with our approach through ontology matching of competence profiles against the task ontology. Strategies used for matching can be different and further investigation into this issue is needed. The same matching technique may be applied to other design areas once competence profiles are created and a design task is described. Even composition of teams to cope with other kinds of tasks may be supported with a similar approach provided that competence profiles are created and the competence demand is specified as an ontology fragment.

## REFERENCES

Andersson, R., & Olsson, A.-K. (1999). *Fields of Education and Training Manual*. Retrieved from http://www.estatisticas.gpeari.mctes.pt/archive/doc/Fields_of_Education_and_Training_eurostat1999.pdf

Bjurklo, M., & Kardemark, G. (1998). Social tests in a model for controlling the enhancement of competence. *Journal of Human Resource Costing and Accounting*, *3*(2), 51–64. doi:10.1108/eb029048

Blomqvist, E., Levashova, T., Öhgren, A., Sandkuhl, K., & Smirnov, A. (2005). Formation of Enterprise Networks for Collaborative Engineering. In *Post-conference proceedings of 3. Intl. Workshop on Collaborative Engineering*, Sopron, Hungary.

Fuchs-Kittowski, F. (2007). *Integrierte IT-Unterstutzung der Wissensarbeit*. Cologne, Germany: EUL Verlag.

Genevi, ve, B., Blaize Horner, R., & Izak, B. (1997). Assessing IT competence in business managers. In *Proceedings of the eighteenth international conference on Information systems* (pp. 468-469). Atlanta, GA: Association for Information Systems.

Giardino, A. M., & Pearce, S. G. (1993). Determining core competences in the information development environment: an example. In *Proceedings of the 1993 conference of the Centre for Advanced Studies on Collaborative research: distributed computing* (Vol. 2, pp. 1032-1040). Toronto, Canada: IBM Press.

Gruber, T. R. (1993). A translation approach to portable ontology specifications. *Knowledge Acquisition*, *5*(2), 199–220. doi:10.1006/knac.1993.1008

Grudin, J. (1994). Computer-Supported Cooperative Work: History and Focus. *IEEE Computer*, May.

Hammer, M. R., Bennett, M. J., & Wiseman, R. (2003). Measuring intercultural sensitivity: The intercultural development inventory. *International Journal of Intercultural Relations*, *27*(4), 421–443. doi:10.1016/S0147-1767(03)00032-4

Henoch, B., & Sandkuhl, K. (2002). Competence modelling as a basis for formation of SME-networks - the SME-chains approach. In *Proceedings of the WWDU 2002 Conference*.

International Labour Organization. (2004, September 18). *International Standard Classification of Occupations, 1988 (ISCO-88)*. Retrieved May 25, 2009, from http://www.ilo.org/public/english/bureau/stat/isco/isco88/index.htm

Jacucci, G., Pawlak, A., & Sandkuhl, K. (Eds.). (2005). The Knowledge Perspective in Industrial Collaborative Engineering. In 3rd *Intl. Workshop on Collaborative Engineering*, Sopron, Hungary.

Jones, S., & Marsh, S. (1997). Human-Computer-Human Interaction: Trust in CSCW. *SIGCHI Bulletin, 29*(3).

Jussupova-Mariethoz, Y., & Probst, A.-R. (2007). Business concepts ontology for an enterprise performance and competences monitoring. *Computers in Industry*, *58*(2), 118–129. doi:10.1016/j.compind.2006.09.008

Kashevnik, A., Sandkuhl, K., Shilov, N., Smirnov, A., & Tarasov, V. (2008). Business Community Creation Based on Competence Management. In P. Cunningham & M. Cunningham (Eds.), *Collaboration and the Knowledge Economy: Issues, Applications, Case Studies,* (pp. 1085-1092). Amsterdam: IOS Press

Lin, F., & Sandkuhl, K. (2007). Polygon-Based Similarity Aggregation for Ontology Matching. In *ISPA Workshops,* (pp. 255-264). Berlin: Springer.

Pahl, G., & Beitz, W. (1996). *Engineering Design: A Systematic Approach*. London: Springer.

Paquette, G. (2007). An Ontology and a Software Framework for Competency Modeling and Management. *Educational Technology & Society*, *10*(3), 1–21.

Sandkuhl, K., Smirnov, A., & Shilov, N. Configuration of automotive collaborative engineering and flexible supply networks. In P. Cunningham & M. Cunningham (Eds.), *Expanding the Knowledge Economy – Issues, Applications, Case Studies*. Amsterdam: IOS Press.

Tarasov, V., & Lundqvist, M. (2007). Modeling collaborative design competence with ontologies. *International Journal of e-Collaboration . Special Issue on the State of the Art and Future Challenges on Collaborative Design*, *3*(4), 46–62.

Tarassov, V., Sandkuhl, K., & Henoch, B. (2006). Using ontologies for representation of individual and enterprise competence models. In P. Bellot, V. Duong & M. Bui (Eds.), *Proceedings of the Fourth IEEE International Conference on Computer Sciences Research, Innovation and Vision for the Future, RIVF,* (pp. 205–212). Ho-Chi-Minh City, Vietnam: IEEE.

Ullman, D. G. (1997). *The Mechanical Design Process*. Singapore: McGraw-Hill Book Co.

## KEY TERMS AND DEFINITIONS

**Collaborative Design:** A design task performed in a dispersed group of workers with a joint collaboration objective.

**Competence Model:** A well-defined formal structure allowing for representation of an individual's competences.

**Competence Profile:** An instance of a competence model. A competence profile describes particular competences of a person.

**Competence:** A set of all knowledge forms and personal abilities that are required for performing tasks (Bjurklo & Kardemark, 1998).

**Cultural Competences:** Experience of individuals of different origin acting as a bridge between groups in the design team from different cultural backgrounds.

**Engineering Design:** A design task within engineering disciplines like mechanical, electrical or computer engineering.

**General Competences:** Abilities that are needed for performing general tasks during collaborative design. Theses abilities are general in nature and applicable in different situations, e.g. ability to plan, ability to form teams or creativity.

**Occupational Competences:** Skills in the field of engineering in question and different technical skills in this engineering area. They are obtained through education and work experience of the person.

**Ontology Matching:** The process of establishing similarity between two ontologies or parts of ontologies. In our approach, a competence profile (part of the ontology representing the collaborative design competence model) can be matched against another ontology (or part of it) representing the collaborative design task.

**Ontology:** Representation of a problem domain using concepts, their properties, relations between concepts, and axioms expressing constraints.

## ENDNOTE

[1] It can be possible that different age groups may prefer different types of information sources but our empirical investigation did not address this issue.

# Chapter 95
# Event-Driven Service-Oriented Architectures for E-Business

**Olga Levina**
*Berlin Institute of Technology, Germany*

**Vladimir Stantchev**
*Berlin Institute of Technology, Germany*

## INTRODUCTION

E-Business research and practice can be situated on following multiple levels: applications, technological issues, support and implementation (Ngai and Wat 2002). Here we consider technological components for realizing business processes and discuss their foundation architecture for technological enabling. The article provides an introduction to the terms, techniques and realization issues for event-driven and service-oriented architectures. We begin with a definition of terms and propose a reference architecture for an event-driven service-oriented architecture (EDSOA). Possible applications in the area of E-Business and solution guidelines are considered in the second part of the article.

DOI: 10.4018/978-1-61520-611-7.ch095

Service-oriented Architectures (SOA) have gained momentum since their introduction in the last years. Seen as an approach to integrate heterogeneous applications within an enterprise architecture they are also used to design flexible and adaptable business processes. An SOA is designed as a distributed system architecture providing a good integration possibility of already existing application systems. Furthermore, SOA is mostly suitable for complex and large system landscapes.

As no single agreed-upon definition of SOA exists, we will use here the SOA understanding as stated in (Schröpfer and Schönherr 2008): "SOA is an architecture style that combines elements of software and enterprise architectures. Its main components are services that are autonomous as well as interoperable and provide re-usable functions via a technically standardized interface. Services can interoperate and exist on all layers of an application system like business process, presentation, business logic, data management layers. Services can be aggregated or coupled based on lower-level services. These can be derived from existing IT systems but also designed and implemented from scratch." This definition already provides the important SOA characteristics such as:

- Service encapsulation: the functionality presented by the service is not visible. Only the interface describing service behavior is stated
- Loose coupling: Services are designed and can work individually, so that they do not rely on each other's functionality
- Service autonomy: a service can be managed independently from other components
- Reusability: a service may be reused within other business process of several enterprises
- Service composition: services can be combined to more complex processes or to a complete business process
- Service discovery: services need to be described and stored for future search and reuse.

A service is encapsulated business functionality, that can't be decomposed without harming its functionality. Further SOA definitions are provided by OASIS and OpenGroup including reference designs (OASIS 2006, OpenGroup 2006).

SOA can be realized using different technologies. Web Services ((W3C)) are often associated with service-orientation and are one of the technologies a SOA can be built upon. Intensely discussed in industry and research, SOA is often seen as an IT revolution. In these discussions the context of already existing distributed architectures based on object-orientation (Erl 2008) or agent technology is often overseen. Thus, SOA is an evolution towards distributed, business process- oriented architectures considering the steady development towards distributed approaches to software and application integration architectures. Also seen as an integration technology, Enterprise Service Bus (ESB) (Erl 2008) is often used to combine existing applications. It allows an integration of already existing enterprise applications making the communication structures more simple and transparent.

Event-driven architecture is often regarded in the context of SOA. Even the term SOA 2.0 is used to describe the combination of service- and event-orientation. Event-driven architecture (EDA) is based on the publish/subscribe principle and therefore enables loose coupling of the architectural components. Elements of an EDA are triggered by incoming events and are not necessary aware of the existence of further components.

Electronic communication and IT-supported implementation of business processes are the main issues in electronic business (E-Business). A fast and transparent order and request processing are essential elements of the business success and are important elements of the competitive advantage of the enterprise. Since a significant number of requests need to be processed by the enterprise, a high automation level needs to be considered. This business environment is often characterized by a distributed and complex IT- structure, high number of incoming requests, need for nearly real-time reaction and multiple interaction partners (e.g. customers, suppliers, etc.) that are linked to each other by the E-Business enterprise itself. Bundling and processing these activities requires not only well defined business processes but also a strong support from the IT architecture-side.

EDA provides a suitable structure to spread and handle numerous incoming events. Instances interested in an event can subscribe for notification, therefore the addressee does not need to be identified or searched for. Complex Event Processing (CEP) (Luckham and Frasca 1998) tools allow for event combination and interpretation. This technology enables correlation and analysis of events from multiple sources and contexts. It also delivers action triggering according to a rule or a pattern.

While EDA offers the way of communication within the architecture, SOA offers a distributed structure approach needed in such environments. Both concepts are intuitive and complement each other with SOA providing business process thinking and encapsulation approaches and EDA providing an asynchronous state change- based communication structure. As described above, these are important characteristics needed in the context of E-Business. For these reasons the two technologies are combined into an event-driven service-oriented architecture (EDSOA) that is presented in the following sections.

This rest of the article provides an introduction on the event- and service-oriented technologies, their origins and application areas. We also give an overview of work already done by researchers and practitioners on this topic.

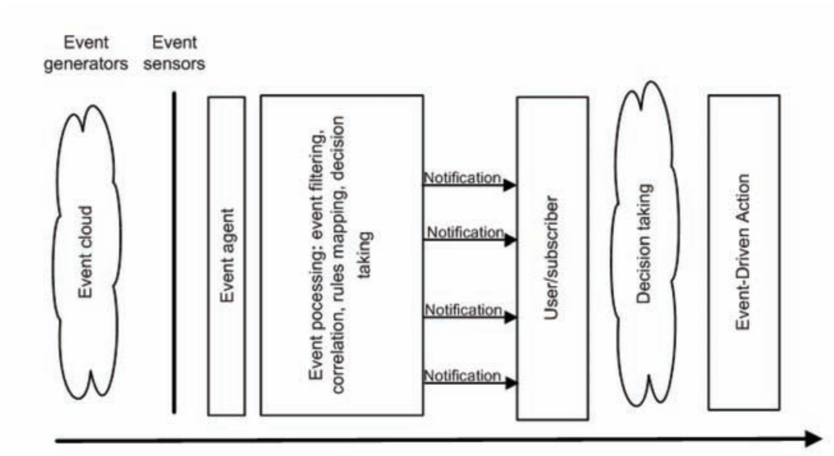
## BACKGROUND

As already stated above, service-orientation is a result of the technological evolution towards more flexible and adaptable enterprise applications and structures. Beside the object-orientation, aspect-oriented programming, enterprise application integration (EAI) and business process management influenced the formation of service-orientation (Erl 2008). Services are functionality structures derived from existing or required business functionalities captured in business processes or in enterprise applications. There are many ways how these functions can be implemented into a structure accordant to the SOA characteristics of flexibility and autonomy. Services can be realized using data-based (Batini, Lenzerini and Navathe 1986), object-oriented (e.g. CORBA) or service-oriented (Erl 2008) approaches. Since a data-oriented approach can be applied only to structured data (Batini, et al. 1986) and object-oriented approach does not enable loose coupling and ubiquitous services access (Baghdadi 2005), service implementation is often realized with Web Services.

Service-orientation can be beneficial when business processes or their parts are standardized or are often repeated without changes, or various processes or systems can use the same service for their task. Therefore, service-orientation allows structuring a system by using services to be later re-constructed to a business process. An RPC-style call (Remote Procedure Call) can serve for service invocation in a SOA. This is a synchronous way of communication and requires the knowledge and answer of the addressee. Services also provide a way to distribute functionality logic. This is an advantage when: (i) the service requestor is interested in the results of service invocation; (ii) a successful service performance is important; (iii) in man- machine interaction when a response is awaited; and (iv) when processes require roll-back actions (van Hoof 2006).

Event-driven architecture has its roots in the necessity to react to (spontaneously) occurring events that require a business process execution. These events and their interaction are the counterpart of the structured and well-organized service-oriented proceeding. Since in E-Business the event scenario is more common than structured and pre-defined processes, EDA is a suitable complement of service-orientation in this context. The main components of an EDA are: event sources, event sinks and event processor. An event processor (the event processing component in Figure 1) may include rules processing engine, as well as a conversion mechanism to encapsulate events in a machine-readable way (event agent). Rule processing is needed to combine and forward incoming events according to the business rules. Components interested in a specific event subscribe for notification. Subscriber also has to decide whether and what action to take. That can be done using complex event processing algorithms or the action can be initiated manually.

*Figure 1. Event-driven architecture*




Event transportation is often implemented using a (message-based) middleware.

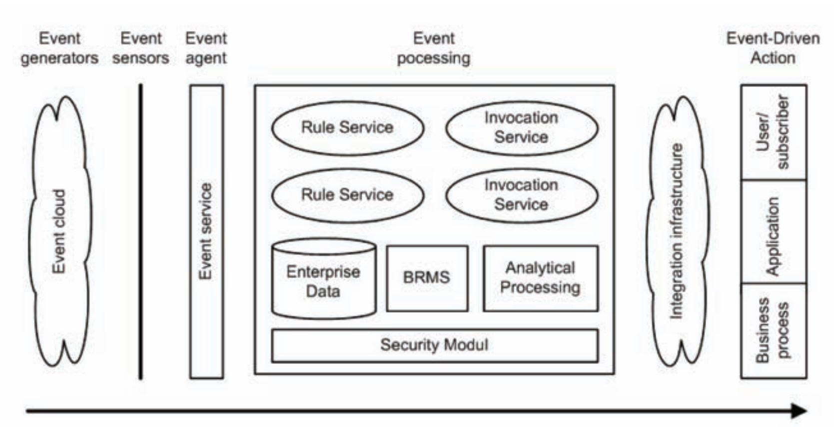
EDA is a structure for distributed and complex systems, very useful in cases when business processes cross the boarders of a single enterprise (B2B processes) and system components are loosely coupled without complete knowledge of their environment.

Discussions on event-driven, distributed architectures and collaboration models in E-Business can be found in (Muehl, Fiege and Buchmann 2000), (Fiege 2000) and (Langdon 2003). Possible combinations of SOA and event processing, as well as process monitoring by events is suggested in (Jobst and Preissler 2006); deeper insight into event- processing from the technical point of view is offered by (Michlmayr, Rosenberg, Leitner and Dustdar 2008, Luckham 1998); event-driven application integration using web services is provided in (Harikumar, Lee, Chiang and Yang 2005) as well as in (Levina 2009); major vendors combine EDA and SOA (Oracle, Techtarget) or provide tools for basic business event monitoring (BAM), e.g. (IBM 2008); frameworks from research that include event- detection and service-orientation are found in e.g. (Cilia 2001). EDA is also an important topic of network management research, e.g. (Krishnamoorthy, Unni and Niranjan 2005).

## ADOPTING EDSOA FOR E-BUSINESS

As stated in the previous section, SOA and EDA complete each other in many ways; an EDSOA is a suitable approach, especially in the context of distributed business processes and dependence of the business model on fast event reaction like it is the case in E-Business. In Figure 2 an EDA is shown. Here event communication and invocation of the architecture components are realized by the services. The loose coupling of components is attenuated by the service-use that enhances the collaboration of the components. Incoming events are encapsulated as event services by the event agent. Functionalities described for EDA in Figure 1 are realized using services. Within the event processing component services are used to invoke business rules services that are mapped to incoming events using analytical methods. An analytical component therefore needs to access enterprise data and stored business rules that are managed within the business rules management system (BRMS). A security module is essential to fulfill reliability and trust requirements. Events are delivered to the event sinks (business process, application system or user) not as a message but as a service using

*Figure 2. EDSOA architecture*




the integration infrastructure, e.g., an enterprise service bus.

Service-orientation enables flexibility and extensibility of the system because of its modularity. While SOA targets actions from the future (service request to complete a specific task), EDA delivers information from the past to the system (event notification from a change that lies in the past). From this point of view SOA requires EDA-data and structure to take a real-time action (a change requiring service execution in turn) which is defined by the business rules. While SOA offers EDA a suitable design approach by providing a distributed environment for separating business logic, processes and technical functions, it benefits from another service invocation technique that loosens the rigor of RPC. Both, structured and spontaneous processes can be efficiently managed by this architecture. Implementing SOA-suitable environment means implementing an environment where events and business rules can operate on their best and already many architectural interactions are standardized (IEEE).

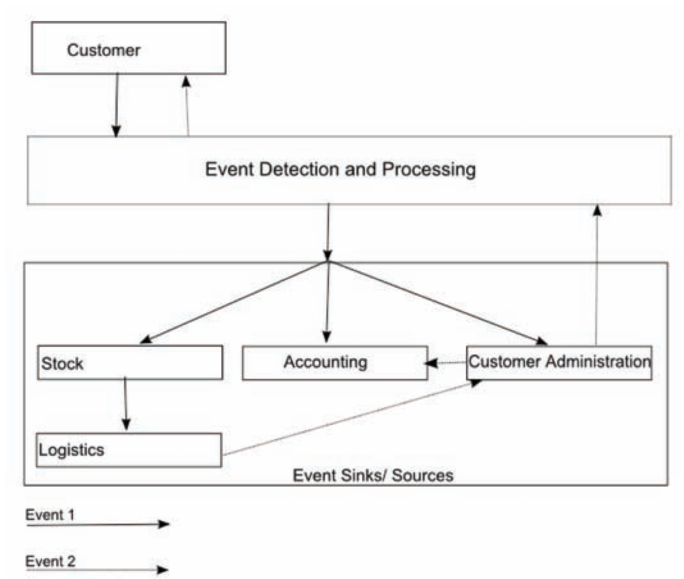
Figure 3 shows the process of an incoming order in the context of E-Business. The order is detected as an event (event1) and is delivered to the subscribers that react to the event according to their incorporated functions. Some reactions result in further events (event 2) that are finally sent to the customer. In this scenario the order is a product that is sent from the stock to a logistic service. The customer can be informed in real-time about the status of his or her order. Being an already standard application in E-Business, the event-driven approach also allows a better integration and collaboration of heterogeneous enterprise applications.

As E-Business is often characterized by a number of different information systems that need to communicate and collaborate with each other, EDSOA offers a suitable integration and collaboration platform with a minimum change effort of the existing system landscape.

## Issues, Controversies, Problems

Companies in business areas that depend on real-time information, like airlines, logistics or credit card companies are already developing their own event-driven systems. These solutions might work for the particular company but their advancement is difficult due to proprietary development technologies. Main discussion issues in the area of event and service-orientation are both technical and organizational. Still a lot of ground research is needed towards a standardized understanding and implementing of EDA and EDSOA. Some enterprise application producers already started

*Figure 3. EDA in e-business*




to market and develop IT- supported business functions that can be used to integrate the event-driven approach. Mostly, these functions include the business activity monitoring (BAM) capabilities with a rather low level of automation. Here further improvement and implementation of classification algorithms is needed, so that the CEP can be performed in the time required for the business process.

Furthermore, event semantics may be different in each solution as there is no official language for event description or management yet, so that event description can't be reused. Best practice technological realization as well as explicit business cases for the use of the event-driven service-oriented paradigm are yet to be established. This also needs a strong event-oriented community and practice.

Implementing a new architecture like SOA requires good managerial support and change management. Here not only the IT department is involved. Implementing an SOA is also rather a middle-term investment which financial success is shown only in the middle-run. Therefore, a lot of companies are still ambiguous towards SOA implementation. Event-driven approach is a new for several industries. Therefore, the event and notification thinking need to be developed first, before the architectural decision can be taken. Additionally, not many enterprise application providers already offer holistic EDA solutions. No best practices or business cases exist yet, therefore the entry level for middle and small enterprise is quite high.

## SOLUTIONS AND RECOMMENDATIONS

Facing the growing awareness for distributed architectures that provide a greater flexibility and adaptation to the environment, SOA implementation will be spreading, also following the achieved and then visible results of earlier experience. Standards for event description and transportation will also spread in the next years as initiatives and efforts are already made. Thinking in event-driven paradigms will also rise as the globalization and competitiveness in the area of E- and "classical" Business are growing; fast reaction is required and is already seen as an important competitive advantage.

EDA and EDSOA concepts will spread in press, research and practice. Therefore, more and more technical as well as management seminars will be offered for EDA and EDSOA implementation will be offered and the number of best practices will rise. To manage high number of events in the needed real-time other technologies as a full EDA or EDSOA offered by software producers. Event infrastructures and business insight solutions like BAM already provide a basis for an event driven architecture. As in an EDSOA business events drive the service orchestration, i.e. event driven solutions can be build upon an existing or a developing SOA.

## FUTURE RESEARCH DIRECTIONS

Future research will include platform independent EDSOA realization, event description language, and performance preserving integration of business processes and events as well as further development of event correlation and pattern processing and recognition in the area of CEP. Integration technology allowing alignment of legacy systems in the enterprise and the event- driven approach will be developed. Software and management pattern for event-driven, service-oriented architecture introduction and implementation need to be developed. Non functional architectural properties need to be formulated and observed. Here technological and managerial implications are to be developed.

## CONCLUSION

Growing competiveness on the global market, shrinking product life cycle as well as customer's awareness of real-time order processing will require businesses, especially electronic based companies, to design their application systems as flexible and autonomous as possible. Automation need for fast processing and event detection will be required to face the challenges. Therefore, a service-oriented, event-driven architecture is needed. It allows a flexible and fast communication and collaboration between distributed system elements. Event detection and processing allows fast and automated fulfillment of incoming requests. Service-orientation keeps the number of functions down to the necessary ones enabling their reuse. A Service is platform- independent and can be built upon the existing architecture. EDSOA is a solution that is being realized to cope with this developments and emerging challenges.

## REFERENCES


W3c. (n.d.). *W. W. C.* W3c Working Group Note.
Baghdadi, Y. (2005). A Business Model For Deploying Web Services: A Data-Centric Approach Based On Factual Dependencies. *Information Systems \& E-Business Management, 3*.

Batini, C., Lenzerini, M., & Navathe, S. B. (1986). A Comparative Analysis Of Methodologies For Database Schema Integration. *ACM Computing Surveys*, *18*, 323–364. doi:10.1145/27633.27634

Cilia, M., Bornhövd, C., & Buchmann, A. P. (2001). Moving Active Functionality From Centralized To Open Distributed Heterogeneous Environments. In *Proceedings Of The 9th International Conference On Cooperative Information Systems*, (pp. 195-210). Berlin: Springer-Verlag

Erl, T. (2008). *Soa Priciples Of Service Design.* Upper Saddle River, NJ: Prentice Hall.

Fiege, L., Muehl, G., & Buchmann, A. (2000). An Architectural Framework For Electronic Commerce Applications. In *Informatik 2001: Annual Conference Of The German Computer Society*, Vienna, Austria.

Harikumar, A. K., Lee, R., Chiang, C.-C., & Yang, H.-S. (2005). An Event Driven Architecture For Application Integration Using Web Services. In *Information Reuse And Integration, Conf, 2005. Iri -2005 IEEE International Conference On.*, (pp. 542-547).

IBM. (2008). *Websphere Business Monitor*. IEEE. (n.d.). *SOA Standards*.

Jobst, D., & Preissler, G. (2006). Mapping Clouds Of Soa- And Business-Related Events For An Enterprise Cockpit In A Java-Based Environment. In *Pppj '06: Proceedings Of The 4th International Symposium On Principles And Practice Of Programming In Java,* (pp. 230-236). New York: ACM.

Krishnamoorthy, V., Unni, N. K., & Niranjan, V. (2005). Event-Driven Service-Oriented Architecture For An Agile And Scalable Network Management System. In *Nwesp '05: Proceedings Of The International Conference On Next Generation Web Services Practices*, (p. 345). Washington, DC: IEEE Computer Society.

Langdon, C. S. (2003). Information Systems Architecture Styles And Business Interaction Patterns: Toward Theoretic Correspondence. *Information Systems And E-Business Management*, *1*, 283–304.

Levina, O., & Stantchev, V. (2009). Realising Event-Driven Soa. In *4th International Conference On Internet And Web Applications And Services*.

Luckham, D. C., & Frasca, B. (1998). *Complex Event Processing In Distributed Systems*. Technical, Stanford University.

Michlmayr, A., Rosenberg, F., Leitner, P., & Dustdar, S. (2008). Advanced Event Processing And Notifications In Service Runtime Environments. In *Debs '08: Proceedings Of The Second International Conference On Distributed Event-Based Systems,* (pp. 115-125). New York: ACM.

Muehl, G., Fiege, L., & Buchmann, A. (2000). Evaluation Of Cooperation Models For Electronic Business. In *Proceedings Of The Conference Of The German Society For Computer Science*, Linz, Austria.

Ngai, E. W. T., & Wat, F. K. T. (2002). A Literature Review And Classification Of Electronic Commerce Research. *Information & Management*, *39*, 415–429. doi:10.1016/S0378-7206(01)00107-0

Oasis. (2006). *Reference Model For Service Oriented Architecture 1.0.*

Opengroup. (2006). *Service-Oriented Architecture (SOA).*

Oracle. (n.d.). *EDA And Oracle*.

Schröpfer, C., & Schönherr, M. (2008). Introducing A Method To Derive An Enterprise-Specific SOA Operating Model. In *12th International Ieee Enterprise Distributed Object Computing Conference, EDOC '08,* (pp. 235-244). Washington, DC: IEEE.

Techtarget. (n.d.). *SOA Moves Toward Event Handling.*

Van Hoof, J. (2006). *How EDA Extends SOA And Why It Is Important*. Retrieved from http://Soa-Eda.Blogspot.Com/2006/11/How-Eda-Extends-Soa-And-Why-It-Is.Html


## ADDITIONAL READING


Agrawal, J., Diao, Y., Gyllstrom, D., & Immerman, N. (2008). Efficient pattern matching over event streams. In *Proceedings of the 2008 ACM SIGMOD international conference on Management of data* (pp. 147-160). Vancouver, Canada: ACM.

Antollini, M., & Buchmann, A. (2006). Implementing a High Level Pub/Sub Layer for Enterprise Information Systems. In Intl. Conference on Enterprise Information Systems (ICEIS'06), Paphos, Cyprus.

Carzaniga, A. (1998). Issues in supporting event-based architectural styles. In Foundations of Software Engineering archive Proceedings of the third international workshop on Software architecture table of contents Orlando, Florida, United State (pp. 17 - 20).

Chandy, K. M., & Schulte, R. W. (2007). How Event Processing improves Business Decision Making. September 23, 2008, from http://complexevents.com/wpcontent/uploads/2007/07/CEP%20article%20long%20Chandy%20and%20Schulte%20final%2017%20july%202007.pdf.

Chandy, K. M., & Schulte, R. W. (2007, July). What is Event Driven Architecture (EDA) and Why Does it Matter? http://complexevents.com/wp-content/uploads/2007/07/EDA

Cugola, G., Di Nitto, E., & Fuggetta, A. (1998). Exploiting an event-based infrastructure to develop complex distributed systems. In *Software Engineering, 1998. Proceedings of the 1998 International Conference on* (pp. 261-270).

Etzion, O. (2005). Towards an Event-Driven Architecture: An Infrastructure for Event Processing Position Paper. In Rules and Rule Markup Languages for the Semantic Web . *Lecture Notes in Computer Science*, *3791*, 1–7. doi:10.1007/11580072_1

Fiege, L., Cilia, M., Muhl, G., & Buchmann, A. (2006). Publish-Subscribe Grows Up: Support for Management, Visibility Control, and Heterogeneity. *IEEE Internet Computing*, *10*(1), 48–55. doi:10.1109/MIC.2006.17

Fiege, L., Mühl, G., & Gärtner, F. C. (2002). Modular event-based systems. *The Knowledge Engineering Review*, *17*(4), 359–388. doi:10.1017/S0269888903000559

Hellerstein, J. L., Ma, S., & Perng, C. (2002). Discovering actionable patterns in event data. *IBM SYSTEMS JOURNAL, 41*(3). November 3, 2008, from http://www.research.ibm.com/journal/sj/413/hellerstein.pdf.

IEE Proceedings Software 153(1):31-37, February 2006 Link IEEE Xplore: http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=1603356

Krallmann, H., Schröpfer, C., Stantchev, V., & Offermann, P. Enabling Autonomous Self-Optimization in Service-Oriented Systems in Autonomous Systems - Self-Organisation, Management, and Control, Mahr, Sheng (Eds.), Springer, 2008, ISBN: 978-1-4020-8888-9, Link: http://www.springerlink.com/content/n3218t90847811g3/

Levina, O., & Stantchev, V. (2009): Realizing Event-Driven SOA: In IEEE Computer Society, Proceedings of the Fourth International Conference on Internet and Web Applications and Services, May 2009.

Luckham, D. C., & Frasca, B. *Complex Event Processing in Distributed Systems*. 1998, Stanford University.

Maréchaux, J. (2006). Combining Service-Oriented Architecture and Event-Driven Architecture using an Enterprise Service Bus. IBM Developer Works; September 8, 2008, from http://www.ibm.com/developerworks/library/ws-soa-eda-esb/#N100D3.

Michelson, B. (2006). Event-Driven Architecture Overview- Venet-Driven SOA is just part of the EDA story: Patricia Seybold Group.

Natis, Y. V. (2003, April). Service-Oriented Architecture Scenario. Gartner Research Note ID Number: AV-19-6751, from http://www.gartner.com/resources/114300/114358/114358.pdf.

Papazoglou, M. P., Traverso, P., Dustdar, S., & Leymann, F. (2007). Service-oriented computing: State of the art and research challenges. *Computer*, *40*(11), 38–45. doi:10.1109/MC.2007.400

Peng, J., Feng, C., Qiao, H., & Rozenblit, J. (2007). An Event-Driven Architecture for Fine Grained Intrusion Detection and Attack Aftermath Mitigation. In *Engineering of Computer-Based Systems, 2007. ECBS '07. 14th Annual IEEE International Conference and Workshops on the* (pp. 55-62).

Perrey, R., & Lycett, M. (2003). Service-oriented architecture. In Applications and the Internet Workshops, 2003. Proceedings. 2003 Symposium on (pp. 116-119).

Pietzuch, P. R. (2002). Event-Based Middleware: A New Paradigm for Wide-Area Distributed Systems? January 5, 2009, from http://www.doc.ic.ac.uk/~peter/manager/doc/prp_event_mw_cabernet.pdf

Sharon, G., & Etzion, O. (2008). Event-processing Network Model and Implementation. *IBM SYSTEMS JOURNAL, 47*(2). Retrieved November 2, 2008, from http://www.research.ibm.com/journal/sj/472/sharon.pdf

Stantchev, V., & Malek, M. Translucent Replication for Service Level Assurance in High Assurance Service Computing, Dong, Paul, Zhang (Eds.), Springer, 2009 ISBN: 978-0-387-87657-3, Link: http://www.springer.com/computer/programming/book/978-0-387-87657-3

Stantchev, V., & Schröpfer, C. Service Level Enforcement in Web-Services Based Systems in International Journal on Web and Grid Services 5(2) 2009, Inderscience Publishers, Link: http://www.inderscience.com/browse/index.php?journalID=47

Stantchev, V., Malek, M.Architectural Translucency in Service-oriented Architectures

Van Hoof, J. (2008, October 3). EDA versus CEP (and SOA). *SOA and EDA*. October 7, 2008, from http://soa-eda.blogspot.com/2008/10/eda-versus-cep-and-soa.html van Hoof, J. (2007). SOA and EDA: Using events to bridge decoupled service boundaries. SearchSOA. August 12, 2008, from http://searchsoa.techtarget.com/tip/0,289483,sid26_gci1246430,00.html.

Walker, W. T. (2005). Emerging trends in supply chain architecture. *International Journal of Production Research*. Retrieved January 21, 2009 from <http://docserver.ingentaconnect.com/deliver/connect/tandf/>.

## KEY TERMS AND DEFINITIONS

**Event:** An event is a state change of a variable under observation, e.g. business object.

**EDA:** Event-driven architecture is a system structure which elements are triggered by events to fulfill their functionality.

**SOA:** An architecture that combines elements of software architecture and enterprise architecture. It is based on the interaction with autonomous and interoperable services that offer reusable business functionality via standardized interfaces.

**Web Service:** Defined by W3C as a "software system designed to support interoperable machine-to-machine interaction over a network".

**ESB:** Enterprise-service bus is a middleware used to integrate enterprise applications by providing a message-based communication platform.

**CEP:** Complex event processing is a concept to identify meaningful events and event patterns according to specified rules as well as assigning a suitable reaction to the event.

**BAM:** Business Activity Monitoring is a technology used to monitor and observe business processes to provide a fast and efficient reaction to incoming events.

# Chapter 96
# Speeding up the Internet:
## Exploiting Historical User Request Patterns for Web Caching

**Chetan Kumar**
*California State University San Marcos, USA*

## INTRODUCTION

The Internet has witnessed a tremendous growth in the amount of available information, and this trend of increasing traffic is likely to continue. According to a Cisco Systems forecast report (2008) the growth in Internet traffic is to be driven by Web 2.0 technologies such as video and social networking and collaboration. Some excerpts of the Cisco forecast report (2008) are as follows.

- "Global Internet Protocol (IP) traffic will increase by a factor of six from 2007 to 2012, reaching 44 exabytes per month in 2012, compared to fewer than 7 exabytes per month in 2007.
- Total IP traffic for 2012 will amount to more than half a zettabyte (or 522 exabytes). A zettabyte is a trillion gigabytes.
- Monthly global IP traffic in December 2012 will be 11 exabytes higher than in December 2011, a single-year increase that will exceed the amount by which traffic increased in the eight years since 2000" (Cisco forecast report 2008).

Despite technological advances this traffic increase can lead to significant user delays in web access (Datta et al. 2003, Mookherjee and Tan 2002, Watson et al. 1999). Web caching is one approach to reduce such delays. Caching involves temporary storage of web object copies at locations that are relatively close to the end user. As a result user requests can be served faster than if they were served

DOI: 10.4018/978-1-61520-611-7.ch096

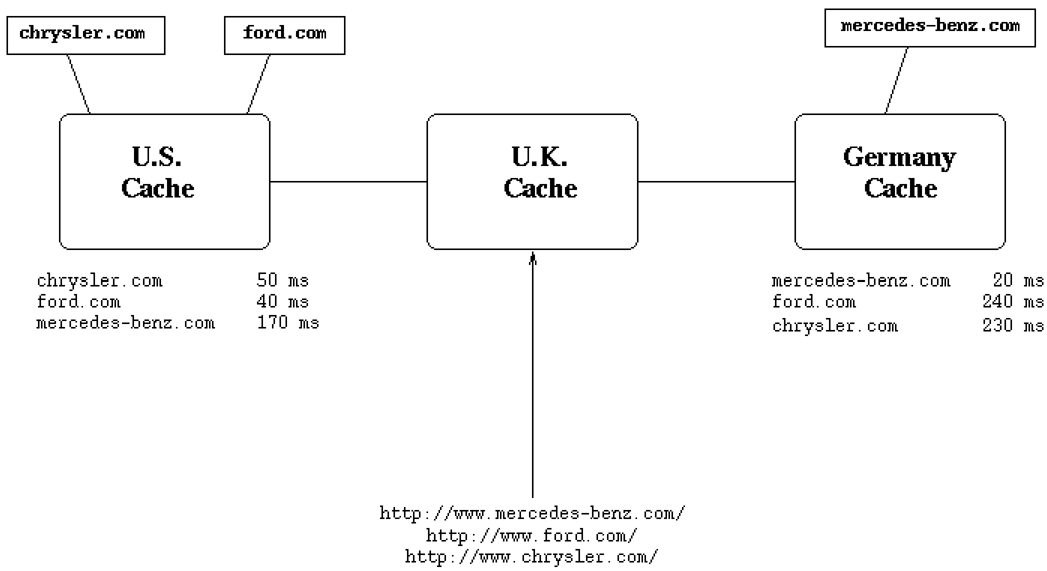
directly from the origin web server (Hosanagar and Tan 2004, Davison 2007).

Caching can be performed at different levels in a computer network. Proxy caches are situated at computer network access points for web users (Davison 2007). Other locations where caching may be performed include browser and web-server levels (Davison 2001, Kumar and Norris 2008). Proxy caches can store copies of web objects and directly serve requests for them in the network, consequently avoiding repeated requests to origin web servers. As a result there is reduced network traffic, load on web servers, and average delays experienced by web users (Cao and Irani 1997, Datta et al. 2003). Kumar (2009) illustrate the benefit of a network of proxy caches using an example of the IRCache network (www.ircache.net). Figure 1 shows how a network of proxy caches with nodes at three locations can reduce user delays. If the U.K. node has requests for web pages chrysler.com, ford.com, and mercedes-benz.com, that it has not cached, then these requests can be satisfied from the U.S. and Germany nodes. Therefore the U.K. node need not go to the origin web server to satisfy requests for objects it does not hold itself but are held by neighbor caches. Since origin server requests typically have the longest waiting times, by reducing them proxy caches can significantly reduce network delays (Kumar 2009). Proxy caching is widely used by computer network administrators and technology providers (Davison 2007). Examples include proxy caching solution providers such as Oracle (www.oracle.com/technology/products/ias/web_cache/index.html), content delivery network (CDN) firms such as Akamai (www.akamai.com), and Internet service providers (ISP) such as AT&T (www.att.com). The following are two illustrations, adapted from Davison (2007), of how some firms may practically benefit from caching. In one case a company such as Intel may employ a proxy cache near its network gateway to serve its many users (e.g., clients within Intel) with cached objects from many servers. As a result Intel reduces the bandwidth required over expensive dedicated Internet connections. In another scenario a content provider such as Yahoo can place a proxy cache directly in front of a particular server to reduce the number of requests that the server must handle. This service to speed up content delivery, also called reverse caching as a proxy node may cache objects for many clients but from usually only one server, is professionally provided by CDN firms such as Akamai. In both scenarios access delays are reduced thereby benefitting all Internet users (Davison 2007). Of course in choosing caching solutions, as in any IT investment decision, firms have to evaluate costs of an implementation versus its benefit, before deciding on the appropriate caching service. In this article we discuss some proxy caching approaches that exploit historical user request patterns to reduce user request delays (Kumar and Norris 2008, Zeng et al. 2004).

## RELATED LITERATURE AND BACKGROUND

There is a growing interest in caching due to its application in reducing user delays while accessing the increasingly congested Internet (Datta et al. 2003, Davison 2007). Podlipnig and Boszormenyi (2003), Zeng et al. (2004), and Datta et al. (2003), provide an extensive survey of numerous caching techniques. These include popular cache replacement strategies such as least recently used (LRU), where the least recently requested object is evicted from the cache to make space for a new one, and their many extensions. While most caching studies focus on improving performance on measures such as user latency and bandwidth reduction, there have been relatively few studies that consider a data or model driven approach for managing caches. Cockburn and Mckenzie (2002) and Tauscher and Greenberg (1997) study client–side behavior on the Internet. They note that the

*Figure 1. A proxy cache network (source: www.ircache.net)*




probability of users revisiting websites is very high. Cao and Irani (1997), Rizzo and Vicisano (2000), and Lorenzetti et al. (1996), have shown repeating 24 hour re-access patterns for web users. But they do not consider dynamic documents such as website front pages that often change contents. Zeng et al. (2004) describe some caching methods that attempt to predict past object requests, such as Top-10 algorithm that compiles a list of most popular websites. Along these lines, Kumar and Norris (2008) propose a new proxy-level caching mechanism that consists of a quasi-static portion that exploits historical request patterns, as well as a dynamic portion that handles deviations from normal usage patterns. The proposed caching mechanism of Kumar and Norris (2008) is shown to perform favorably versus other popular mechanisms such as LRU. Therefore caching approaches that exploit historical user request patterns can be used by computer network administrators and online content providers to significantly reduce delays experienced by web users at proxy server levels.

## USING HISTORICAL REQUESTS PATTERNS FOR WEB CACHING

Previous studies have demonstrated at the proxy level users typically re-access documents on a daily basis, and demand for a document spikes in multiples of 24 hours (Cao and Irani 1997, Rizzo and Vicisano 2000, Lorenzetti et al. 1996). However they primarily consider static documents that are unaltered in content and size. Kumar and Norris (2008) propose a new proxy-level caching mechanism that considers aggregate patterns observed in user object requests. This is along the lines of other interesting proxy caching approaches surveyed by Zeng et al. (2004) which use some aspects of historical user request patterns. In their caching approach Kumar and Norris (2008) aim to exploit repeating access patterns for web documents whose contents may change over time, but whose URL address remains the same. Instances of these types of web content include the front pages of many sites (e.g., www.yahoo.com, www.att.com, www.msn.com, www.google.com, etc.) which may vary the specific content of their sites, but retain the same home page URL. Therefore

*Table 1. Top 10 requested sites at IRCache network*

| Top 10 requested sites for days 1 through 30 | Top 10 requested sites for day 31 |
|---|---|
| yahoo.com | friendster.com |
| friendster.com | yahoo.com |
| microsoft.com | icq.com |
| water.com | microsoft.com |
| icq.com | msn.com |
| animespy.com | water.com |
| atwola.com | animespy.com |
| msn.com | 17tahun.com |
| google.com | adbureau.net |
| phpwebhosting.com | google.com |

even if the website front page contents change, as long as aggregate user patterns for accessing the site at a particular time of day are identified, then the latest contents of the front page can be downloaded prior to the surge in user requests. In addition a dynamic portion in the integrated caching mechanism can handle deviations from past requests. If object requests deviate from historical patterns then a portion of the cache employs a variation of LRU policy, thereby ensuring the integrated mechanism performs no worse than LRU. An indication of validity of using historical request patterns to predict object requests is shown by analyzing IRCache proxy trace data by Kumar and Norris (2008). Table 1 demonstrates that the top 10 most requested sites in a 30 day period is similar to those requested on following day 31. These similarities can be exploited for every time interval in the day, while also allowing the caching mechanism to accommodate deviations from historical patterns. The performance of the proposed caching mechanism is evaluated versus LRU policy using a comprehensive IRCache network proxy trace dataset. The parametric test results indicate that the integrated mechanism of Kumar and Norris (2008) outperforms the popular LRU policy by more than 50% in terms of total costs.

## CONCLUSION

An effective proxy caching mechanism has many benefits for all Internet users, including reduced network traffic, load on web servers, and web user delays (Cao and Irani 1997, Datta et al. 2003, Davison 2007). These benefits can be readily apparent to an end user. A cached website may seem to load instantaneously compared to several seconds delay in case of some origin server requests. Users appreciate and tend to revisit fast loading websites. Internet companies can also conserve investing resources in server farms for replicating web content to enhance load speeds (Davison 2007). Therefore proxy caching is beneficial for both the specific network where it is used as well as for all Internet users in general. Given the test results of Kumar and Norris (2008), as well as the merits of other caching approaches surveyed in Zeng et al. (2004), we believe that effective proxy caching mechanisms that exploit historical request patterns can significantly reduce delays for web users if they were to be deployed in large scale networks.

## ACKNOWLEDGMENT

This article includes a review of the discussion of Kumar, C. and Norris, J.B. (2008). A New Approach for a Proxy-Level Web Caching Mechanism. *Decision Support Systems*, *46*, 52-60; among other sources. Interested readers are referred to Kumar and Norris (2008) and Zeng et al. (2004) for a detailed discussion and performance evaluation of proposed proxy web caching mechanisms that exploit historical user request patterns.

## REFERENCES

Cao, C., & Irani, S. (1997). Cost-Aware WWW Proxy Caching Algorithms. In *Proceedings of the Usenix Symposium on Internet Technologies and Systems*.

*Cisco Visual Networking Index forecast report.* (2008). Retrieved from http://www.cisco.com/en/US/netsol/ns827/networking_solutions_sub_solution.html#

Cockburn A. & McKenzie, B. (2002). Pushing Back: Evaluating a New Behaviour for the Back and Forward Buttons in Web Browsers. *International Journal of Human-Computer Studies*.

Datta, A., Dutta, K., Thomas, H., & VanderMeer, D. (2003). World Wide Wait: A Study of Internet Scalability and Cache-Based Approaches to Alleviate It. *Management Science*, *49*(10), 1425–1444. doi:10.1287/mnsc.49.10.1425.17312

Davison, B. D. (2001). A Web Caching Primer. *IEEE Internet Computing*, *5*(4), 38–45. doi:10.1109/4236.939449

Davison, B. D. (2007). *Web Caching and Content Delivery Resources*. Retrieved from http://www.web-caching.com

Hosanagar, K., & Tan, Y. (2004). Optimal Duplication in Cooperative Web Caching. In *Proceedings of the 13th Workshop on Information Technology and Systems*.

Kumar, C. (2009). Performance Evaluation for Implementations of a Network of Proxy Caches. *Decision Support Systems*, *46*, 492–500. doi:10.1016/j.dss.2008.09.002

Kumar, C., & Norris, J. B. (2008). A New Approach for a Proxy-Level Web Caching Mechanism. *Decision Support Systems*, *46*, 52–60. doi:10.1016/j.dss.2008.05.001

Lorenzetti, P., Rizzo, L., & Vicisano, L. (1996). *Replacement Policies for a Proxy Cache*. Retrieved from http://info.iet.unipi.it/~luigi/research.html

Mookherjee, V. S., & Tan, Y. (2002). Analysis of a Least Recently Used Cache Management Policy for Web Browsers. *Operations Research*, *50*(2), 345–357. doi:10.1287/opre.50.2.345.430

Podlipnig, S., & Boszormenyi, L. (2003). A Survey of Web Cache Replacement Strategies. *ACM Computing Surveys*, *35*(4), 374–398. doi:10.1145/954339.954341

Rizzo, L., & Vicisano, L. (2000). Replacement Policies for a Proxy Cache. *IEEE/ACM Transactions on Networking, 8*(2), 158–170.

Tauscher L. & Greenberg, S. (1997). How People Revisit Web Pages: Empirical Findings and Implications for the Design of History Systems. *International Journal of Human Computer Studies, Special issue on World Wide Web Usability, 47*, 97–138.

Watson, E. F., Shi, Y., & Chen, Y. (1999). A user-access model-driven approach to proxy cache performance analysis. *Decision Support Systems*, *25*, 309–338. doi:10.1016/S0167-9236(99)00017-2

Zeng, D., Wang, F., & Liu, M. (2004). Efficient Web Content Delivery Using Proxy Caching Techniques. *IEEE Transactions on Systems, Man and Cybernetics. Part C, Applications and Reviews*, *34*(3), 270–280. doi:10.1109/TSMCC.2004.829261

## KEY TERMS AND DEFINITIONS

**Web Caching:** This involves temporary storage of web object copies at locations that are relatively close to the end user. Consequently user requests can be served faster than if they were served directly from the origin web server.

**Proxy Caches:** These caches are located at computer network access points for web users. Proxy caches can store copies of web objects and directly serve requests for them in the network. Therefore they reduce user delays by avoiding repeated requests to origin web servers.

**Origin Web Server:** The server where web content originates. User requests that are satisfied by the origin server typically have the longest waiting times.

**Historical User Request Patterns:** These are user web object request patterns that have previously been observed. For example, at proxy level users typically re-access documents on a daily basis, and demand for a document spikes in multiples of 24 hours.

**Web 2.0 Technologies:** Web traffic that primarily consists of user generated content such as video and social networking and collaboration.

**Static Documents:** Those web documents that are unaltered in content and size.

**Dynamic Documents:** Web documents such as website front pages that often change contents.

**Least Recently Used (LRU) Caching Policy:** LRU is a popular cache replacement strategy where the least recently requested object is evicted from the cache to make space for a new one.

# Chapter 97
# The Effect of User Location and Time of Access on Ecommerce:
## A Long Tail Study of Website Requests

**Chetan Kumar**
*California State University San Marcos, USA*

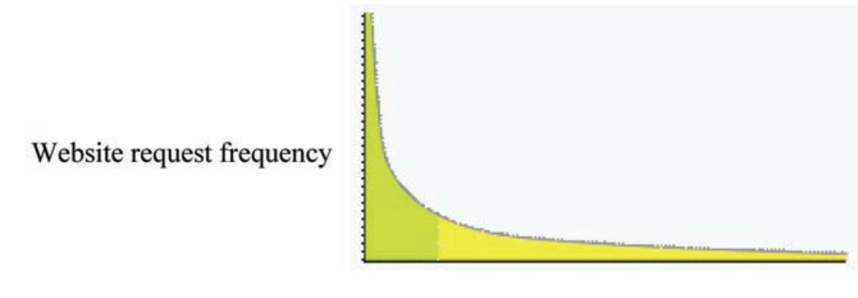
## INTRODUCTION

The amount and range of information on the Internet is growing at a rapid pace. Cisco systems report (2008) expects Internet traffic growth to be spurred by video, social networking and collaboration applications collectively referred to as Web 2.0 technologies. The Cisco systems report (2008) forecasts that "global Internet Protocol (IP) traffic will increase by a factor of six from 2007 to 2012, reaching 44 exabytes per month in 2012, compared to fewer than 7 exabytes per month in 2007." ComScore report (2009) estimates that the total global Internet audience has surpassed 1 billion visitors in December 2008. Magid Abraham, CEO of ComScore Inc., says "Surpassing one billion global users is a significant landmark in the history of the Internet. It is a monument to the increasingly unified global community in which we live and reminds us that the world truly is becoming more flat. The second billion will be online before we know it, and the third billion will arrive even faster than that, until we have a truly global network of interconnected people and ideas that transcend borders and cultural boundaries." The increase in Internet traffic is aided because making information available online is becoming relatively inexpensive, and as more people have Internet access demand for information increases. The trend of increasing Internet traffic is likely to continue (Datta et al. 2003, Cisco systems report 2008).

Visitation of users to websites can be represented by a long tail model, a term coined by Chris Anderson (2006), shown in Figure 1 (Kumar, Norris and

DOI: 10.4018/978-1-61520-611-7.ch097

*Figure 1. Long tail model (adapted from: http://en.wikipedia.org/wiki/The_Long_Tail)*




Sun 2009). Anderson (2006) drew inferences from an earlier study of Brynjolfsson et al. (2003) that had noted this effect in the digital economy due to reduced search costs. There are a few popular websites with a very high number of visitations, and these form the steep end of the curve. There are a large number of rarely requested websites that form the tapering long tail. This pattern of website visitation has been empirically demonstrated by a number of prior studies (Breslau et al. 1999, Kumar, Norris and Sun 2007). In this article we discuss how user location and time of access affect website visitations, and some resulting implications for Ecommerce (Kumar, Norris and Sun 2009, Anderson 2006).

## RELATED LITERATURE AND DISCUSSION

Prior to Internet era economic scale in most businesses favored goods and services that were targeted towards large customer bases. For instance, books catering to large audiences are more likely to be published than those aimed at niche markets (Anderson 2006). However the inexpensive online medium reduced entry barriers and intermediaries for niche players. Websites targeted to niche audiences can potentially exist because of: (a) relatively inexpensive hosting costs for the information service provider, and (b) efficient search engines such as Google that allow users to find all sorts of information on the Internet. These factors contribute towards the presence of the long tail of infrequently requested websites. Kumar, Norris and Sun (2009) investigate this phenomenon by using real world data and show how users' location and time of access (weekdays versus weekends) affects this long tail model. Their results can be used to improve online marketing strategies, affiliate advertising models, and Internet caching algorithms. The Interactive Advertising Bureau reports that in 2007 Internet ad revenues totaled $21 billion, an increase of 25% over 2006. Despite this increase, since online advertising is still only 10% of all US ad spending it has considerable room to grow (Associated Press 2008). Therefore studies that aim to improve this area of Ecommerce can be useful for both business community and academic researchers.

Past studies have examined client–side study of human behavior in the context of the Internet. Kehoe and Pitkow (1996) evaluate how demographic attributes of Internet users affect their browsing behavior. Hu et al. (2007) propose a model to predict users' gender and age from their web browsing behavior. Studies have also shown that the probability of user revisitation to a website is very high, and that many users only use one or two search engines most of the time (Cockburn and Mckenzie 2002, Tauscher and Greenberg 1997, Deborah 2005). In his influential study Zipf (1949) first identified the distribution that relates object request frequency to its rank. Building on these results Breslau et al. (1999), among others, modeled online visitations using Zipf distribution (1949). Kumar, Norris and Sun (2009) study goes beyond previous online visitation studies by examining differences in user browsing behavior due to varying geographical locations and time of access. There are several factors that motivate the study. Users in different geographical areas may have different demographic profiles. For instance, in some regions in the United States (US) the local population has greater percentages of immigrant residents or high skilled workers. In these regions residents tend to have more diversified interests and the differences may exhibit in diversified online visitations. We also expect that the user's time of access has an effect on diversity of website requests. For example, users may exhibit varying browsing behavior on weekdays compared to weekends.

## EFFECT OF USER LOCATION AND TIME OF ACCESS ON WEBSITE REQUESTS

Knowledge on identified patterns in user website request behavior can help business managers design better marketing strategies to allocate online advertising budgets. This may also improve customizing online ads or affiliate marketing models for Internet portals such as Google, Yahoo and others. There is increased interest, among both business community and academic researchers, on online marketing and content customization based on users' preferences and their demographic attributes. Brynjolfsson et al. (2007) contrast Internet buying habits to offline catalog purchases, and Baye et al. (2007) develop a model for pricing products and advertisements online. Customizing content to users has been identified to be an important area for improvement in Internet advertising. Studies have shown benefit of contextual marketing in Ecommerce, customizing online advertising according to user profile, and how usability of website improves online purchase rate (Luo and Seyedian 2003, Bhatnagar and Papatla 2001, Venkatesh and Agarwal 2006). Building on these studies, Kumar, Norris and Sun (2009) conduct an empirical investigation on the long tail characteristics of website requests at different proxy server locations and user access times. This expands on an earlier study of Kumar, Norris and Sun (2007) that specifically considers the effect of user location on website request heterogeneity. They use web trace data from the IRCache network that maintains proxy servers at nine cities in the US (www.ircache.net). The examined data was collected from 29 April to 30 June, 2004, it has 926,552 total website requests, and it includes both the URLs and time of requests, among other attributes. Their statistical tests confirm the following three hypotheses. First there exists a long tail of infrequently requested websites in addition to few very popular ones as shown by earlier studies. Going beyond, the second and third hypotheses then confirm that both server location and time of access indeed have a significant effect on diversity of website requests. These results can partially be explained by differences in demographic profiles at locations and diverse browsing behavior between weekdays and weekends. An example of demographic differences is discussed in the study using data from US Census Bureau (2007), shown in Table 1. Silicon Valley has a greater percentage of foreign born persons and languages other than English spoken at home versus Urbana-Champaign. An examination of website request patterns shows that there is a larger proportion of infrequently requested websites, or a longer tail, at Silicon Valley compared to Urbana-Champaign. The authors' reason one factor that may partially explain differences in website requests diversity between the two locations is due to differing proportion of immigrants and non English speakers. Similarly at all locations there is greater diversity of website requests in weekends versus weekdays. The authors reason this may be attributed to more available free time

*Table 1. Demographic profile for Santa Clara, CA and Urbana-Champaign, IL locations*

| Server Locations (counties where servers are located) | Foreign born persons, percent, 2000 | Language other than English spoken at home, percent age 5+, 2000 |
|---|---|---|
| Silicon Valley (Santa Clara) | 34.1% | 45.4% |
| Urbana-Champaign (Champaign) | 8.0% | 11.8% |

during weekends that allows users to search for more diverse information sources. These results can be used to design better online marketing strategies, affiliate advertising models, and Internet caching algorithms. For example, online portals may target and price affiliate advertising more effectively depending on the diversity of website requests at different locations and time of access. As an illustration, an Internet portal website such as Yahoo may choose to advertise obscure products more in heterogeneous regions while focusing on mainstream product in more homogeneous regions. The same is true for choosing products for promotion online depending on diversity of requests at different times of access such as weekdays or weekends. The pay-per-click advertising model at search engine firms such as Google may similarly be adjusted to accommodate that some locations have greater affinity for niche websites than others. In addition Internet caching algorithms may improve performance in reducing user access delays by considering specific location and time of access object request patterns. As an example, for website locations and time periods with greater diversity of website requests we assign closer to equal priorities for caching different objects. With lesser requests diversity we assign greater priorities to more popular objects. This can improve current LRU based caching mechanisms that do not consider server locations and time of access differences (Kumar 2009).

## CONCLUSION

Internet based marketing, advertising, and content delivery is becoming increasingly important for businesses and institutions. Internet traffic growth is expected continue at a rapid pace (Datta et al. 2003, Cisco systems report 2008). As mentioned earlier, since total Internet advertising revenues is still only 10% of all US ad spending, it has considerable growth potential (Associated Press 2008). There is also increased interest on online marketing and content customization based on users' preferences and their demographic attributes. Given these trends, studies that aim to improve this area of Ecommerce can be useful for both business community and academic researchers (Anderson 2006, Brynjolfsson et al. 2007, Bhatnagar and Papatla 2001, Kumar, Norris and Sun 2009, Hu et al. 2007). Therefore studies that characterize and exploit user Internet browsing behavior contribute to an important area for research on Ecommerce.

## ACKNOWLEDGMENT

This chapter includes a review of the discussion of Kumar, C., Norris, J.B., and Sun, Y. (2009). Location and Time Do Matter: A Long Tail Study Of Website Requests. *Decision Support Systems, 47*, 500-507; among other sources. Interested readers are referred to Kumar, Norris and Sun (2009) and Anderson (2006) for a detailed discussion of long tail model and its Ecommerce applications based on user website request patterns.

## REFERENCES

Anderson, C. (2006). *The Long Tail: Why the Future of Business is Selling Less of More*. New York: Hyperion.

Associated Press. (February 25, 2008). *Internet ad revenue exceeds $21B in 2007*. Retrieved April 20, 2008 from http://www.usatoday.com/money/advertising/2008-02-25-online-ad-revenue_N.htm

Baye, M. R., Rupert, J., Gatti, J., Kattuman, P., & Morgan, J. (2007). A Dashboard for Online Pricing. *California Management Review*, *50*(1), 202–216.

Bhatnagar, A., & Papatla, P. (2001). Identifying Locations for Targeted Advertising on the Internet. *International Journal of Electronic Commerce*, *5*(3), 23–44.

Breslau, L., Cao, P., Li, F., Phillips, G., & Shenker, S. (1999). Web caching and Zipf-like distributions: Evidence and Implications. In *Proceedings of the Eighteenth Annual Joint Conference of the IEEE Computer and Communications Societies INFOCOM*.

Brynjolfsson, E., Hu, Y. J., & Simester, D. (2007). *Goodbye Pareto Principle, Hello Long Tail: The Effect of Search Costs on the Concentration of Product Sales*. Retrieved from http://ssrn.com/abstract=953587

Brynjolfsson, E., Hu, Y. J., & Smith, M. (2003). Consumer Surplus in the Digital Economy: Estimating the Value of Increased Product Variety. *Management Science*, *49*, 1580–1596. doi:10.1287/mnsc.49.11.1580.20580

Catledge, L., & Pitkow, J. (1995). Characterizing Browsing Strategies in the World Wide Web. In Computer Systems and ISDN Systems. In *Proceedings of the Third International World Wide Web Conference,* Darmstadt, Germany, (pp. 1065–1073).

*Cisco Visual Networking Index forecast report*. (2008). Retrieved Jan 20, 2009 from http://www.cisco.com/en/US/netsol/ns827/networking_solutions_sub_solution.html#

Cockburn, A., & McKenzie, B., & JasonSmith, M. (2002). Pushing Back: Evaluating a New Bahaviour for the Back and Forward Buttons in Web Browsers. *International Journal of Human-Computer Studies*, *57*, 397–414. doi:10.1006/ijhc.2002.1025

Comscore Inc. report. (2009). *Global Internet Audience Surpasses 1 billion Visitors*.Retrieved Jan 23, 2009 from http://www.comscore.com/press/release.asp?press=2698

Datta, A., Dutta, K., Thomas, H., & VanderMeer, D. (2003). World Wide Wait: A Study of Internet Scalability and Cache-Based Approaches to Alleviate It. *Management Science*, *49*(10), 1425–1444. doi:10.1287/mnsc.49.10.1425.17312

Deborah, F. (2005). *Search Engine Users: Internet searchers are confident, satisfied and trusting – but they are also unaware and naïve*. Retrieved from http://www.pewinternet.org/pdfs/PIP_Searchengine_users.pdf Hu, J., Zeng, H., Li, H., Niu, C., & Chen, Z. (2007). Demographic prediction based on user's browsing behavior. In *Proceedings of the 16th International conference on World Wide Web*, Banff, Alberta, Canada.

Kehoe, C., & Pitkow, J. (1996). Surveying the Territory: GVU's Five WWW User Surveys. *The World Wide Web Journal*, *1*, 77–84.

Kumar, C. (2009). Performance Evaluation for Implementations of a Network of Proxy Caches. *Decision Support Systems*, *46*, 492–500. doi:10.1016/j.dss.2008.09.002

Kumar, C., Norris, J. B., & Sun, Y. (2007). Location Does Matter: A Long Tail Study Of Website Requests. In *Proceedings of the Sixth International Workshop on e-Business (WEB)*.

Kumar, C., Norris, J. B., & Sun, Y. (2009). Location and Time Do Matter: A Long Tail Study Of Website Requests. *Decision Support Systems*, *47*, 500–507. doi:10.1016/j.dss.2009.04.015

Lorenz, M. O. (1905). Methods of Measuring the Concentration of Wealth. *Publications of the American Statistical Association*, *9*(70), 209–219. doi:10.2307/2276207

Luo, X., & Seyedian, M.(2003–4, Winter). Contextual Marketing and Customer-Orientation Strategy for E-Commerce: An Empirical Analysis. *International Journal of Electronic Commerce*, *8*(2), 95–118.

Podlipnig, S., & Boszormenyi, L. (2003). A Survey of Web Cache Replacement Strategies. *ACM Computing Surveys*, *35*(4), 374–398. doi:10.1145/954339.954341

Tauscher, L. & Greenberg, S. (1997). How People Revisit Web Pages: Empirical Findings and Implications for the Design of History Systems. *International Journal of Human Computer Studies, Special issue on World Wide Web Usability, 47*, 97–138.

U.S. Census Bureau. (2007). *State and County facts*. Retrieved from http://quickfacts.census.gov/qfd/

Venkatesh, V., & Agarwal, R. (2006). Turning Visitors into Customers: A Usability-Centric Perspective on Purchase Behavior in Electronic Channels. *Management Science*, *52*(3), 367–382. doi:10.1287/mnsc.1050.0442

Zipf, G. K. (1949). *Human Behavior and the Principle of Least Effort*. Cambridge, MA: Addison-Wesley.

## KEY TERMS AND DEFINITIONS

**Website Visitations:** Different websites requested by end users.

**Long Tail:** Model used to characterize pattern of few very popular websites and a large number of infrequently requested websites.

**Web 2.0 Technologies:** Web traffic that primarily consists of user generated content such as video and social networking and collaboration.

**Website Request Frequency:** Number of times a website is requested.

**Website Rank:** Websites ranked in order of its popularity. A more frequently requested website is ranked higher than a less frequently requested one.

**User Location:** Geographical area where a web user is located.

**Time Of Access:** The time at which a user accesses different websites.

**Diversified Online Visitations:** Differences in user website request patterns due to factors such as user location and time of access.

**Content Customization:** Customizing online content according to user's preferences and demographic profiles.

**Online Marketing:** Marketing strategies related to the Internet based medium.

**Internet Caching:** Reducing user delays on the Internet by storing copies of web objects at locations that are relatively close to the end user.

# Chapter 98
# Incorporating Knowledge Management into E-Commerce Applications

**Sandra Moffett**
*University of Ulster, UK*

**Martin Doherty**
*University of Ulster, UK*

**Rodney McAdam**
*University of Ulster, UK*

## INTRODUCTION

Knowledge Management (KM) is the process of critically managing knowledge to meet existing needs, identify and exploit existing and acquired knowledge assets and develop new opportunities (Quintas et al, 1997). With the emergence of knowledge-intensive industries, where organisations rely on knowledge of their staff for competitive advantage (Lustri et al., 2007), KM has become key for business success (Mu-jung et al., 2007). KM is now an integral business function (Zhou and Fink, 2003) in both traditional and internet-based businesses (Borges Tiago et al., 2007) to the extent that KM is now viewed essential for profit (Yang, 2008). It is widely acknowledged today that new technologies, in particular access to the Internet, tend to modify communication between stakeholders in the business world, such as relationships between the organisation and its clients, the internal functioning of the organisation, including enterprise-employee relationships and the relationship of the organisation with partners and suppliers. This integration to improve the functioning of the organisation to create value for all parties involved is referred to as Electronic Commerce (e-commerce, EC) (Turban et al, 2006).

The main challenges facing organisational change and development are threefold. Firstly, knowledge discovery, secondly, corporate collaboration and thirdly, rapid decision making (Curley, 1998). Under the KM umbrella, EC can embrace this challenge, facilitating content creation, development, refinement and delivery, collaborative work

DOI: 10.4018/978-1-61520-611-7.ch098

practice within and external to the organisation and business/market/customer intelligence.

This chapter will review how each of the three challenges identified can be incorporated into EC applications. As the internet is now the largest information resource globally many opportunities have been provided changing the way people shop, perform business dealings and communicate with each other. Taking into consideration four perspectives of EC, the chapter will present tools and techniques which should be incorporated into a fully functioning web commerce application.

## BACKGROUND

Much confusion exists around the practical implementation of knowledge-orientated programmes, this is especially true from a technological viewpoint. KM seeks to develop a strategy for the capture, use and transfer of knowledge across the organisation, to improve efficiency and increase competitive edge (Demerest, 1997). KM is concerned with embracing a diversity of knowledge sources, cultivating knowledge wherever it resides. Technology can be viewed as both a key contributor and enabler to the field of KM (Davenport and Prusak, 1998). This perspective is related to technological ability in capturing data, information, and knowledge that surpasses human capacity in absorbing and analysing these, in a focused manner (Shenk, 1997). As technological developments become more advanced in application and utilisation, it is emerging those employees who have access to technologies that detect and manage business opportunities, will have the distinct advantage of exploiting market shifts.

While KM technologies may incorporate characteristics of traditional data and information technologies, they also extend these capabilities. Knowledge technologies attempt to push users to think beyond their current boundaries, thus facilitating organisational activity, promoting continuous improvement and growth through innovation. In today's knowledge-intensive organisations the primary objective of ICT is to lead users to the information they need. This includes creating, gathering, storing, accessing and making available the right information that will result in insight for the organisations' users (Davenport and Prusak, 1998). Thus, the pervasive use of information technology in organisations, qualifies it as a natural medium for information flow (Borghoff and Pareschi, 1999).

A study conducted by Moffett et al, (2002) outlined that 43% of UK companies currently implementing KM are adopting a technology focused approach. Further analysis of this group uncovered a number of key issues regarding technological adoption for KM. Firstly, KM systems should be well maintained, user-focused systems dedicated to communication and information flow within the organisation. A variety of technological tools should be used for knowledge work; these tools support function classifications as outlined by Moffett and McAdam, (2003). Secondly, dedicated roles must be established to promote technological use within the organisation. Employees at all levels should be encouraged to use KM systems for efficient and effective decision making. Reward and recognition must be awarded for their efforts. Thirdly, training must be provided to encourage full organisation of the tools installed. Fourthly, emphasis should be placed on Web-based systems encouraging use to full potential. While many organisations are comfortable to use the World Wide Web (WWW) for information gathering, most are apprehensive to employing the Internet as an electronic commerce device. Even though they comprehend that a well designed, organisation-wide, fully implemented technical infrastructure for KM can improve information processing capabilities they are unsure how to adopt Web technologies to achieve this.

## TYPES OF E-COMMERCE

E-commerce (EC) can be defined according to business perspective (and processes), service attributes, features (such as online provisions) and customer classifications (Rayport and Jaworski, 2003). EC attributes focus on the exchange of digitized information between parties in either technology-enabled or technology-mediated ways and intra and interorganisational activities that support marketplace exchanges (Laudon and Traver, 2003). EC can be classified according to its features, namely, ubiquity, global search, universal standards, richness, interactivity, information density and personalization/customization (Evans and Wurster, 2002). There are many different types of EC. The four most common are Business to customer (B2C), Business to business (B2B), Customer to Customer (C2C) and Peer to Peer (P2P) (Turban et al, 2006). Each type has unique selling points, however all tend to take advantage of the extensive marketspace, reduction in establishment and running costs, utlisation of emerging technologies and secure electronic payment systems.

EC is underpinned by the concepts of KM where the purpose of a KM project is to identify, capitalise on and value the intellectual assets of an organisation by involving the entire staff using collaborative practices. The sharing of tacit and explicit knowledge can lead to better decision making, faster time to market, cost effective and efficient workflow and enhanced service to clients/customers (Davenport and Prusak, 1998). Ensuring that information is presented in the required format to enable effective knowledge sharing is the focus of Content Management. Providing up-to-date, accurate information can greatly enhance everyday operations within an organisation. In addition, technologies that capture and share information on customers, such as Customer Relationship Management (CRM or E-CRM) systems, enable organisations to better know their clientele and gain their loyalty using pertinent information to better gage and respond to customer wants and needs, this is the focus of BI. An organisation that implements a KM strategy, using technologies to deliver information to users in a format they require (content management) so decisions can be made to increase market share (BI) will ultimately lead to competitive advantage and sustainability.

Figure 1 depicts how e-commerce within an organisation is supported by KM where EC systems support functions such as web design, procurement, payment, etc. to facilitate collaboration, business intelligence, content management and customer relation management.

The following sections further investigate the roles of content management, collaboration and BI under EC remit.

## CONTENT MANAGEMENT

When considering EC organisations should focus on capturing and transferring knowledge through the application of 'publication' rather than 'contribution' models. As information is better put to use when it is packaged and presented for a specific purpose, content management is concerned with effectively collecting, managing and presenting conglomerates of information formed as a cohesive whole through targeted publications. Content management systems organise and automate collection, administration and publishing processes when the information is too large or diverse to process manually. They are also beneficial when the design and content of the document needs to be manipulated separately or when more that one publication can be derived from a single base of content.

A key driver for content management is the switch to event-driven/needs based publishing strategies where technological content can be updated, published and disseminated instantly resulting in reduction of costs and time of content development, duplication, distribution and usage.

*Figure 1. KM and EC integration*


While the traditional publishing model contains seven steps from creation to implementation, the new publishing model, based on Internet technologies, consist of only two, creation of content and migration to the Internet environment (Telleen, 1997). This fast paced publishing environment is key for EC success. Some of the tools which make content management in EC viable include agents and filters (which reduces the 'push' information syndrome where information is sent to end users 'just-in-case' it may be required), e-publishing systems, document imaging and the semantic web.

By combining publishing capabilities with KM systems information is presented in a consistent format regardless of its source, author or location (Offsey, 1997). This richness of presentation delivers targeted, styled and branded content to all users, such as via an electronic publishing system. This type of system can be applied in EC to merge data supplied on differing platforms, for example merging product catalogues. Traditional paper based catalogues can be transferred to electronic form using document imaging through the use of scanners.

For knowledge to be shared effectively on the Internet there has to be some degree of computational manipulation of data displayed via Web pages. Traditionally, these pages have been developed using Hypertext Mark-up Language (HTML) however content provided in this way leads to serious problems in accessing and processing the vast display of information offered. Therefore, while HTML is suitable for the display of small, uncomplicated documents, the rush to make data available across the Web has demonstrated weakness in its structure, mostly in relation to poor metadata assertions and static data presentation (Duval et al, 2002). To overcome such difficulties the Semantic Web is emerging as a means of setting global standard protocols for extensive machine-readable information exchange. The aim of the Semantic Web is to standardise the Internet system via common language, tools and information publication based on existing Internet standards of Unique Resource Indicators (URIs), Unicode and Extensible Mark-up Language (XML), a tag-based language for describing tree-like structures with a linear syntax. By adding tags (annotation of digital resources with keywords; Golder and Huberman, 2006) individual users' characterisation of objects such as websites, emails, photos, video or any other piece of digital media is captured, this supports the search and retrieval of required information for other users.

The advantage of using standard formats is that different types of users can share the same information even if they use different platforms and software. This seamless integration of linked resources facilitates a 'one-stop shop' for data transactions, overcoming problems of merging and scalability. However, one must remember that the Semantic Web is currently under development and many challenges still exist for full implementation to be a reality, with few applications. Many potential users are reluctant to undertake transformation of Web resources to the new formats with the view of 'why publish when there is no-one to link to'.

Another issue with current development is the inability to merge data sources. While it is relatively straightforward to run another persons' program locally via the Internet (after one has overcome security measures and firewall protection), the same does not apply to bringing information directly from another sources' application to merge with your own. Although XML is emerging as the 'core' Semantic Web language, upon which all other developments rest, there is still a long way to go before new Web applications are created in this base level standard and all current Web material has been transformed. Once this has been achieved languages for defining structure can be added. The use of ontologies will enable better expressive automated protocols, hence facilitating advanced web services such as accurate web search, intelligent software agents, decision support systems and ubiquitous computing.

## COLLABORATION

Collaborative technology can improve parallel processing, productivity, coordination and adaptiveness ICASIT, (2002). Social-software systems facilitate communication, collaboration and interaction between people in large communities (Kolbitsch and Maurer, 2006). This is achieved by supporting self-organising processes where individual and collective knowledge are merged and can be viewed in the form of digital artefacts such as chat logfiles, wiki articles, weblog entries or archived digital communications. As in the case of the Semantic Web these virtual social network systems rely heavily on the process of tagging, 'social tagging' refers to the social context where all members of the group can benefit from the tag classifications. The artefacts are tagged by individual users, then collectively aggregated to create a set of metadata for that particular item. The accumulated collection of tags represents the community view of the artefact. Thus the social tagging compilation, developed from a bottom-up, user-orientation approach, creates metadata which aids search facilities for the group. In addition, objects may be categorised in several dimensions, which makes it easier to retrieve them than in strict taxonomic hierarchies (Weinberger, 2007).

Social tagging also creates an indirect rating of resources by a community, the more the item has been tagged, the higher it is ranked. Tags linked to an artefact by an individual are displayed in a 'tag cloud', an alphabetical listing of all tag associations that are weighted by frequency of use. More frequently used tags can be applied as hyperlinks for linked to other resources related to the tag. Users can obtain new information from varied sources by simply browsing the hyperspace via tags. In addition, infoglut can be reduced as tags filter and structure information, facilitating the retrieval of relevant information in a more systematic process.

Social tagging is useful for EC as goods and service promotions can be targeted to collective user groups. If several members of the virtual network have visited a particular website, or purchased a particular item online, links can be made to the vendor site using social tagging mechanisms. This results in more like minded persons following the same hyperlinks via tags or finding the link via tag searches. Frequent use of the EC site leads to more effective social tagging, resulting in a recurring loop for site utilisation.

## BUSINESS INTELLIGENCE

Business intelligence (BI) refers to skills, technologies, applications and practices used to help an organisation acquire a better understanding of its commercial context. Business intelligence may also refer to the collected information itself. BI technologies provide historical, current, and predictive views of business operations. BI aims to support better business decision-making by equipping knowledge workers with information to quickly spot trends within business, financial and market data. Although, emphasis has been afforded to commercial data for some time, ensuring that it was adequately captured and stored, the application of high powered statistical and visualisation tools to commercial data, offers fast access and insight to vast quantities of data in summarised format. Tools within the BI stream include data warehousing, data and text mining, modeling and prediction tools, reporting and dashboards and business performance management.

Organisations typically contain two sets of data, namely, operational and informational. The essence of data warehousing is to provide an architectural model to control the flow of data from operational systems to decision support environments. By interrogating data warehouses using data mining application tools such as Intelligent Miner and Clementine, data patterns, classifications and associations can be determined, leading to optimisation of current organisation information assets and the formation of new relationships between customers, suppliers and internal processes.

EC encourages organisations to broaden their use of data warehousing and mining by utilising the five main functions of managerial decision-making, namely, model building, 'what-if' analysis, goal-seeking, risk analysis and graphical analysis on increasingly complex datasets (Offsey, 1997). Effective decision making can be reflected in EC workflow applications, such as a help-desks (technical support to customers through procedures for entering, tracking and resolving queries) and frequently asked questions (expertise and technical support to the user in a first-pass attempt to solve problems prior to human intervention, such as via Action Workflow Metro and Webflow application tools).

## FUTURE RESEARCH DIRECTIONS

Although the field of KM continues to grow and deepen (Davenport and Prusak 1998; Corso et al, 2003) many organisations have found that tensions exist between knowledge-orientated applications and the progression of organisational change, hindered by inadequate enabling technologies. Considering the large investment capital expended by many firms in KM systems (Curley, 1998) and the growing number of companies that see KM as potentially helping them survive and compete, there is a need for more definitive and comprehensive studies in this field. Employing a variety of research methodologies, future research is needed in areas such as cultural acceptance, process refinement, technological development and application.

## CONCLUSION

EC is now considered a product of KM, where organisations can build on underpinning concepts such as content management, collaborative practice and BI to deliver dynamic web applications. This chapter has presented a number of tools and techniques which should be incorporated when designing high quality EC applications.

## REFERENCES

Berners-Lee, T. Hendler, J. & Lassila, O. (2001), The Semantic Web: A new form of Web content that is meaningful to computers will unleash a revolution of new possibilities. *Scientific American.Com*. Retrieved from http://www.sciam.com

Borges Tiago, M. T., Couto, J. P., Vieira, J. C., & Tiago, F. (2007). Virtual CRM and E-business performance. In *proceedings of International Congress 'Marketing Trends'*, Paris. Retrieved from http://www.escp-eap.eu/conferences/marketing/2007_cp/HTML/pages/paper_lista.htm

Borghoff, U., & Pareschi, R. (1999). *Information Technology for Knowledge Management*. Retrieved from http://www.iicm.edu/jucs_3_8

Corso, M., Martini, A., Paolucci, E., & Pellegrini, L. (2003). Knowledge management configurations in Italian small-to-medium enterprises. *Integrated Manufacturing Systems*, *14*(1), 46–56. doi:10.1108/09576060310453344

Curley, K. (1998). The Role of Technology. *Knowledge Management: A Real Business Guide*. London: Caspian Publishing Ltd.

Davenport, T., & Prusak, L. (1998). *Working Knowledge - How Organisations Manage What They Know*. Boston: Harvard Business School Press.

Demerest, M. (1997). Understand Knowledge Management. *Journal of Long Range Planning*, *30*(3), 374–384. doi:10.1016/S0024-6301(97)90250-8

Duval, E., Hodgins, W., Sutton, S., & Weibel, S. L. (2002), Metadata Principles and Practicalities. *D-Lib Magazine, 8*(4). Retrieved from http://www.dlib.org/dlib/april02/weibel/04weibel.html

Evans, P., & Wurster, T. S. (1999). *Blown to Bits: How the New Economics of Information Transforms Strategy*. Cambridge, MA: Harvard Business School Press.

Golder, S., & Huberman, B. A. (2006). Usage patterns of collaborative tagging systems. *Journal of Information Science*, *32*(2), 198–208. doi:10.1177/0165551506062337

ICASIT. (2002). *KM Tools: Collaboration Tools and Articles*. Retrieved from http://www.icasit.org/km/tools/collabsite.htm

Kolbitsch, J., & Maurer, H. (2006). The Transformation of the Web: How Emerging Communities Shape the Information we Consume. *Journal of Universal Computer Science*, *12*(2), 187–213.

Laudon, K., & Traver, C. (2003). *E-Commerce: Business, Technology, Society,* (3rd Ed.). Upper Saddle River, NJ: Prentice Hall.

Lustri, D., Miura, I., & Takahashi, S. (2007). Knowledge management model: practical application for competency development. *The Learning Organization*, *14*(2), 186–202. doi:10.1108/09696470710727023

Malhotra, Y. (1998). TOOLS@WORK: Deciphering the Knowledge Management Hype. *Journal for Quality and Participation*, *21*(4), 58–60.

Moffett, S., & McAdam, R. (2003). Contributing and Enabling Technologies for knowledge management. *International Journal of Information Technology and Management*, *2*(1/2), 31–49. doi:10.1504/IJITM.2003.002447

Moffett, S., McAdam, R., & Parkinson, S. (2002). Developing a model for technology and cultural factors in Knowledge Management. *Journal of Knowledge and Process Management*, *9*(4), 237–255. doi:10.1002/kpm.152

Mu-Jung, H., Mu-Yen, C., & Kaili, Y. (2007). Comparing with your main competitor: the single most important task of knowledge management performance measurement. *Journal of Information Science*, *33*(4), 416–434.

Offsey, S. (1997). Knowledge Management: Linking People to Knowledge for Bottom Line Results. *Journal of Knowledge Management*, *1*(2), 113–122. doi:10.1108/EUM0000000004586

Quintas, P., Lefrere, P., & Jones, G. (1997). Knowledge management: a strategic agenda. *Journal of Long Range Planning*, *30*(3), 385–391. doi:10.1016/S0024-6301(97)90252-1

Rayport, J. F., & Jaworski, B. J. (2003). *Introduction to e-commerce*, (2nd ed., International ed.).

Shenk, D. (1997). *Data Smog*. New York: Harper and Collins.

Telleen, S. (1997). *Intranets as Knowledge Management Systems: basic concepts and definition.* Retrieved from http://www.iorg.com/papers/knowledge.htm

Turban, E. King, D. & Lang, J. (2006). *Introduction to Electronic Commerce*. Upper Saddle River, NJ: Prentice-Hall Inc.

Weinberger, D. (2007). *Everything is Miscellaneous: The Power of the New Digital Disorder*. Upper Saddle River, NJ: Henry Holt & Company Inc.

Yang, J. (2008). Managing knowledge for quality assurance: an empirical study. *International Journal of Quality & Reliability Management*, *25*(2), 109–124. doi:10.1108/02656710810846907

## ADDITIONAL READING

Bair, J. (1997). Knowledge Management: the era of shared ideas . *Forbes*, *160*(6), 28.

Fensel, D. (2004), Ontologies: A Silver Bullet for Knowledge Management and Electronic Commerce, Second Edition, Published by Springer-Verlag, Berlin

McCampbell, A. S., Clare, L. M., & Gitters, S. H. (1999). Knowledge Management: the new challenge for the 21st century . *Journal of Knowledge Management*, *3*(3). doi:10.1108/13673279910288572

Palmer, S. B. (2001), The Semantic Web: An Introduction, [online] http://infomesh.net/2001/swintro

## KEY TERMS AND DEFINITIONS

**Knowledge Management (KM):** The merging of human activity, process improvement and technological application for more efficient business practices.

**E-Commerce (Electronic-Commerce, EC):** Selling goods and services over the Internet.

**Collaboration:** Getting people to work together closer for more effective decision making and knowledge sharing.

**Content Management:** Organizing components and subject matter of an application so it meet the needs of users.

**Business Intelligence (BI):** Using organisation data and knowledge resources for better informed decision making to enhance customer relations.

**Tagging:** Labeling data to create a catalogue of descriptions.

**Semantic Web:** An extension of the current Internet where information and services are better defined to enable more efficient use in terms of content creation, sharing, searching and development.

# Chapter 99

# Application of Semantic Web Technology in E-Business:

## Case Studies in Public Domain Data Knowledge Representation

**Sotirios K. Goudos**
*Aristotle University of Thessaloniki, Greece*

**Vassilios Peristeras**
*National University of Ireland, Ireland*

**Konstantinos Tarabanis**
*University of Macedonia, Greece*

## INTRODUCTION

In the E-Business and particular in the eGovernment domain special focus is often given to the demand side, i.e. the everyday practice and reality of citizen and business contacts with government and businesses. Information services available online from public administration are the first stage for e-government. This stage has drawn a great amount of effort from many countries worldwide in order to satisfy the demand for readily available information. The implementation of an information system that will serve this demand is not always an easy task. This is due to the inherent difficulties that exist in the public administration domain. There are many complicated services with numerous executional paths, depending on the type of process. In many cases divergent and conflicting legislation may exist for the same case, which complicates the search effort for the average citizen. As a result, it may be difficult for a citizen to find, based on the relevant legislation the correct information regarding the formal documents and the procedure that must be followed for a certain service.

To solve this problem, the authors have chosen the semantic web technologies, and propose an infrastructure that could simplify the procedure. The main objective of this chapter is to present a

DOI: 10.4018/978-1-61520-611-7.ch099

flexible and scalable framework of an information system for such complex cases and to show the advantages of the semantic web technologies application to E-Business. Examples of two real cases in Greece are given. The first case that has attracted the authors' attention is the case of getting an operation license for any kind of an enterprise. The second case is that of finding the benefits entitled to a citizen based on his/her specific profile.

## BACKGROUND

Several information technologies exist for the creation of web-based E-Business applications. The use of Semantic Web (Berners-Lee, Hendler, & Lassila, 2001) and Semantic Web Services (Fensel, Bussler, & Maedche, 2002) technologies to enable the interoperability of systems and applications is gaining momentum worldwide.

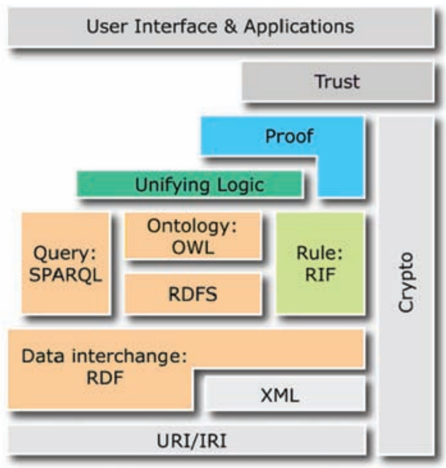
The state-of-the art technology in a web environment is adding semantic meaning to web recourses. Currently these resources are usually only human understandable: the mark-up (HTML) only provides information for textual and graphical information intended for human consumption. Semantic Web aims for machine understandable information that can be processed and shared by both computers and humans. Tim Berners-Lee (2001) provides the definition of the Semantic Web as "an extension of the current one [Web], in which information is given well-defined meaning, better enabling computers and people to work in cooperation."

An E-Business information system can be implemented in several different ways. For example a set of business rules could be modeled using simple if – then rules in any programming language. Process modeling using a workflow system is also an option. Relational databases using SQL queries could also be selected for the implementation. The semantic technology is not a competitor of the above-mentioned technologies since they apply to different types of applications for different reasons but there are some areas of overlapping. It is not an easy task to design the relational database or the workflow system to represent a complex scenario. In simpler cases the relational model or if-then rules can be used. But in complicated cases an ontology model provides more flexibility and robustness in design and implementation. The advantage of semantic technology over the above-mentioned technologies lies on the fact of creating machine-readable data capable of modeling complex cases. The same information can be shared not only among humans but also among clever agents in the web. Another major advantage is the fact that information using semantic technologies can be distributed anywhere in the web. Ontologies can be imported, merged with others, populated and expanded in a distributed way. This kind of scalability is perhaps the most important advantage of the semantic technology. More details about the relation of ontologies to formalisms currently used in software engineering can be found in (Tran, Lewen, & Haase, 2007).

### OWL Web Ontology Language

Data representation in a semantic web environment is given in layers as shown in Figure 1 (McGuinness & van Harmelen, 2004). These layers include XML (W3C, 2008), RDF (Resource Description Framework) (Manola F. & Miller, 2004), Ontology (OWL) (Dean, 2004), and Logic. OWL is an ontology language for the Semantic Web, developed by the World Wide Web Consortium (W3C) Web Ontology Working Group (Schwartz, 2003). In OWL, an ontology is a set of definitions of classes and properties. OWL has the ability of applying constraints on the way those classes and properties can be employed. OWL DL (Description Logic) is an OWL sublanguage that supports those users who want the maximum expressiveness while

*Figure 1. Semantic web "layer cake"*




retaining computational completeness. OWL DL was the sublanguage selected for the creation of our ontologies.

Individuals in OWL DL represent objects in the domain that we are interested in. Individuals can also be referred to as instances of classes. In fact OWL classes are thought of as sets of individuals. OWL individuals may belong to more than one class. In OWL properties represent relations between two individuals or between an individual and a data value. Two types of properties exist, Object properties and Datatype properties. The Object properties link an individual to an individual and the datatype properties link individuals to data values such as an integer, a string or a Boolean.

Properties may be stated to have a unique value if declared as functional properties. Properties link individuals from a domain class to individuals from a range class. The range of a property limits the individuals that the property may have as its value.

Currently the new OWL 2.0 specification that adds several extensions to the previous version is still work in progress (The W3C OWL Working Group, 2008a, 2008b).

Several attempts were made to apply semantic web technologies in the E-Business domain. Some cases refer to attempts to build generic E-Business representations and models that cover wide application areas and are not restricted to specific cases. We have grouped these initiatives according to the following two categories depending on their modeling perspective.

The first category contains data models, where the modeling effort is focused on identifying the main participating objects and relationships. Several attempts that fall into this category include modeling efforts and applications based on XML schemas. For example the UK Government Common Information Model (Office of e-Envoy UK, 2002), which is a high-level information model for all activities undertaken by the public sector. Above XML layer, ontologies also play an important role in information systems engineering using semantic web technologies. The DIP ontology (DIP Project, 2004), which is stated to be "an extensive ontology that models a wide range of eGovernment and community services and information". WebDG Ontologies (Medjahed, Rezgui, Bouguettaya, & Ouzzani, 2003) have been developed done under the Web Digital Government (WebDG) project. In the project ontologies were used to organize government information in order to make automatic composition feasible.

The second category includes service/process models where the modeling effort is based on identifying generic processes or services. Following a Semantic Web Service approach, the Ontology enabled E-Gov Service Configuration (ONTOGOV) project (OntoGov, 2006) has recently proposed an eGovernment domain specific service ontology, or a meta-ontology as it is called by the consortium. The proposed ontology is based on the two major generic service ontologies, namely OWL-S(OWL-S Services Coalition, 2004) and Web Service Modeling Ontology (WSMO) (Roman et al., 2005). The Federal Enterprise Architecture (FEA) Ontology (TopQuadrant, 2005) consists of various approaches, models and definitions for communicating the overall organization and relationships of architecture components required for developing and maintaining a Federal Enterprise Architecture. The SemanticGov (SemanticGov, 2007) Project uses the WSMO framework for Semantic Web Services modeling and execution environment. In (Vassilios Peristeras et al., 2006; Wang et al., 2007) the WSMO-PA specification for modeling public services is given.

The use of ontologies in reorganizing e-document management in public administration is presented in (R. Klischewski, 2006). The usage of ontologies and semantic technologies for describing E-Business services can improve the management of changes (Stojanovic, Abecker, Stojanovic, & Studer, 2004). Automated classification of citizens using an ontology is given in (Moulin, Bettahar, Barthès, & Sbodio, 2007). An intelligent search engine for an E-Business application based on modeling the systems' electronic catalogue using an ontology is presented in (Markellos, Sakkopoulos, Sirmakessis, & Tsakalidis, 2007). An infrastructure for personalization of services using ontology-based profiling of users citizens is given in (Grandi et al., 2006). An activity-based approach for the development and use of ontologies for E-Business services is introduced in (Ralf Klischewski & Ukena, 2008). A Business ontology was designed in (Xiao, Xiao, & Zhao, 2007) for sharing business knowledge. A quality ontology for the adaptive evaluation of E-Business services is given in (Magoutas, Halaris, & Mentzas, 2007). Other domain specific ontologies include an ontology for modeling of life events (Trochidis, Tambouris, & Tarabanis, 2007), an ontology for an e-participation recourse center (Wimmer, 2007) and in an eGovernment virtual organization (Tang & Yang, 2007). An application that creates electronic forms from semantic descriptions is given in (Stadlhofer & Salhofer, 2007).

More details about the classification of modelling efforts and semantic web applications can be found in recent review paper (V. Peristeras, Tarabanis, & Goudos, 2009).

## BUSINESS CASES DESCRIPTION

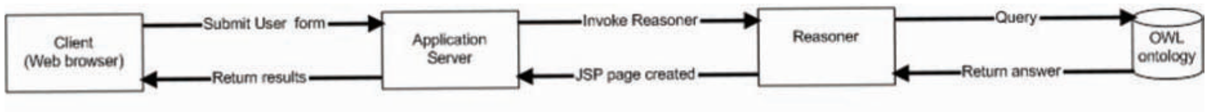
In this section we outline the business cases that are used as test-beds for semantic web technology. Both cases are based on complex legislation. The first case is the issuance of operation license to companies. In Greece getting an operations license for any kind of enterprise is a complex task. It involves submitting the appropriate documents from a number of public services and authorities. The Prefecture issues both the registration and the operations license. First it requires the applicant to enter a process for obtaining a registration license. After the registration license task is completed the operations license must be obtained. It involves submitting the appropriate documents from a number of public services and authorities. These documents are submitted to distinct departments of the Prefecture, which issues a certificate for every type of document. These certificates together with the registration license are again submitted to another department of the Prefecture. Finally the Prefecture issues the operations license.

Every enterprise in Greece should submit documents needed based on three major factors that influence the whole enterprise. These are: the number of employees that the enterprise will employ, the location of the enterprise (urban, suburban or rural) and the power in KW needed for the operation of the enterprise. Every one of these attributes has three different possible states. Each state requires a document from a different public service.

Therefore anyone who wants to start a new enterprise must search in various and complex legislation in order to find the correct documents required.

The second case is about the benefits that any citizen is entitled to based on his/her education, his/her family status, his/her working location or even some special skills such as ability to work with PCs. For example, a married public servant with a master's degree in informatics is entitled to

Figure 2. System architecture




certain benefits. A large number of such benefits (more than 100) exist. The legislation describes in detail the documents required to be provided by the applicant in order to obtain these benefits. An additional complexity is that the amounts for these benefits may change quite frequently. Thus, the task of quickly providing the relevant information for the amount he/she is entitled to is challenging.

In the end, anyone who wants to be adequately informed about the existence and the exact provisions of such benefits must search in various and complex legislation.

Several possible combinations exist for both the above scenarios. An efficient way to implement electronically the above cases is using semantic web technology, as it will be presented in the next section.

## SYSTEM DESCRIPTION

In this section we present the proposed information system architecture (see Figure 2). It consists of a web server, a reasoner and an OWL file which is used as the knowledge base.

The users access the application though a common Internet browser. The advantage of every web-based front end is that it requires only an Internet browser in order to execute and it can be accessed from anywhere in the Internet. The system architecture used is server-side therefore the client only shows the form and the results page. The server uses the data given to invoke the reasoner. The reasoner sends various queries to the knowledge base. The answers returned are parsed to web server that creates the results web page. The extracted results contain a list of the documents required in order to obtain an operation license (for the first case) or contain a list of the entitled benefits (benefit name and amount), plus the list of documents required in order to obtain them (for the second case).

More specifically the web server used was Apache Tomcat, the knowledge base was an OWL file with the ontology definition and the reasoner was JTP (Java Theorem Prover) (Fikes, Jenkins, & Frank, 2003). The system components are explained in detail in the next sections.

### The Ontologies

The business cases presented in the previous section can be modeled with a set of OWL classes having properties and individuals. We briefly present the basic modeling principles and the ontologies. Both ontologies have been created using the Protégé Ontology Editor (http://protege.stanford.edu/) with the OWL plug-in (Holger Knublauch, Fergerson, Noy, & Musen, 2004; H. Knublauch, Musen, & Rector, 2004).

#### Case 1 Ontology

The classes are given schematically in Figure 3. These consist of four major classes; *Document*, *Enterprise*, *Certificate* and *EnterpriseDescriptor*. More specifically:

- Class *Document* is the abstract representation of the documents required. Class *Document* has four subclasses

*Figure 3. The class hierarchy for the first case*


*LocationDocument*, *CategoryDocument*, *PowerDocument* and *ProximityDocument*. The documents required for every case are modeled as individuals of these classes.

- The *Enterprise* class defines the concept of the enterprise. The various types of enterprises like a bakery store or a mining industry are modeled as subclasses of this class.
- *EnterpriseDescriptor* class is a superclass which represents the properties of the Enterprise. The various features that describe an Enterprise are given as subclasses of the *EnterpriseDescriptor* Class. The four subclasses are *Power*, *Location*, *EmployeeNum* and *SiteProximity*. These classes are the abstract representations of the properties that characterize an enterprise according to current legislation.
- The *Certificate* class represents the concept of the certificate required for each attribute of the enterprise. The class *Certificate* has also four subclasses. Each subclass has other subclasses, which represent the specific certificates required for each *EnterpriseDescriptor* subclass.

A number of object properties are also created for the above classes. For example object properties for describing the different attributes of an Enterprise are *belongsToCategory*, *LocatedIn*, *hasPower*, and *locatedNear*. The first three are functional properties and their domain is Certificate class, while their range corresponds to the respective *EnterpriseDescriptor* subclass. The object property *hasLicense* represents the certificates needed for the final operations license with domain the *Enterprise* class and range the *Certificate* class. The property *hasDocument*, represents the documents required in order to obtain a certificate of each category.

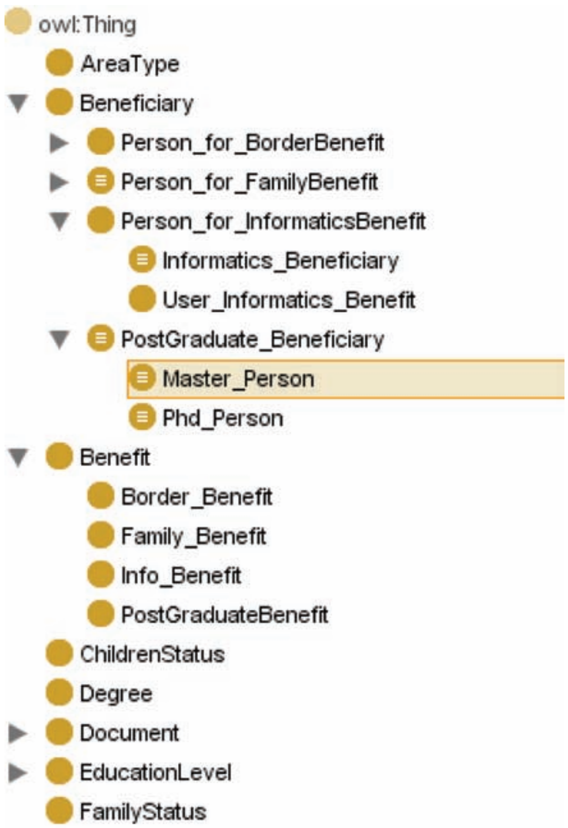
## Case 2 Ontology

Figure 4 shows the class tree for the ontology of the second case.

The ontology consists of seven major classes; Document, *Benefit*, *Beneficiary*, *FamilyStatus*, *EducationLevel*, *AreaType*, and *Degree*. More specifically:

- The *Benefit* class defines the concept of the benefit. The various types of benefits like family benefit or border benefit are modeled as subclasses of this class.

*Figure 4. The class hierarchy for the second case*




- Class *Beneficiary* is the abstract representation of the person (e.g. public servant) entitled to the benefits. Its subclasses are the different types of persons entitled to different benefits.
- The *Degree* class represents the concept of a university degree like a BSc or a MSc. Individuals of this class are: *Msc*, *Bch* and *Phd*.
- Class *FamilyStatus* is the abstract representation of the family status. Examples of individuals that belong to this class are *Marrried*, *NotMarried* and *Divorced*.
- Class *EducationLevel* represents the four different types of education levels valid in Greece. These are modeled as four distinct individuals of the class. These are: *PE* (university level), *TE* (technical education), *DE* (secondary education) and *YE* (mandatory education).
- *AreaType* class represents the distinct areas that a public servant in Greece may live and work (e.g. border areas). There are three individuals of this class: *CategoryA* area, *CategoryB* area and *Border* area. These areas are defined in Greek legislation for certain geographical areas of Greece.

Class *Benefit* has the datatype property *amount* that represents the amount in euros for each benefit. This property is defined functional with property domain the class *Benefit*. A number of object properties are also created for the above class. The object properties for describing the different attributes of a *Beneficiary* are *entitledTo*, *livesIn*, *hasDegree*, *hasDegreeIn*, *hasDocument*, *hasEducationLevel*. For all the above properties, domain is the *Beneficiary* class, while their range corresponds to the respective self-explicable class. For example property *entitledTo* has range the *Benefit* class.

In a similar way object property *hasDegree* has range defined in the *Degree* class. Three object properties are declared functional which implies single values. These are *hasEducationLevel*, *hasFamilyStatus* and *livesIn*. Another object property is *hasDocument*, which is defined with domain the *Beneficiary* class and range the *Document* class. This property represents the documents required in order to obtain a benefit of each category.

## The Reasoner

The reasoner used was JTP (Java Theorem Prover). JTP supports OWL DL and uses Knowledge Interchange Format (KIF) format for queries and answers. When the user presses the form submit button, the web server invokes JTP by sending KIF formatted queries and assertions.

First a new individual of the Enterprise (first case) or the Beneficiary (second case) class is created on the fly. The properties set by the user with the user interface are entered as assertions to the reasoner. Finally, queries are performed to ask the reasoner for the desired information.

The reasoner uses the OWL knowledge base and finally returns the deduced results. These are the list of the specific documents to be submitted by the user for the first case. For the second case the results include the entitled Benefits, the monthly amounts for every Benefit and the documents required in order to obtain them. This way the user gets all the information. The system uses JSP (Java Server Page) and Java servlets in order to dynamically create the results in HTML format.

## Use Cases

The user may select the first or second case from the application first page. In both cases after user selection a form appears.

For the first case the user has to fill in the enterprise details. For a selected enterprise some details are set automatically through the semantic logic. For example if the user selects a *Drugstore* then the property *belongsToCategory* is set to *LessThan100* employees as it comes from the definition of the *Drugstore* class. When the selection process is over then the user presses the submit button and sends the selected data to the server. Let us assume that the user selects a drug store as the Enterprise type. The user also selects that the drug store is located in a suburban area and that is located close to a coast and an archaeological site. The power category is set to less than 12KW and the employee number to less than 100 due to the class definition of the drug store. The results obtained are a complete list of all the documents needed, more specifically in our case these are: a Prefecture approval document, a technical report signed by a civil engineer, a legally signed document, an approval document obtained from the Greek Tourist Organization and an approval document obtained from the Greek Archaeological Service. So the user has all the information needed in a quick and easy way.

In similar way in the second case the user enters his/her personal details. For example, the user selects family status (married or not), number of children, level of education, postgraduate degree type if any, the degree subject (as informatics, engineering etc.) and the type of area he/she lives in. The results obtained are a complete list of all the benefits entitled to the user, the amount of each in euros and the list of documents needed in order to receive the benefits.

In the case of a new law for both cases the application can be easily expanded to accommodate the new provisions. The changes required can be made by directly editing the appropriate OWL file. Minor changes to the front end may also be required.

## FUTURE RESEARCH DIRECTIONS

Our future work will include the development of a complete semantically enabled web service for a common E-Business case. In particular we will use the WSMO framework for modeling such cases. The above approach has the advantage of providing a complete semantic web services framework consisting of both a modeling language and an execution environment. In this future version an additional component will be created and linked to the current application. That is, the presented case will be the first processing step of a larger application. The data found in the first step will serve as input to another component. The latter will execute a semantic web service based on WSMO. This will update and inform the public administration financial services about any new benefits added to citizen's monthly payment based on any change in his/her personal profile.

## CONCLUSION

A semantic web application to support common informational E-Business services in Greece has been presented. The proposed framework and application can be used in a wider sense to help in simplifying the search procedure in public administration. The OWL web ontology language has the potential to be used for knowledge representation of complex E-Business cases. In these cases, OWL can increase performance and decrease development time due to its flexibility and scalability.

Another advantage of the presented system is the ability for quick and easy updates. For example let's assume that a new law is issued that gives a new benefit to single mothers. In a traditional relational database implementation this would require a database schema modification. This type of change would probably require a major rewrite in tables and queries. An ontology modification is also required in this case but this can be done in a more flexible way. For example the main ontology may remain unchanged and a new ontology can be created that imports the old. The physical location of the new ontology can be in any site on the web. In any case, ontology modification requires simple text file editing in contrast to a database schema modification, which is usually a more complicated procedure.

## REFERENCES

W3C. (2008). Extensible Markup Language (XML) 1.0 (Fifth Edition). *W3C Recommendation.* Retrieved March 13, 2009, from http://www.w3.org/TR/xml/

Access-eGov. (2007). Project FP6-2004-27020 [online]. Retrieved 16/08/2007, from http://www.accessegov.org

Berners-Lee, T., Hendler, J., & Lassila, O. (2001, May). The Semantic Web. *Scientific American*.

Dean, M., et al. (2004). OWL web ontology language reference. *W3C Recommendation*. Retrieved from http://www.w3.org/TR/owl-ref/

Fensel, D., Bussler, C., & Maedche, A. (2002). *Semantic Web Enabled Web Services.* Paper presented at the ISWC 2002.

Fikes, R., Jenkins, J., & Frank, G. (2003). JTP: A system architecture and component library for hybrid reasoning. In *Proceedings of the Seventh World Multiconference on Systemics, Cybernetics, and Informatics*.

Grandi, F., Mandreoli, F., Martoglia, R., Ronchetti, E., Scalas, M. R., & Tiberio, P. (2006). Semantic Web techniques for personalization of eGoverment services. *Lecture Notes in Computer Science,* (pp. *LNCS*, *4231*, 435–444.

Klischewski, R. (2006). Ontologies for e-document management in public administration. *Business Process Management Journal, 12*(1 SPEC. ISS.), 34-47.

Klischewski, R., & Ukena, S. (2008). *An Activity-Based Approach towards Development and Use of E-Government Service Ontologies.* Paper presented at the Proceedings of the 41st Annual Hawaii International Conference on System Sciences (HICSS41).

Knublauch, H., Fergerson, R. W., Noy, N. F., & Musen, M. A. (2004). *The Protégé OWL Plugin: An Open Development Environment for Semantic Web Applications.* Paper presented at the Proceedings of Third International Semantic Web Conference - ISWC 2004, Hiroshima, Japan.

Knublauch, H., Musen, M., & Rector, A. (2004). *Editing Description Logic Ontologies with the Protégé OWL Plugin.* Paper presented at the International Workshop on Description Logics - DL2004, Whistler, Canada.

Magoutas, B., Halaris, C., & Mentzas, G. (2007). An ontology for the multi-perspective evaluation of quality in e-Government services. *Lecture Notes in Computer Science, LNCS*, *4656*, 318–329.

Manola, F., & Miller, E. (2004). RDF Primer. *W3C Recommendation*. Retrieved from http://www.w3.org/TR/rdf-primer

Markellos, K., Sakkopoulos, E., Sirmakessis, S., & Tsakalidis, A. (2007). Semantic web search for e-government: The case study of intrastat. *Journal of Internet Technology*, *8*(4), 457–468.

McGuinness, D. L., van Harmelen, F., et al. (2004). OWL Web Ontology Language Overview. *W3C Recommendation*. Retrieved from http://www.w3.org/TR/owl-features/

Medjahed, B., Rezgui, A., Bouguettaya, A., & Ouzzani, M. (2003). Infrastructure for E-Government Web Services. *IEEE Internet Computing Magazine*, *7*(1), 58–65. doi:10.1109/MIC.2003.1167340

Moulin, C., Bettahar, F., Barthès, J.-P., & Sbodio, M. (2007). Ontology Based Categorization in eGovernment Application. In *On the Move to Meaningful Internet Systems 2007: CoopIS, DOA, ODBASE, GADA, and IS,* (pp. 1153-1160).

Office of e-Envoy UK. (2002). *e-Services Development Framework Primer v1.0b*. Retrieved Noe 2002, from http://www.govtalk.gov.uk/documents/eSDFprimerV1b.pdf

OntoGov. (2006). *Project FP6-507237* [online]. Retrieved 16/08/07, from http://www.euser-eu.org/ShowCase.asp?CaseTitleID=455&CaseID=978&MenuID=54

OWL-S Services Coalition. (2004). *OWL-S: Semantic Markup for Web Services.* W3C Member Submission. Retrieved March 2005, from http://www.w3.org/Submission/OWL-S

Peristeras, V., Mocan, A., Vitvar, T., Nazir, S., Goudos, S. K., & Tarabanis, K. (2006). *Towards Semantic Web Services for Public Administration based on the Web Service Modeling Ontology (WSMO) and the Governance Enterprise Architecture (GEA).* Paper presented at the International EGOV Conference (DEXA 2006), Poland.

Peristeras, V., Tarabanis, K., & Goudos, S. K. (2009). Model-driven eGovernment interoperability: A review of the state of the art. *Computer Standards & Interfaces*, *31*(4), 613–628. doi:10.1016/j.csi.2008.09.034

DIP Project. (2004). *D9.3 e-Government ontology*.

Roman, D., Keller, U., Lausen, H., Bruijn, J. d., Lara, R. e., Stollberg, M., et al. (2005). Web Service Modeling Ontology. *Applied Ontology, (1)*77-106.

Schwartz, D. G. (2003). From Open IS Semantics to the Semantic Web: The Road Ahead. *IEEE Intelligent Systems*, *18*(3), 52–58. doi:10.1109/MIS.2003.1200729

SemanticGov. (2007). *Project FP6-2004-IST-4-02* [online]. Retrieved 16/8/2007, from http://www.semantic-gov.org

Stadlhofer, B., & Salhofer, P. (2007). *Automatic generation of e-government forms from semantic descriptions.* Paper presented at the Proceedings of the 1st international conference on Theory and practice of electronic governance, Macao, China.

Stojanovic, L., Abecker, A., Stojanovic, N., & Studer, R. (2004). On managing changes in the ontology-based e-government. *Lecture Notes in Computer Science*, *3291*, 1080–1097.

Tang, X., & Yang, F. (2007). *A study on dynamic ontology for information integration in E-governmental virtual organization.* Paper presented at the Proceedings of International Conference on Wireless Communications, Networking and Mobile Computing, (WiCOM 2007), Shanghai.

The W3C OWL Working Group. (2008a). OWL 2 Web Ontology Language: Profiles. *W3C Working Draft* Retrieved 13 March, 2009, from http://www.w3.org/TR/owl2-profiles/

The W3C OWL Working Group. (2008b). *OWL 2 Web Ontology Language: Structural Specification and Functional-Style Syntax.* W3C Working Draft. Retrieved 13 March, 2009, from http://www.w3.org/TR/owl2-syntax/

TopQuadrant. (2005). *FEA Refererence Model Ontologies (FEA RMO) v1.1*.

Tran, T., Lewen, H., & Haase, P. (2007, March 5-9, 2007). *On the role and application of ontologies in information systems.* Paper presented at the Proceedings of IEEE International Conference on Research, Innovation and Vision for the Future, RIVF 2007, Hanoi.

Trochidis, I., Tambouris, E., & Tarabanis, K. (2007, 9 July 2007 through 13 July 2007). *An ontology for modeling life-events.* Paper presented at the 2007 IEEE International Conference on Services Computing, SCC 2007, Salt Lake City, UT.

Wang, X., Vitvar, T., Peristeras, V., Mocan, A., Goudos, S. K., & Tarabanis, K. (2007). *WSMO-PA: Formal Specification of Public Administration Service Model on Semantic Web Service Ontology.* Paper presented at the 40th Annual Hawaii International Conference on System Sciences, (HICSS 2007).

Wimmer, M. A. (2007). *Ontology for an e-participation virtual resource centre.* Paper presented at the Proceedings of the 1st international conference on Theory and practice of electronic governance, Macao, China.

Xiao, Y., Xiao, M., & Zhao, H. (2007, September 21-25). *An ontology for e-government knowledge modeling and interoperability.* Paper presented at the Proceedings of International Conference on Wireless Communications, Networking and Mobile Computing, (WiCOM 2007), Shanghai.

## KEY TERMS AND DEFINITIONS

**Description Logics:** A family of knowledge representation (KR) formalisms that represent the knowledge of an application domain by first defining the relevant concepts of the domain (its terminology), and then using these concepts to specify properties of objects and individuals occurring in the domain.

**KIF:** Knowledge Interchange Format is a computer-oriented language for the interchange of knowledge among disparate computer programs.

**Reasoner:** A software system able to infer logical consequences from a set of asserted facts or axioms.

**RDF:** Resource Description Framework is a family of W3C specifications that have been used as a general method for conceptual modeling of information that is implemented in web resources.

**Semantic Web Service:** They are the server end of a client-server system for machine-to-machine interaction via the World Wide Web. Semantic services are a component of the semantic web because they use markup that makes data machine-readable in a detailed and sophisticated way.

**Web Service:** A software system designed to support interoperable machine-to-machine interaction over a network.

**XML:** Extensible Markup Language is a general-purpose specification for creating custom markup languages.

# Chapter 100
# Design Elements and Principles for Maintaining Visual Identity on Websites

**Sunghyun R. Kang**
*Iowa State University, USA*

**Debra Satterfield**
*Iowa State University, USA*

## INTRODUCTION

The visual design of a website is critical when establishing a strong corporate identity on the web. The look and feel of a website will quickly influence a user with regard to how they perceive the image of the business. It will determine whether they feel comfortable or included in the site's target audience and whether or not they feel the business is professional or trustworthy. If at a first glance, the visual design does not connect on these levels with the user the likelihood of them using the site or purchasing products is greatly diminished. Therefore, the site must quickly capitalize on a known and trusted pre-existing corporate identity, or establish a new corporate identity that is professional and appropriate.

The purpose of this chapter is to examine design factors and determine which of these factors affect people's ability to identify and perceive information on web sites. This chapter discusses how design elements can cross media boundaries and create a consistent and effective user experience between the physical business and its presence on the web. This chapter explains branding elements such as logos, color systems, typography, grid structure, photography, graphic style, and the visual hierarchy of information with regard to how they can be used in static and dynamic applications.

The following areas are discussed: (1) design elements of corporate identity that are effective in creating web site identity; (2) the visual elements of web site identity; and (3) strategies for creating visual identity using design elements and principles while taking into consideration the web's limitations and strengths.

DOI: 10.4018/978-1-61520-611-7.ch100

## THE DESIGN ELEMENTS OF CORPORATE IDENTITY THAT ARE EFFECTIVE IN CREATING WEB SITE IDENTITY

Corporate identity design in the physical world has been developed to consistently apply logos, colors, typography, grids, and other stylistic treatments to a variety of media and applications. In addition, corporate identity design in the physical world has a much longer history than does web site identity design. Therefore existing strategies and elements of corporate identity design from the physical world will be useful as a model for developing a strategy for web site identity design.

According to Haig and Haper, logos and symbols are known as basic and fundamental elements in the development of corporate identity design. A logo, as "one of business' most outspoken non-verbal cues," (Haig & Haper, 1977, p 1) conveys a company's philosophy and message. Dowling (2001) further articulates the roles of corporate symbols: to create awareness; to trigger recognition of an organization; and to activate a stored image of the organization (p 167). Logos are used as a powerful tool for marketing. People often tend to make buying decisions based on the brand name rather than just for the product itself. Nike, Apple, and McDonald's logos are well-known examples of these types of corporate symbols.

Color is another important element in corporate identity. Color is easier to read than form or shape and it holds the viewer's attention longer (Dowling, 2001, p 177). We have often heard about Coca Cola red, Kodak yellow, and Barbie pink. Color also has cultural and psychological associations. The same color can be interpreted in different ways depending on the culture and context of the situation.

A corporate identity system can be thought of as a tool that is used to maintain a company's corporate visual image. This system must be flexible enough for different applications, at the same time, tight enough to maintain visual consistency across media. Haig and Haper (1977) point out that 65 percent of our daily communication experiences are non-verbal (p9). Thus, the impact of visual information is a large part of our everyday life. The visual elements of a corporate identity system such the logo and color scheme can create an immediate sense of recognition for the company, express its character, and build familiarity and trust (Haig and Haper, 1977, p14). Corporate identity systems build branding far beyond just logos and colors. Therefore, both branding and corporate identity systems need to be integrated in the market place.

## THE VISUAL ELEMENTS OF WEB SITE IDENTITY

Symbols are the most powerful elements used to build corporate identity systems in the physical world. But are they the most powerful element when creating web identity? Are symbols a powerful enough element on the web to build identity? What are the other elements used to build site identity? In answer to this, icons, symbols, colors, images, typography, and web page layout (including visual hierarchy) are all elements that need to be considered for the creation of a web site identity.

### Creating an Initial Sense of Web Site Identity on the Homepage

The major role of a web site identity design does not dramatically differ from the role of corporate identity design in the physical world. Like corporate identity (Morgan, 1999, p47), web site identity should be a visual statement of the web site's role and function. It should also be a means of visual communication with users or customers. The most important aspect of web site identity design is for the site to provide the company's nature and characteristics at a glance. Furthermore, a company's web site identity should have a unique design and features that are distinguishable from its competitors' web sites. This uniqueness of web site identity design can help a business build immediate recognition. The key element to creating a successful web site identity is grabbing users' attention, building a positive impression, and making sure they stay on the web site and/or return. This positive impression and experience can help a company build good branding on their web site. In addition, a company's vision and value can be communicated through web site identity design.

## Company Name or Logo as a Web Site Identifier

The company name, logo, or sometimes both, and a web address (URL) are used to identify a web site. These site identifiers are generally located in the top section of the homepage. The size of the site identifier is limited due to the screen size and screen resolution. Nielson and Tahir (2002) mentioned that a tagline can give users a verbal cue about what the web site offers. According to an analysis of one hundred e-commerce web sites (Kang and Lee), about 66% of E-commerce homepages have a tagline associated with the logo or use a tagline that is independent of the logo (2003). However, a site identifier is often incorporated with a tagline to support the identification of the web site.

According to Kang's research, young adults identify web sites by their structure or by visual cues such as "sign in," while older adults tend to rely on a logo or site name to identify web sites (2005). A site identifier should have a unique appearance to identify the characteristics of a particular web site. Most web sites repeat the site identifier on each web page to maintain site identity; it tells users that they are still on the same site. A web site identifier that repeatedly shows up on each web page can be also used to build brand identity. Building a good brand image with a positive identity is the best way to enhance web site branding.

## Color

Color is a powerful tool for building a company's identity. While color can be used to maintain uniformity, it is a less powerful element on the web than in the physical world. Rather, on the web, color is often used to indicate different categories or levels. Color-coding is a useful way to organize information on a web site. However, color-coding for web sites can be problematic. Sometimes, the final destination is the same but the web page has a different path from different categories thus making color hard to control for navigation. In addition, many web sites use color as a background element rather than for color-coding. In this regard, a dominant color is used to maintain site identity. For example, Coca-Cola's web site maintains red as the dominant color for all of their global web sites. For Coca-Cola, this ensures that their brand image on the various international web sites is consistent with other media. Colors can also been used to indicate links such as visited and active links. Nielsen (2004), on his web site, advised designers to "use different colors for visited and unvisited links."

## Image

Nielsen and Tahir (2002) are skeptical about using graphics on web sites. They suggest that designer should "use graphics to show real content, not just to decorate your homepage (p21)." Most web design guidelines suggest that designers not use purely decorative elements for design. When web sites were first introduced, the technology for handling colors and images was limited. Low modem speeds couldn't handle large graphics. Now advanced technology allows web designers to use more graphics and even sounds or animation. These graphics can be used as visual cues to forecast the characteristics of a web site. Norman (2004) mentions that photography is a powerful way to appeal human emotions (p50). Many web sites use photographic images to enhance their visual appearance. Depending on the purpose of a web site, illustrations, photography, and other graphics can enhance navigation and help maintain web site identity. For instance, The Nike homepage uses a photograph of a dynamic athlete, the Coca cola homepage uses happy people and the Coca Cola bottle, and Disney uses an illustration to promote their web site to their audience.

## Layout

A web site's structure is known as its information architecture. The navigation technique of a web site is determined by the information architecture of the site. In turn, this navigation method will affect the layout of the web site design. Successful navigation is invisible when it is working (Spool et al, 1999, p9). After conducting a web usability test, Spool pointed out navigation problems such as " users did not have the domain–or business area–knowledge they needed to navigate the site and the site structure didn't meet users' expectation" (Spool et al, 1999, p 15). Layout is a visible form of information architecture. The information architecture of a site is abstract, while the layout of a site is a more concrete visual representation of the information architecture. Most web pages are divided into four main areas: title; navigation; content; and footer (Kang & Lee, 2003). A wireframe layout without any visual elements can help designers to see the relationship between links, content, and other interface elements (VanDijck, 2003, p14).

The layout is designed based on the quantity of content information, numbers of organizational categories, and marketing and design strategies. For instance, newspaper web sites use multiple columns to handle excessive amounts of information. Layout style, along with visual elements such as image, color, and typography, will determine the stylistic characteristics of web site identity. A layout style with an appropriate and consistent visual appearance should be decided before a designer begins coding the web site. Layout design, along with graphic imagery, is one of the most important elements for maintaining web site identity.

## Design System

All of these elements, layout, color, logo or company name, and imagery, need to be organized in a unified system to maintain web site identity. The system has to be strict enough to maintain visual consistency and flexible enough to manage the web's dynamic characteristics. The relationships of consistency and flexibility are like two sides of a coin. Maintaining a strong visual consistency will help users know they are on the same web site, while flexibility in the design allows users to identify different web pages within the same web site. Therefore, a coherent design system helps to maintain a consistent yet flexible visual identity throughout a web site.

A consistent layout and visual style will give users a unified feeling. This unified feeling creates the web site identity. Well-organized systems with clear hierarchies and well-balanced layouts create a good visual experience and increase the performance of the web sites. For example, the main navigational elements need to be consistently located at the same place on each page. This consistency not only relates to maintaining web site identity but also web usability.

The system should also consider information hierarchy as it applies to the users' goals and the web site's purpose. Information hierarchy can be established by understanding a company's business goals and user's tasks on the web site. Important information should be made visually dominant to support information hierarchy. The design system also needs to consider the limitations and possibilities of web sites. HTML text is difficult for designers to control because users can change the type size and typefaces. In addition, links and scrolling can provide unlimited possibilities. The design system must address how to manage the linked web pages and the length of web sites.

Kang and Lee (2003) point out that many web designers and developers don't seem to pay attention to text alignment. When a web site has more than one alignment setting, it creates unusual negative space and causes visual chaos. As solutions, Kang and Lee (2003) suggest implementing a grid system using tables. Watzman (2003) mentioned that a grid is a good way to improve usability and it also gives a consistent look and feel to the page (P268-285). This type of grid system maintains web site identity as a cohesive whole. A company web site also needs a system-specific manual and style guide to maintain web site identity.

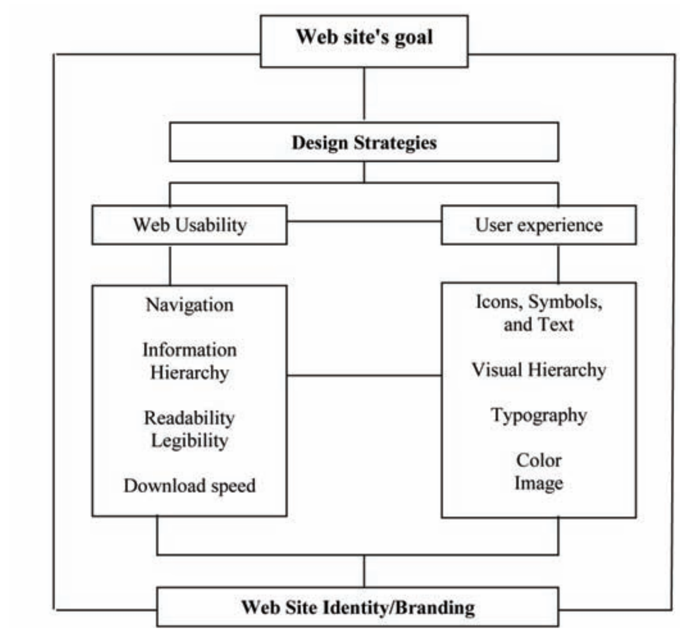
## DESIGN STRATEGIES FOR WEB SITE IDENTITY

There are many ways to convey the same message. The most important consideration in the creation of web site identity is an understanding of a company's goals for having the web site and the users' goals for visiting the web site. The design strategy for a web site comes from an understanding of the business and how to provide appropriate information in this media. It is also determined by the target audience and an understanding of the web's limitations and strengths.

Designing appropriate interactions between the web site and the users is a key to successful web site usability. There is no doubt that usability is an important part of building a successful web site. Norman, in his book (2004), *Emotional Design,* shows how humans' emotional and cognitive processes are affected by their everyday life. Norman assures readers that attractive things work better, create positive feelings, and encourage creative thinking (P19). In addition, usability becomes visible through visual elements. In a broad sense, usability can be considered a part of user experience. User experience depends on visual elements, which in turn affect the final appearance of web site design. Figure 1 shows the relationship between web site usability and user experience when developing web site identity. To build a successful web site identity, a designer must understand not only web site usability but also users' emotions and experiences. Users will experience a web site through navigational interfaces. The interface is a communication tool between the web site and the users. The interaction that takes place as facilitated by the interface is a personalized experience for each individual. Symbols, icons, colors, text, and images are the tools that create this user experience. When a web site has unique icons for navigation, people will remember the icons and identify the web site through them. For example, Amazon's symbol and tab navigation structure are unique enough to identify the web site. Therefore, people remember Amazon's tab navigation and it becomes one of the site's identifiers.

Garrett (2003) describes a web site as a "self-service" product (p11). When a user opens a web site, they need to find out how to use it. If the user does not understand what kind of site it is or cannot find what they are looking for, they will leave the web site immediately. Thus, web usability and user experience are closely related and cannot be discussed separately. Web usability is invisible and abstract, whereas navigation and information architecture are visualized through design elements. When information architecture is delivered by means of clear information hierarchy, the structure of web site will be easy to understand and easy to navigate. To clarify information hierarchy, a designer uses different sizes of type, color contrast, and/or images. The visual hierarchy needs to support the information hierarchy. For instance, if secondary information gains more visual attention than primary information, users will be confused about which information is more important. Readability and legibility further depend on the designer's typographic skills. For example, a black background with purple text will

*Figure 1. Framework for the design strategies of web site identity*




not be easy to read. Long text lines with narrow leading will make it difficult for users to find the next text line. Color and image will affect a user's emotions while big images will cause slow download speeds. Thus, these concrete elements of user experience contribute to the usability of a web site.

Web site identity is connected to web site branding. "Brand experience can be fulfilled online through creative and interactive segments (Temporal, et al., 2001, p 28)." Building a good brand impression will give users the confidence to visit a web site again. Branding is especially important to e-commerce and corporate web sites. The best web site identity combines effective usability and user experience. As Norman mentioned (2004), "attractive things make people feel good (p19) " and create positive emotions. Visual elements such as logos, images, colors, and typography will create positive user experiences and build good brand impressions. Understanding the balance between usability and user experience will help designers create successful web site identity systems.

## CONCLUSION AND RECOMMENDATIONS

Web design involves teamwork. A graphic designer alone cannot create an effective web site and a web programmer alone also has difficulty creating a visually unified web site. It is critical that both programmers and designers understand the roles of usability and user experience in order to build a successful web site identity design system. Web usability is about ease of navigation, clear information hierarchy, readability and legibility, and fast download speed. User experience and web site identity are created through the effective use of visual elements such as color, images, layout, icons, and symbols. In order to create successful web site identity, designers need to take the following steps:

- Define the company's goals and users' goals for the web site,
- Define the information structure and navigation method,

- Decide on a visual style and visual vocabulary that appeals to the target audience,
- Plan a site layout that can meet the aforementioned goals, and
- Design a system to maintain web site identity.

Just like corporate identity systems in traditional media, web site identity must be considered critical to an effective branding effort on the web. At the same time, to design effective web site identity systems, a designer must take into consideration the web's unique dynamic and flexible characteristics.

## REFERENCES

Dowling, G. (2001). *Creating Corporate Reputation: identity, image, and performance.* New York: Oxford University Press.

Gattett, J. (2003). *The Elements of User Experience*. Indianapolis: New Riders.

Haig, W., & Harper, L. (1997). *The Power of Logos: how to create effective company logos.* New York: Van Nostrand Reinhold.

Kang, S. R. (2005). Information Literacy of Web sites: Research on the Age Gap. In *Proceeding in the International Design Congress 2005*, Taiwan.

Kang, S. R., & Lee, E. (2003). Investigating Elements on the E-commerce Homepage: Focus on Business to Customer Websites. In *Proceeding CD in The 6th Asian Design Conference CD*, Japan.

Morgan, C. L. (1999). *Logos: Logo, identity, brand, culture*. Switzerland: Roto-Vision.

Nielsen, J. (2004). *Guidelines for Visualizing Links*. Retrieved Jan 13, 2009 from http://www.useit.com/alertbox/20040510.html

Nielsen, J., & Tahir, M. (2002). *Homepage Usability*. Indianapolis: New Riders.

Norman, D. (2004). *Emotional Design: Why we love (or hate) everyday things*. New York: Basic books.

Spool, J. M., Scanlon, T., et al. (1999). *Web Site Usability: A Designer's Guide*. San Francisco: Morgan Kaufmann Publishers.

Temporal, P., & Lee, K. C. (2001). *Hi-tech hi-touch branding: creating brand power in the age of technology.* New York: Wiley.

Van Dijck, P. (2003). *Information Architecture for designers*. Switzerland: Roto-vision.

Watzman, S. (2003). Visual Design Principles for Usable Interfaces. In J. A. Janco & A. Sears (Eds.), *The Human-Computer Interaction Handbook*. Mahwah, NJ: Lawrence Erlbaum Associates.

## KEY TERMS AND DEFINITIONS

**Corporate Identity:** Taglines, logos, and marketing elements which could build company's identity and brand image.

**Visual Identity:** Visual elements such as a corporate logo, system elements, color system, typography to build company's identity.

**Design System:** Strategy to integrate and maintain corporate identity using visual elements.

**Experience Design:** The way that the target audience experiences the brand from the first knowledge of the company through the complete consumer process.

**Information Hierarchy:** Structure and priority given to various pieces of information.

**logo:** A graphical element composed of a symbol and/or organization name.

**Grid:** Organizational structure used to create information templates.

# Chapter 101
# Designing e-Business Applications with Patterns for Computer-Mediated Interaction

**Stephan Lukosch**
*Delft University of Technology, The Netherlands*

**Till Schümmer**
*FernUniversität in Hagen, Germany*

## INTRODUCTION

Probably the most important aspect of e-Business and e-Commerce is that it mediates the interaction between various stakeholders in a business setting. New organizational forms such as virtual organizations emerged in which independent companies form a strategic alliance for a close collaboration towards a shared goal (e.g., shared product development). New forms of B2C (business-to-customer) interaction argue for the importance of hearing the customer's voice e.g., by providing means for customization (Piller, 2006) or by collecting the customers' feedback (Levine, Locke, Searls, & Weinberger, 2000). And in some cases, C2C (customer-to-customer) interaction has become an integrated part of the business (in settings where customers also act as providers of goods or services). Closely related to these trends is the emergence of the Web 2.0 as "*a set of economic, social, and technology trends that collectively form the basis for the next generation of the Internet – a more mature, distinctive medium characterized by user participation, openness, and network effects.*" (Musser, O'Reilly et al., 2006, p. 4). Again, collaboration and user participation is one of the most important terms in this definition and it is what makes Web 2.0 different from traditional web sites that have mainly focused on content delivery rather than interaction and collaboration among users of content. Considered from an e-business perspective, there are important analogies, especially the shift from mass delivery to customized goods and services that are co-created by traditional sellers and customers.

DOI: 10.4018/978-1-61520-611-7.ch101

Interestingly, this analogy is not yet widely reflected in the technology support. If business would move from traditional provider-customer interaction to the so-called c-business, the respective support technologies need to be designed so that the social processes of collaboration become an integral part. First examples of web-based collaborative applications provide hints towards the future of c-business: *Google Docs* (http://google.docs.com), *Yahoo Groups* (http://groups.yahoo.com/), the *Amazon bookstore* (http://amazon.com/), or *Google Earth* (http://earth.google.com/) are all instances with comparable characteristics. They activate the users to create and share information instead of only consuming information created by a single owning company. At Google Earth, users, e.g., tag the map of the earth with points of interest or photography that is shared among all users. The information provider (Google) transfers parts of his business to the customers and acts as an enabler for information creation done by customers. Through the efforts of the user community, the map becomes a reflection of what the inhabitants of the different places on the map consider as relevant. The same is true for the Amazon book store: by allowing users to comment on books and to comment on comments, the bookstore becomes a place for exchanging thoughts rather than just consuming. Considered from a B2C e-commerce perspective, this increases the stickiness of the store (Schümmer, 2001a). Once customers are involved in an interaction with other customers, they have additional incentives for returning to the store. Instead of having a community of circumstances that brings together all users who want to buy books, the site evolves to a community of interest for books of a specific topic (Schümmer, 2001a).

Yahoo groups support users in creating places for discussion and exchanging ideas and content. The shared manipulation of files is one of the core ideas of Google Docs where users can interact synchronously on a shared document using just their web browser as client infrastructure. Again, such tools open up new opportunities for e-business. They are the enabling technology that allows organizations to create goal-oriented distributed project teams that collaborate intensively in order to reach a shared objective.

The remaining part of this article discusses aspects common to these e-business applications and presents an approach to capture the best practices within these applications by means of patterns. Then, we describe how patterns for end-users can look like, outline the structure of a pattern language for computer-mediated interaction and explain how the different patterns of this language form a holistic pattern catalogue for computer-mediated interaction. The pattern language is illustrated by means of an example pattern. Finally, we give a conclusion and discuss questions for future work.

## BACKGROUND

Several core aspects that make collaborative e-business applications like the ones described above compelling:

- Users can create and share content.
- Users can get in contact with other users whom they in most cases have not met before.
- Users can express their opinion on content and on users.
- Users become aware of other users' presence and actions, which transforms the usage experience from a single-user experience to a group experience.

Looking more closely at these aspects, all of them have been subject of research and development in the area of computer supported collaborative work (CSCW) and groupware. Peter and Trudy Johnson-Lenz defined groupware systems as "*intentional group processes plus software to support them*". (Johnson-Lenz and Johnson-

Lenz, 1981) Often this definition is extended by considering not only group processes but also community processes. Users interacting in a community follow a common global goal but may have different sub-goals. They contribute to the community in order to satisfy both personal and shared goals.

Tim Berners-Lee commented on the Web 2.0 hype that "Web 2.0 for some people means moving some of the thinking client side so making it more immediate, but the idea of the Web as interaction between people is really what the Web is. That was what it was designed to be as a collaborative space where people can interact." (Berners-Lee, 2006) Thus, the challenges imposed by the Web 2.0 hype are anything else but new. However, the Web 2.0 hype has the positive effect that the aspects of collaboration and human-human interaction that were often ignored by current applications now move back to the focus of many system developers. And, as we see from the examples mentioned above, collaboration opens new potentials that change the way how we can interact over computer networks and move e-business to c-business applications.

## A PATTERN LANGUAGE FOR COMPUTER-MEDIATED INTERACTION

The development of such collaborative applications a challenging task. Apart from the actual task of the application, e.g. editing texts or spreadsheets, developers have to consider various aspects ranging from low-level technical issues up to high-level application usage. Among others, network connections between the collaborating users have to be established to enable communication, parallel input from the collaborating users has to be handled, specific group functions have to be included to provide group awareness, and the data has to be shared and kept consistent to allow users to work on common task at all (Ellis, Gibbs, & Rein, 1991). Nevertheless, the last twenty years of research and development in the area of computer-supported collaborative work have identified various good practices for the design of such applications.

A widely accepted approach to capture and communicate good practice knowledge from experts to novices is to use design patterns. Design patterns are considered as a lingua franca for design (Erickson, 2000). The concept of patterns has its roots in architecture where the architect Christopher Alexander collected a large collection of patterns for designing towns and buildings (Alexander et al., 1977). The core of a pattern description is that it describes a solution to a recurring problem in a specific context. A collection of interrelated patterns forms a pattern language. The pattern language for computer-mediated interaction consists of 71 patterns and captures best practices for the collaborative applications (Schümmer & Lukosch, 2007).

### An End-User Friendly Pattern Structure

When developing collaborative applications not only the interaction of one user with the tool but also the interaction among a number of users has to be taken into account. For a successful application, it is crucial to involve end-users in the development process (Schümmer et al., 2006). Involving end-users in the development process requires that end-users and developers can communicate using a common language. This language has to allow end-users and developers to identify and specify social and technical requirements as well as best practices for a solution. As result, the patterns for computer-mediated interaction always address a *socio-technical* problem. They describe the technology that supports the *group process* and therefore include a technical and a social aspect. Patterns for computer-mediated interaction are thus *socio-technical patterns.* Development processes like the *Oregon Software Development Process*

*(OSDP)* (Schümmer, Lukosch, & Slagter, 2006) rely on such patterns to foster end-user involvement and enable communication as well as interaction among developers and future end-users.

The socio-technical perspective on groupware design has to be aware of three key aspects:

- It is difficult to predict the reciprocal effect of changes to either the social or the technical system.
- The process used to create the socio-technical system will affect the acceptance of the system.
- Both social and technical systems change over time.

Patterns are a good means for empowering the user and the groupware developer so that they can react to the changing requirements during the group process. Besides the standard elements of a design pattern, i.e., a *context description*, a *problem statement*, a *solution statement*, and a *collection of examples* where the solution is in place, the patterns for computer-mediated interaction include several further aspects to address the socio-technical problems.

The structure oft the patterns for computer-mediated interaction is shaped to meet both end-user's and developer's needs for detail and illustration. The *pattern name* is followed by the *intent*, and the *context* of the pattern. All these sections help the reader to decide, whether or not the following pattern may fit into his current situation.

Then follows the core of the pattern composed of the *problem* and the *solution* statement separated by a *scenario* and a *symptoms* section. The *scenario* is a concrete description of a situation where the pattern could be used, which makes the tension of the *problem* statement tangible. The *symptoms* section helps to identify the need for the pattern by describing aspects of the situation more abstract again.

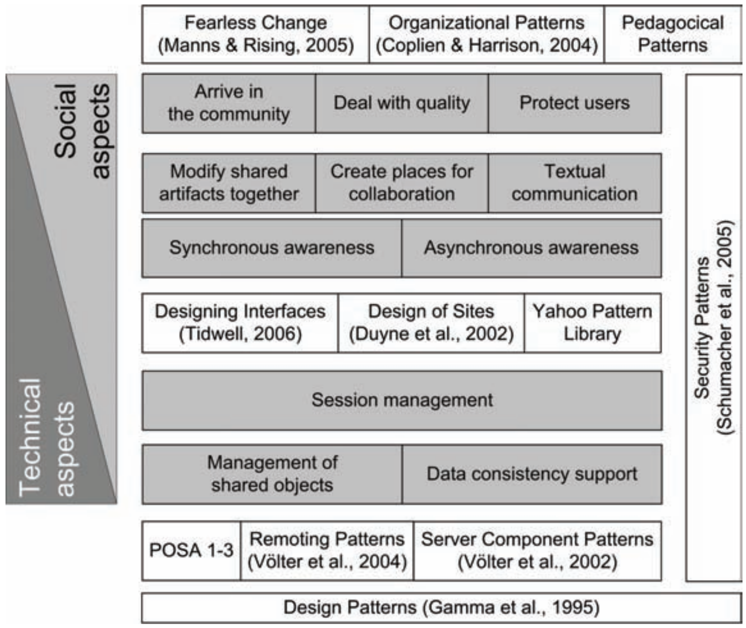
After the *solution* section, the solution is explained in more detail and indications for further improvement after applying the pattern are provided. The *participants* section explains the main components or actors that interact in the pattern and explains how they relate to each other. The *rationale* section explains, why the forces are resolved by the pattern. The *check* section lists a number of questions, one has to answer before applying the pattern in a development context. Unfortunately, the application of a pattern can in some cases raise new unbalanced forces. These counter forces are described in the section labeled *danger spots*.

The solution presented in a pattern represents a proven solution to a recurring problem, so the *known uses* section provides well-known examples where this pattern is applied. Finally, the *related patterns* section states what patterns are closely related to this one, and with which other patterns this one should be used.

The pattern language for computer-mediated interaction (Schümmer & Lukosch, 2007) identifies 11 categories that group the 71 patterns according to the patterns' most important forces. In addition, different abstraction levels show which patterns will be used by whom in the development process. Patterns at a high abstraction level have their main focus on the social process (like the WELCOME AREA pattern) while patterns on a low abstraction level have their main focus on the technical support (such as the CENTRALIZED OBJECTS pattern that describes how shared objects can be accessed from a common location).

Figure 1 shows the different clusters of our language as shaded boxes. Top level clusters address issues at a community level. The clusters in the middle layer address issues on a group level. Finally, the clusters on the lower levels address technical issues. The white boxes represent complementary pattern languages. We will explain the clusters of our pattern language in this section providing a tour through some prominent patterns of the pattern language (Coplien and Harrison, 2004, Manns and Rising, 2005, Tidwell, 2006, Duyne, Landay, & Hong, 2002, Völter, Kircher,

*Figure 1. Layers in the pattern language for computer-mediated interaction*




& Zdun, 2004, Völter, Schmid, & Wolff, 2002, Gamma, Helm, Johnson, & Vlissides, 1995, Schumacher, Fernandez-Buglioni, Hybertson, Buschmann, & Sommerlad, 2005).

When establishing a community, the community owner, i.e., the user interested in the community's topic, will have to think about the relation of community with the surrounding environment. Once, the community is established, it becomes important to deal with quality. Protecting users is especially important in larger communities where not all users know one another. All the patterns in these clusters can be implemented on top of most collaboration infrastructures. With minimal support, e.g., when basing the interaction on e-mail, most of the pattern's implementation will be the design of a social process. However, the processes can also be implemented as part of the groupware application which will provide a better guidance for the users.

The next lower layers describe technical solutions for a better group support. The basic assumption for these patterns is that the members have found peers in a community and now want to better support their tasks in the community. Most importantly, the designer has to think about how to modify shared artifacts together. Users need to be able to access shared information. This rather tool-oriented view on collaboration is complemented with a place-oriented view. The group shapes places for collaboration. Most collaboration support tools offer some means for textual communication. Awareness is an important aspect of computer-mediated interaction. It describes how users can understand the actions of other users in order to situate their own actions in the group context. The synchronous awareness cluster shows ways how this understanding can be achieved if a group of users collaborates at the same time. The cluster of asynchronous awareness complements the patterns from the above cluster with patterns that help to stay aware of collaboration partners over longer times. All the patterns in these clusters rely on a technical collaboration infrastructure.

The infrastructure can again be described on two layers. On a higher level, session management has to be considered and on the lower level, shared objects and concurrent access to these objects needs to be handled. The cluster on session management assumes that collaboration episodes are embedded in a technical representation of users, the computer systems on which they act, and the used artifacts. Sessions are modeled as shared objects. Finally, data consistency support becomes important when users change shared objects at the same time.

## AN EXAMPLE PATTERN: SHARED BROWSING

This section illustrates the concept of the design pattern for computer-mediated interaction by presenting selected parts of the Shared Browsing pattern (Schümmer and Lukosch, 2007). The Shared Browsing pattern can especially be used in B2C e-commerce contexts where customers should interact in the process of product selection.

- **Context:** Users of your application have different degrees of knowledge about the data or the virtual environment that is presented in the application. Now you are thinking about ways to ease their orientation in the environment.
- **Problem:** Users have problems finding relevant information in a collaboration space. They often get lost.
- **Symptoms:** You should consider applying this pattern when...
    - Users take a long time to find the information that they are looking for.
    - The goal is to find the information as a group, but several group members duplicate efforts to reach this goal.
    - Users want to talk about shared artifacts, but do not know how to ensure that their peer user sees the same artifact.
- **Solution:** Browse through the information space together. Provide a means for communication, and collaborative browsers that show the same information at each client's site.
- **Dynamics:** Users collaborate in a shared information space. When interacting with a specific chunk of information, users position themselves at this chunk. The position of each user can be described as a location.

The collaborative browser communicates and shares the location of each user in the group. How this information is processed depends on the navigation strategy of the collaborative browser. Examples of different navigation strategies in collaborative browsing are:

- *Master-slave browsing* in which one user "drives" and the other users follow. Whenever the master user updates the position, this position is also set for all slave users.
- *Anarchistic browsing* that does not have any roles. Whenever one user moves to a new location, all other users follow.
- *Democratic browsing* in which the group has to form a collaborative opinion before its members move on to the next artifact.

**Rationale:** In a study of traditional libraries, Twidale, Nichols, & Paice (1997) showed that browsing should be a collaborative action. Although many searches for information is carried out alone in such places, Twidale et al. (1997) show that interaction between users also takes place.

Since collaborative browsers always show the same artifacts, their users will be able to communicate about the content shown. This helps them to understand the artifacts better.

- **Check:** When applying this pattern, you should answer these questions:
    - How should you represent the view location? Can you use a URL or a coordinate?

    - Which browsing strategies will you offer the users?
- **Known Uses:** *TUKAN* (Schümmer, 2001b), *CobWeb* (Stotts, Prins, Nyland, & Fan, 1998), and *GroupScape* (Graham, 1997).
- **Related Patterns:** Application Sharing, Shared Editing, Remote Field of Vision, Collaborative Session, Floor Control, Vote, Embedded Chat, Replay.

An e-business application scenario for this pattern could be an event-management system where buyers can shop, e.g., for movie tickets. Such a system could be enhanced by the Shared Browsing pattern in order to support a group of friends in the movie selection process. Group members would select relevant movies independently and store references to these movies on a shared wish list. After this phase of independent browsing, they would review the relevant movies together using a master-slave browsing approach.

## CONCLUSION AND FUTURE RESEARCH

In this article, we presented a pattern language for computer-mediated interaction. We discussed the pattern language in the context of other well-known pattern languages and described an example pattern for the use in e-business settings. The pattern language presents a first step towards a better understanding of computer-mediated interaction in a networked environment and offers best practices for designing applications in the emerging c-business domain. Case studies (Schümmer & Lukosch, 2007) on prominent groupware applications, like, e.g., *BSCW* (http://www.bscw.de) or *CoWord* (http://cooffice.ntu/edu.sg/coword), as well as the application of the patterns to design groupware (Lukosch & Schümmer, 2006) show that the most important patterns are captured within the pattern language for computer-mediated interaction. Still, there is a large potential for mining additional patterns in order to complement the pattern language for computer-mediated interaction in the area of workflow management, computer-mediated collaborative learning, gaming and entertainment, media use in collaboration, or mobile and other new computing devices.

## REFERENCES


Alexander, C., Ishikawa, S., Silverstein, M., Jacobson, M., Fiksdahl-King, I., & Angel, S. (1977). *A pattern language*. New York: Oxford University Press.

Berners-Lee, T. (2006). *developerworks interviews*. Retrieved June 1, 2009, from http://www-128.ibm.com/developerworks/podcast/dwi/cm-int082206.txt

Coplien, J. O., & Harrison, N. B. (2004). *Organizational Patterns of Agile Software Development*. Upper Saddle River, NJ: Prentice Hall.

Duyne, D. K. V., Landay, J., & Hong, J. I. (2002). *The Design of Sites: Patterns, Principles, and Processes for Crafting a Customer-Centered Web Experience*. Reading, MA: Addison-Wesley Longman Publishing Co., Inc.

Ellis, C., Gibbs, S., & Rein, G. (1991). Groupware some issues and experiences. *Communications of the ACM*, *34*(1), 38–58. doi:10.1145/99977.99987

Erickson, T. (2000). Lingua francas for design: sacred places and pattern languages. In *Proceedings of the conference on Designing interactive systems*, (pp. 357–368). New York: ACM Press.

Gamma, E., Helm, R., Johnson, R., & Vlissides, J. (1995). *Design Patterns*. Reading, MA: Addison-Wesley.

Graham, T. C. N. (1997). Groupscape: Integrating synchronous groupware and the world wide web. In S. Howard, J. Hammond, & G. Lindgaard, (Eds.), *Human-Computer Interaction, INTERACT '97, IFIP TC13 Interantional Conference on Human-Computer Interaction*, Vol. 96 of *IFIP Conference Proceedings*, (pp. 547–554), Sydney, Australia. Boca Raton, FL: Chapman & Hall.

Johnson-Lenz, P., & Johnson-Lenz, T. (1981). Consider the groupware: Design and group process impacts on communication in the electronic medium. In S. Hiltz & E. Kerr, (Eds.), *Studies of Computer-Mediated Communications Systems: A Synthesis of the Findings*, (Vol. 16). Newark, NJ: Computerized Conferencing and Communications Center, New Jersey Institute of Technology.

Levine, R., Locke, C., Searls, D., & Weinberger, D. (2000). *The cluetrain manifesto*. Cambridge, MA: Perseus Publishing.

Lukosch, S. & Schümmer, T. (2006). Groupware development support with technology patterns. *International Journal of Human Computer Studies, Special Issue on 'Theoretical and Empirical Advances in Groupware Research', 64*(7), 599–610.

Manns, M. L., & Rising, L. (2005). *Fearless Change: Patterns for Introducing New Ideas*. Reading, MA: Addison-Wesley.

Musser, J., O'Reilly, T., & the O'Reilly Radar Team (2006). *Web 2.0 Principles and Best Practices*. Sebastopol, CA: O'Reilly Radar.

Piller, F. (2006). *Mass Customization*. Wiesbaden, Germany: Gabler Verlag.

Schumacher, M., Fernandez-Buglioni, E., Hybertson, D., Buschmann, F., & Sommerlad, P. (2005). *Security Patterns*. Chichester, UK: John Wiley & Sons, Ltd.

Schümmer, T. (2001a). GAMA-Mall – shopping in communities. In L. Fiege, G. Mühl, & U. Wilhelm, (Eds.), *Proceedings of the Second International Workshop on Electronic Commerce (WELCOM'01)*, (pp. 51-62). Heidelberg, Germany: Springer.

Schümmer, T. (2001b). Lost and found in software space. In *Proceedings of the 34th Hawaii International Conference on System Sciences (HICSS-34), Collaboration Systems and Technology*, Maui, HI. Washington, DC: IEEE-Press.

Schümmer, T., & Lukosch, S. (2007). *Patterns for Computer-Mediated Interaction*. Chichester, UK: John Wiley & Sons, Ltd.

Schümmer, T., Lukosch, S., & Slagter, R. (2006). Using patterns to empower end-users – The Oregon software development process for groupware. *International Journal of Cooperative Information Systems, Special Issue on '11th International Workshop on Groupware (CRIWG'05)', 15*(2), 259–288.

Stotts, D., Prins, J., Nyland, L., & Fan, T. (1998). *Cobweb: Tailorable, analyzable rules for collaborative web use*. Technical report, Dept. of Computer Science, University of North Carolina, Chapel Hill.

Tidwell, J. (2006). *Designing Interfaces*. Sebastopol, CA: O'Reilly.

Twidale, M. M., Nichols, D. M., & Paice, C. D. (1997). Browsing is a collaborative process. *Information Processing & Management*, *33*(6), 761–783. doi:10.1016/S0306-4573(97)00040-X

Völter, M., Kircher, M., & Zdun, U. (2004). *Remoting Patterns – Foundations of Enterprise, Internet, and Realtime Distributed Object Middleware.* Chichester, UK: John Wiley & Sons, Ltd.

Völter, M., Schmid, A., & Wolff, E. (2002). *Server Component Patterns: Component Infrastructures Illustrated with EJB*. Chichester, UK: John Wiley & Sons, Ltd.

## KEY TERMS AND DEFINITIONS

**Design Pattern:** Description of a solution to a recurring problem in a specific context.

**Electronic Collaboration:** Process of collaborating by means of electronic tool support.

**Groupware Systems:** Intentional group or community process plus computer support.

**Patterns for Computer-Mediated Interaction:** Design patterns that address the design of groupware systems.

**Pattern Language:** Collection of interrelated patterns for a problem domain.

**Socio-Technical System:** A system that recognizes the interaction between people and technology.

**Socio-Technical Pattern:** A design patterns that combines a technical and a social solution.

**User-Centered Design:** Design process which gives attention to the needs of the end-user.

# Chapter 102
# A SOA-Based Framework for Internet-Enabled CRM

**Wei-Lun Chang**
*Tamkang University, Taiwan*

## INTRODUCTION

Because of changes in the service economy, the service-oriented management (SOM) approach has been adopted widely for contemporary enterprises. Service-oriented management is the operational management of service delivery within a service-oriented architecture[1] (SOA), which provides a differentiated service delivery capability during operation. SOA furnishes a basis for e-service composition and delivery over the Internet and allows e-service companies to design customized e-services and combine them dynamically based on their needs (Ordanini and Pasini, 2008). This concept enables firms to manage and serve customers anytime and anywhere via any device, that is, CRM can be executed without the limitations of location, time, device, and service type.

Customer relationship management (CRM) is a significant issue for today's companies. In particular, a good CRM strategy may assist firms to earn advanced profits, increase customer perceived value, and acquire new customers. In this study, CRM is transformed from traditional CRM (face-to-face) to Internet-Enabled CRM (over the Internet). This chapter defines Internet-Enabled CRM as conducting CRM by utilizing devices which can deliver e-services through the Internet. The extent of Internet-Enabled CRM includes electronic CRM (E-CRM), mobile CRM (M-CRM), and ubiquitous CRM (U-CRM).

In order to apply U-CRM in practice, the existing technologies such as WiMAX/WiFi (infrastructure) and Internet-based environment (platform and device) are required. The notion is to conduct CRM anytime and anywhere via any devices. However, the challenge that companies have faced is the Internet-based environment. While WiMAX and WiFi have been popular recently, people still have troubles to access the Internet anytime and anywhere. The reason is people are still used to access the Internet at a fixed location; particularly, their homes and offices.

DOI: 10.4018/978-1-61520-611-7.ch102

A famous company “NTT DoCoMo” from Japan enables their customers to access Internet-based services via mobile devices. Their report reveals many Japanese users access Internet via mobile devices rather than computers. Hence, companies need to provide more Internet-based services to attract users in accordance with the implementation of these required technologies.

The existing CRM framework is based mostly on the company’s perspective; for example, it considers how to acquire customers, retain customers, and create profits from customers. Hence, a holistic framework for both sides is still lacking, especially for e-service industry. In this work, we propose a value cube and a SOA-based framework for Internet-Enabled CRM. The proposed value cube indicates the difference between conventional CRM and Internet-Enabled CRM in terms of business value, customer perceived value, and social value.

We divide the SOA-based framework into two parts—the customer perspective and the e-service provider perspective—and identify several components to represent the hierarchy in the framework based on SOA technology. We aim to identify the significant elements of and the value of Internet-Enabled CRM and to provide a roadmap and practical and managerial implications for future CRM.

The rest of this chapter is organized as follows. Section 2 discusses the value cube of Internet-Enabled CRM. Section 3 devises a SOA-based CRM framework. Section 4 introduces the value of SOA-based CRM by comparing two different concepts. Section 5 illustrates a taxonomy of CRM e-services. Section 6 provides managerial implications, and the concluding remarks are furnished in Section 7.

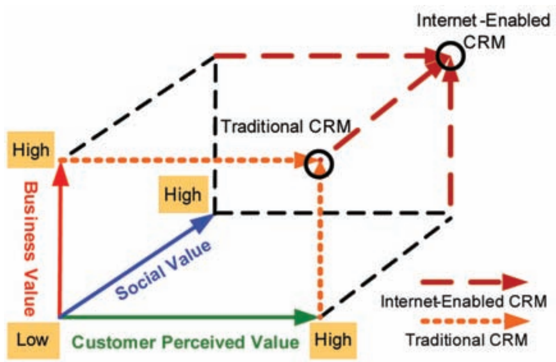
## A VALUE CUBE FOR INTERNET-ENABLED CRM

In the era of wireless technology, three dimensions of value are identified for Internet-enabled CRM: (1) business value, (2) customer perceived value, and (3) social value (see Fig. 1). Business value is generated from companies and is always represented by monetary value (e.g., profits). Firms can easily observe the changes in profit (customer profitability) for a given time period and can modify their CRM strategies accordingly. Customer retention another indicator with which to measure profits. According to the 80/20 rule, 20 percent of customers will generate 80% of a company’s profits, so it is important to retain those customers. Internet-enabled CRM provides Internet-based e-services that customers can access anytime and anywhere, and companies can utilize new technologies (e.g., wireless and mobile devices) to help earn profits based on certain e-services, so Internet-enabled CRM is believed to attain high business value.

Customer perceived value is generated by customers and reflected in their willingness to pay. The concept of willingness-to-pay represents how much customers intend to pay for furnished e-services, and different CRM strategies may result in different behaviors of customers. For example, customers will not pay for the e-services which are inappropriate for them, even if they are delivered. Internet-enabled CRM provides opportunities for customers to acquire the most appropriate e-services when they face problems, and the technology helps companies identify customers’ information, such as location, personalized preferences, and behaviors. Thus, Internet-enabled CRM can help attain high customer perceived value.

Social value is generated by collective intelligence—the wisdom of crowds—over the Internet. According to certain theories (e.g., Delphi method, brainstorming), group decision-making is superior to individual decision-making. Internet-enabled CRM allows peers to assist each other in solving problems based on wireless technologies (e.g., agent-based approach). Traditional CRM merely allows firms to decide what services to deliver—a one-way delivery concept—but Internet-enabled CRM allows peers from the social network to collaborate to decide what e-services will be fur-

*Figure 1. A value cube for internet-enabled CRM*




nished right away. Thus, Internet-enabled CRM is believed to attain high social value.

Basically, companies expect to enhance their profits via good CRM services. In marketing, word-of-mouth is significant to the social network which empowers the firms to enhance the reputation. Thus, many companies spend much money to bloggers who may write positive comments on their blogs to generate advanced social value. The articles from blogs can affect the intention and behavior of potential customers, and surely the customer value may be increased. If the potential customers become the consumers, the firms may earn more profits by enhancing social value and customer perceived value. Hence, the companies are willing to take closer the measurement of social value and customer perceived value.

In short, Internet-enabled CRM facilitates high business value, customer perceived value, and social value in our proposed value cube. Traditional CRM may attain high business value and customer perceived value, but it lacks a social network effect in the e-service delivery process. We believe Internet-enabled CRM is superior to traditional CRM in terms of collaboration for Internet-enabled services. Hence, Internet-enabled CRM is expected to extend social value dimension from low to high and to provide complete solutions for managing customers well.

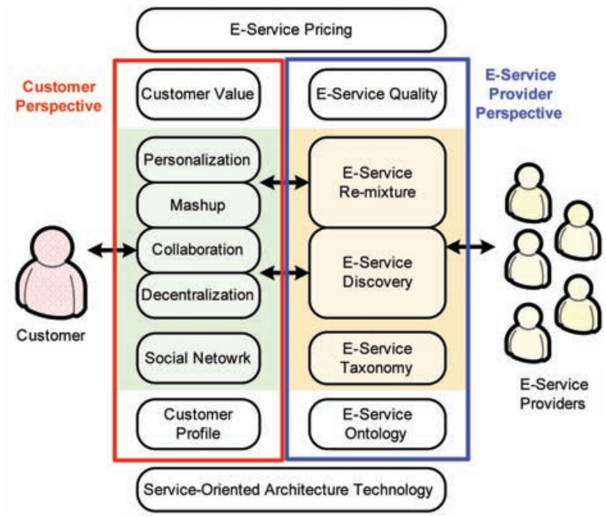
## A SOA-BASED CRM FRAMEWORK

In this research, we define e-services as those that are produced, provided or consumed through the use of ICT-networks, such as Internet-based systems and mobile solutions (Scupola, 2008). E-services have three main characteristics (Hoffman, 2003): (1) the service is accessible via the Internet or other electronic networks, (2) the service is consumed by a person via the Internet or other electronic networks, and (3) the possibility of a fee that the consumer pays the provider for using the e-service. In this section, we propose an innovative SOA-based CRM framework from the customer and e-service provider perspectives. From the customer perspective, the customer profile must be created based on SOA technology. Next, since each customer has a social network (e.g., families, friends), the providers can utilize the power of collective wisdom (collaboration) from the social network to develop a composite of e-services. From the e-service provider perspective, an e-service ontology should be created based on SOA technology. Once the e-service ontology is established, an e-service taxonomy will appear, and e-service providers can discover and re-mix existing e-services in order to match customers' real-time needs. Finally, customer value and e-service quality need to be measured to maintain good relationships between customers and e-service providers. We discuss details of those components in the following sub-sections.

### Customer Perspective

In the customer-perspective part of the framework, we identify significant components for customers, including social network, decentralization/collaboration, mashup/personalization, and customer value. These components are particularly crucial and essential in the environment of Internet-Enabled CRM. The following description demonstrates the concepts and rationales of those components.

*Figure 2. A SOA-based CRM framework*




## Social Network

The social network component indicates the power of collective wisdom. The effect of word-of-mouth is extremely important for the existing Internet environment. In particular, a collective decision is possible from the virtual world and useful for solving problems. For example, we can send a request to any system over the Internet and call for the online help, meaning that collective decisions can be realized anytime and anywhere. The role of online social network is different from the online forums. Our framework aims to help companies form a customer social network which can assists customers to solve problems each other. The concept is similar to online CRM self-services. Peers from the social network are exactly the consumers of the companies rather than ordinary online users from forums. In addition, the online social network also enhances the cohesion of social value. The cohesion of social value is also the key point to affect potential customers.

## Decentralization/Collaboration

Decentralization is the concept of decomposing the efforts of each peer from the social network. Each peer has his or her expertise and can contribute to certain solutions based on a different knowledge base. Decentralization solves the problem of domination by specific peers in the group decision process, and collaboration allows peers to solve problems together collaboratively over the Internet. Peers from a social network discuss and brainstorm with one another to generate solutions. Thus, the proposed solutions will be filtered by peers collaboratively via decentralizing efforts from a group decision-making process (e.g., e-brainstorming, Delphi method).

## Mashup/Personalization

After the solutions are identified by peers from the social network, the e-services should be organized according to required hardware (e.g., a hand-held device) and software (e.g., basic e-services). This is the concept of mashup. Moreover, the composited e-services are personalized and identical to the specific customer because peers in the group decision-making process are selected from the specific customer's social network, which means they are familiar with the customer and can realize the customer's preference more accurately. Thus, the composited e-services are not only personalized but helpful to the customer.

### Customer Value

Customer value is a specific term in Internet-Enabled CRM, which is not the same with current customer lifetime value (CLV) concept; for example, customer value is based on the e-service environment and should be estimated by perceived value. The basic concept of customer value is to explore the perceived value of e-services a customer uses based on his or her access costs.

$$\text{Customer Value} = \frac{\text{Profit}}{\text{Cost}}$$

The traditional concept of customer lifetime value is no longer helpful in identifying the profit from each customer, especially in an e-service environment. Financial indicators are not the only way to estimate customer value. Many e-services are free (Shampanier, 2007) and customers will not pay for them if the services can not solve their problems over the Internet. Hence, a new measurement of customer value is needed for future e-service industry.

## E-Service Provider Perspective

From the perspective of the e-service provider in the framework, we identify significant components for e-service providers, such as e-service ontology, e-service taxonomy, e-service discovery, e-service re-mixture and e-service quality. These components are particularly crucial and essential in the environment of Internet-Enabled CRM. The following descriptions will demonstrate the concepts and rationales of those components.

### E-Service Ontology

E-service ontology is significant for e-service industry, since e-service providers can follow the format of each e-service based on the e-service ontology. However, e-service ontology is not easy to construct because of domain limitations. For example, entertainment e-services have specific attributes, such as scope, required hardware, and memory of device. Daily-life e-services focus on totally different attributes, including personal preference, schedule, and intended objective. Hence, e-service ontology is important and essential in covering the entire e-service industry based on existing SOA technology.

### E-Service Taxonomy

Once the e-service ontology is constructed, we can classify the e-services into different categories. An e-service taxonomy is needed to assist e-service providers in determining to what category the delivered e-service belongs (Cook et al., 1999). The e-service providers can also easily identify what kind of e-services still need to improve or be established in the current status. The taxonomy is useful and essential, so more research can focus on this topic in the future.

### E-Service Discovery

When e-service providers create e-services based on the e-service ontology and position them into appropriate categories according to e-service taxonomy, the providers can easily and quickly discover what e-services they require. Dynamic e-service discovery is a significant part of the e-service delivery process. E-service providers should provide personalized e-services; however, the required e-services need to be composites from different fundamental e-services. Thus, a real-time method to discover e-services is needed to satisfy customer needs at any time.

### E-Service Re-Mixture

An e-service re-mixture component means that e-service providers can reorganize the e-services efficiently. Customer needs are generated according to different contexts; however, work is still need on how to catch up with their needs. The accuracy of delivered e-services is another important issue for e-service re-mixture since, if the e-service providers deliver the wrong e-services, the customer will not use them, resulting in a failed delivery process. If this happens to e-service providers, it will result in poor effectiveness (e.g., do the wrong things) (Robbins and Coulter, 2007). Hence, e-service re-mixture should be efficient and effectiveness.

### E-Service Quality

E-service quality was originally measured by Zeithaml et al. (2005) from the evolution of the PZB model. E-service has specific attributes (e.g., delivery over the Internet or other electronic networks) and issues (e.g., security, privacy) and will be different from conventional services. Today, e-service quality is measured by customer perceptions. However, a fair third party is still lacking which could monitor e-service providers and the quality of delivered e-services. This third party could also provide a fair instrument for measuring e-service quality, not merely customer perception or e-service provider identification. This issue can be elaborated in greater details in future studies.

### E-Service Pricing

Service pricing has become a significant topic in service marketing and has been identified as a potential research issue by Rust and Chung (2006). Zeithaml *et al.* (1985) indicated that cost-oriented pricing was the most popular approach used by service firms. However, while this method offers some advantages, the simplistic nature of cost-oriented pricing is not effective for selling over the Internet. Many researchers have investigated the topic of the pricing of services, and most have emphasized analytical and simulation approaches. However, little has been done on developing appropriate and efficient e-service pricing approaches, even though the existing service pricing method is no longer applicable to the e-service environment. Thus, an appropriate pricing approach is needed for the future e-service industry. Certainly, the pricing method should be based on high customer perceived value and high perceived e-service quality.

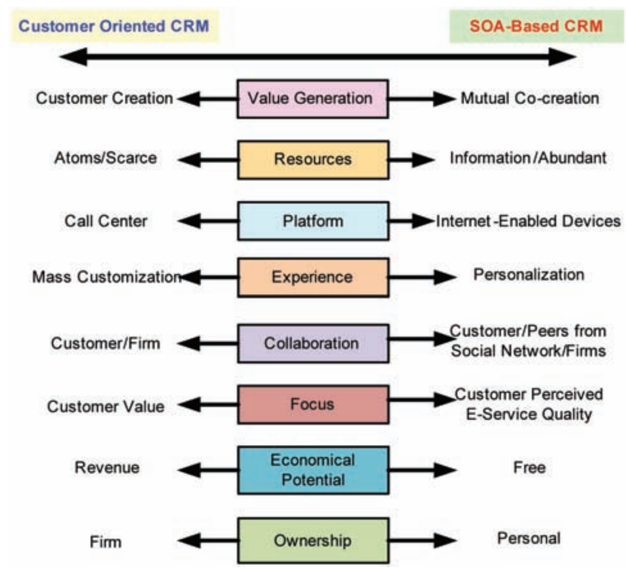
## THE VALUE FOR SOA-BASED CRM

In this section, we compare traditional customer-oriented CRM with SOA-based CRM in terms of value generation, resources, platform, experience, collaboration, focus, economical potential, and ownership (as shown in Figure 3). This work identifies the differences between the two types of CRM and the major characteristics of SOA-based CRM.

First, value is generated in different ways in the two concepts. Customer-oriented CRM provides what the customer needs (customer creation), while SOA-based CRM co-produces what the customer needs (mutual co-creation). In the meantime, the resources for customer-oriented CRM are atoms because of the limited abilities of providers. However, SOA-based CRM enables e-service providers to cooperate with their specific abilities, so resources are abundant because of the various types of furnished information.

The platforms are also different in the two concepts. Customer-oriented CRM operates based on a traditional concept which relies on call centers. SOA-based CRM improves the ability to operate CRM according to Internet-enabled devices. In particular, the notion of experience is varied. SOA-based CRM can attain personalization, but customer-oriented CRM can only reach mass customization. Thus, Internet technology

*Figure 3. A comparison of two CRM concepts*




enables the new CRM concept to get closer to personalization.

Customer-oriented CRM allows the customer and a firm to collaborate at the same time; however, SOA-based CRM strengthens collaboration by getting involved with more roles (e.g., customer, peers from the social network, and e-service providers). Meanwhile, customer-oriented CRM focuses only on customer value in terms of financial perspective, while SOA-based CRM focuses on customer perceived e-service quality. Once the perceived quality is high, the perceived value will be enhanced.

In details, the major difference of customer value between traditional CRM and E-CRM is the characteristics of e-services. The measurement of traditional CRM (e.g., CLV) merely focuses on how much money the customers can generate for the company. We consider the features of e-services such as perceived quality, time to use e-service, and marketing fees for e-services should be taken into account in customer value. These two concepts are complement but not contradiction. For examples, many book stores also have online book stores and customers may be different. If the companies have both types of customers, they can use different concept to measure the precise customer value (either for regular customers or online customers) and generate appropriate strategies.

Moreover, customer-oriented CRM generates revenues for firms when the customers are satisfied and become permanent consumers. However, SOA-based CRM moves toward the concept of the free economy, where customers expect free-to-use future e-services, e.g., searching and free information. Based on this particular phenomenon, e-service providers need to discover other ways to earn money. For example, Google provides many free e-services and earn profits from the advertisement. Free economy will become the trend of the future e-services which may attain sufficient scale of economics. That is, the users will get used to pay nothing over the Internet and the only source of profits will be online advertisement. Finally, the firm owns and controls the generated value for customer-oriented CRM, but each customer can own it for SOA-based CRM.

In summary, traditional customer-oriented CRM is in the mainstream today and is successful in earning profits for firms. SOA-based CRM not only enhances the traditional concept but enables companies with more abilities to strengthen their competitive advantages.

## A TAXONOMY OF CRM E-SERVICES

In this section, we classify CRM e-services as components based on a SOA framework. The existing CRM e-services consist of four major components: attractive e-service, interacting e-service, analytic e-service, and retaining e-service. Attractive e-service provides e-services which employ marketing methods. For example, blog marketing, experience marketing, and 1-to-1 marketing are extremely suitable for e-services. These attractive e-services can be utilized by firms that appeal to customers using an appropriate approach, and e-service providers can devote traditional marketing methods to the Internet environment.

The second component is interacting e-service, which allows firms and customers interact over the Internet. In this category, e-service providers can furnish post-purchase survey e-services, online responding e-services, and collected FAQ e-services. Post-purchase survey e-services allow firms to get a better understanding of their customers after purchase, and online responding e-service enables customers to obtain real-time answers when they have a problem. For example, some travel agents hire employees to work at home and answer questions via Skype. Collected FAQ e-service furnishes fast self-services to customers anytime and anywhere.

The third component is analytic e-service, which is used to analyze customers through two main e-services: statistic analysis and data mining e-services. Statistic analysis employs conventional statistical approaches, like clustering and linear regression, while data mining employs artificial intelligence approaches, like neural networks and genetic algorithms, to analyze customers. Thus, this category provides clues for future e-service providers by furnishing various analytic approaches dynamically via the Internet.

Finally, retaining e-service includes customer segmentation e-service and performance measurement e-service. In this category, the aim is to help firms retain their customers. Customer segmentation e-service can assist firms to segment their customers, identify key value, and provide retaining strategies. Performance measurement e-service provides various metrics with which to measure performance (e.g., retention rate) and the effectiveness of certain strategies.

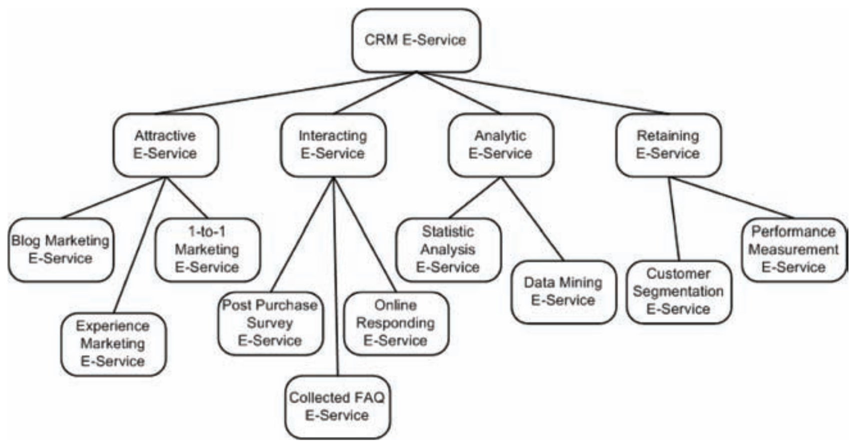
The proposed taxonomy still needs improvement and further elaboration. The existing categories can be extended by any e-service provider in order to embrace the whole concept of CRM e-services.

## MANAGERIAL IMPLICATIONS

### Collective Wisdom Empowerment

A superior example of collective intelligence/wisdom is Wikipedia, which allows each user to contribute knowledge on the platform. Collective intelligence (wisdom) refers to the concept that people can contribute together in order to attain good performance of Internet-Enabled CRM. The proposed framework allows peers to collaborate in order to release the power of collective wisdom. Our SOA-based CRM framework enables each user to expand his or her social network and invite friends to help. Once the number of users increases, the knowledge will be accumulated quickly. For example, the online knowledge base (e.g., Yahoo Knowledge+ in Taiwan) helps many users to solve their problems on their own by self-services. Hence, the SOA-based CRM framework makes social network powerful and feasible for future implementation.

*Figure 4. A taxonomy of CRM e-services*




## Real-Time E-Service Composition

Real-time e-service composition is also a significant issue for Internet-Enabled CRM. E-service providers should be aware of what customers really want at any time, based on their needs. Even when e-service providers acquire customer needs, they still have to compose the required e-services and deliver them to the customer quickly. Certain e-service providers can discover required e-services from the framework (e-service ontology or e-service taxonomy) more efficiently and dynamically bundle them as a package. Our framework advances the e-service delivery process and implements the concept of service-oriented management.

## Win-Win Pricing Strategy

Google is an example to demonstrate that future e-services will be free for charge. However, there are some specialized e-services need to be charged, such as online consultant services or online editing services. Most traditional pricing approaches consider only the firm's perspective, and few studies take into account the customer perspective in the pricing process. Thus, a win-win pricing approach is needed that will consider profit and perceived value simultaneously in the pricing approach. The idea is to ensure at least the minimum profit for firms and the appropriate price (e.g., willingness to pay) for each customer. In addition, we aim to generate a customized and personalized price for each customer based on unique perceived value. Firms can obtain responses from customers by measuring perception of e-services and improve the quality of the e-services based on feedback, and customers can pay the prices based on what they are willing to pay. Hence, using our approach, companies can consider both sides simultaneously to deliver an acceptable and reasonable price. This win-win approach will lead the companies to earn more profits and greater customer satisfaction.

## CONCLUDING REMARKS

This study identifies the importance of Internet-Enabled CRM in terms of an e-service value cube and SOA-based CRM framework. Internet-Enabled CRM is a novel concept that allows e-service providers to deliver e-services anytime and anywhere. In addition, Internet-Enabled CRM empowers collective intelligence based on the customer's social network. The e-service value cube consists of three dimensions of value: (1) business value, (2) customer perceived value, and (3) social value. We aim to attain high business value, high customer perceived value, and high social value using Internet-Enabled CRM.

In addition, the proposed SOA-based CRM framework provides two perspectives: (1) customer perspective and (2) e-service provider perspective. The e-service providers can follow the guidelines for concepts such as e-service ontology and e-service taxonomy to create and position their e-services. They also can discover and remix in real time the existing e-services in order to satisfy customer needs immediately. Customers can utilize their social networks to get help via group decision-making using agent-based technology; that is, the collective wisdom can be realized over our framework. In short, this work identifies the components for Internet-Enabled CRM and provides a roadmap for the future e-service industry.

## REFERENCES


Cook, D. P., Goh, C. H., & Chung, C. H. (1999). Service Typologies: A State of the Art Survey. *Production and Operations Management*, *8*(3), 318–338.

Hoffman, K. D. (2003). Marketing + MIS=E-service. *Communications of the ACM*, *46*(6), 53–55. doi:10.1145/777313.777340

Ordanini, A., & Pasini, P. (2008). Service co-production and value co-creation: The case for a service-oriented architecture (SOA). *European Management Journal*, *26*, 289–297. doi:10.1016/j.emj.2008.04.005

Robbins, S. P., & Coulter, M. (2007). *Management, Pearson International Edition* (9th). Upper Saddle River, NJ: Pearson Education.

Rust, R. T., & Chung, T. S. (2006). Marketing Models of Service and Relationships. *Marketing Science*, *25*(6), 560–580. doi:10.1287/mksc.1050.0139

Scupola, A. (2008). E-Services in Danish Research Libraries: Issues and Challenges at Roskilde University Library. In *Cases on Managing E-Services*. Hershey, PA: IGI Global.

Shampanier, K., Mazar, N., & Ariely, D. (2007). Zero as a Special Price: The True Value of Free Products. *Marketing Science*, *26*(6), 742–757. doi:10.1287/mksc.1060.0254

Zeithaml, V., Parasuraman, A., & Berry, L. L. (1985). Problems and strategies in services marketing. *Journal of Marketing*, *49*(Spring), 33–46. doi:10.2307/1251563

Zeithaml, Valerie A., Parasuraman, A., & Malhorta, A. (2005). E-S-QAL A Multiple-item Scale for Assessing Electronic Service Quality. *Journal of Service Research*, *7*(3), 213–233. doi:10.1177/1094670504271156


## KEY TERMS AND DEFINITIONS

**Internet-Enabled CRM:** The concept that enterprises can conduct customer relationship management via Internet-based platforms. For example, customers can use PC/laptop or mobile device to access Internet. Companies can provide CRM e-services through these devices to assist customers solve their problems anytime and anywhere.

## ENDNOTE

[1] SOA is a method for systems development and integration in which functionality is grouped around business processes and packaged as interoperable services.

# Chapter 103
# Building Context-Aware E-Commerce Systems:
## A Data Mining Approach

**Anahit Martirosyan**
*University of Ottawa, Canada*

**Thomas Tran**
*University of Ottawa, Canada*

**Azzedine Boukerche**
*University of Ottawa, Canada*

## ABSTRACT

*Context is any information/knowledge about an application and user that can be used by an e-commerce system to provide efficient services to the users of the system. In this article, we propose to extend usage of context as compared to previously designed context-aware e-commerce systems. While in previous work, context was mainly considered for mobile e-commerce systems, we propose to build and use context for e-commerce systems in general. The context is employed to tailor an e-commerce application to the preferences and needs of users and provide insights into purchasing activities of users and particular e-commerce stores by means of using Data Mining techniques. This article proposes a model of context that includes micro-, macro- and domain contexts that constitute knowledge about the application and its user on different levels of granularity. The article also proposes a technique for extracting groups in social networks. This knowledge is part of macro-context in the proposed model of context. Moreover, the article discusses some of the challenges of incorporating context with e-commerce systems, emphasizing on the privacy issue, with an ultimate goal of developing intelligent e-commerce systems.*

## 1. INTRODUCTION

While most people tacitly understand what context is, they find it difficult to explain. The term "context-aware system" was first defined by Schilit et al. (1994) as software that "adapts according to its location of use, the collection of nearby people and objects, as well as changes to those objects over time". We adopt the definition of context given by Dey (2001), "Context is any information that can be used to characterize the situation of an

DOI: 10.4018/978-1-61520-611-7.ch103

entity. An entity is a person, place, or object that is considered relevant to the interaction between a user and an application, including the user and the application themselves." With an understanding of what context is, application designers can determine what behaviours or features the applications should support and what context is required to achieve the behaviours.

In order to obtain the knowledge about the users and applications and to be able to tailor the e-commerce system to the preferences and needs of the users, Data mining techniques can be used. E-commerce domain possesses an enormous amount of data which can be mined in order to turn it into knowledge (Ansari et al., 2001). Data mining is the process of analyzing data and summarizing it into useful information (to increase revenue, cut costs etc.), i.e., finding patterns and correlations in the data. Data mining goes through phases of data extraction, storage, analysis, and data presentation in a useful format. Data mining software analyzes relationships and patterns in the stored data based on user queries.

Thus the goal of using data mining in the context of this paper is to gain the knowledge necessary to adapt the e-commerce system to customers based on their needs, interests and preferences, as well as to provide the e-commerce stores, manufacturers/suppliers with useful insights into purchasing activity of the customers, as discussed in the following sections.

## 2. BACKGROUND

The research on context-aware e-commerce systems mostly concentrates on mobile-commerce (m-commerce) (Tarasevich (2003), Vassilakis et al. (2007), Thawani et al. (2007), Jin & Miyazawa (2002)). Three broad categories of context are considered in the model of context for m-commerce proposed by Tarasevich (2003), namely environment, participants and activities. The "Environment" component of the model considers the physical properties of objects in the physical environment such as location, brightness, and noise level, etc. The "Participants" category considers properties of the user(s) and other participants. These include the user's location as well as the user's personal properties (such as gender, age, education). The "Activities" category includes the tasks and goals that the participants have, it also includes events in the environment (e.g., weather). The model as well considers the possible interactions between different categories of the context model. Time is also incorporated into the model. This enables building context history and predicting the future context.

Vassilakis et al. (2007) discuss the issues, challenges and research directions for mobile and context-aware e-commerce. The context taken into account by the applications can involve location, time of access, the devices used to access an m-commerce application, the communication network, the nature of transaction carried out etc. The challenges that are introduced by the mobile and context-aware e-commerce systems are dictated by the limited communication bandwidth, limited computational power, small screen size of mobile devices (such as PDAs and cell phones). An important aspect of the applications is the user interface issue.

In m-commerce applications, due to user mobility, users can be anywhere anytime (location context) while running an m-commerce application. Mobile devices' limitations such as small screen and key pads add other challenges to m-commerce applications. These challenges can be resolved by employing natural interfaces (such as speech interface) instead of traditional screen and keyboard as in the e-commerce applications, which would allow a user to be mobile (e.g., ride a bicycle) and use the m-commerce application. By making an m-commerce application context-aware, the application can successfully be used when environmental conditions, user's circumstances and user priorities change.

User modelling is considered a key concern in context-aware applications (Samulowitz, 2001). The paper proposes a hierarchical structure relating different user models to each other. A user model contains the system's assumptions about users. User models enhance usability of applications by embedding information about users such as location-based services and service discovery to name just a few. In a hierarchical user model, a user may have multiple models each specialized on a certain context of use. However, there may be certain information common to all of the models, such as settings regarding the security and privacy issues. In the hierarchy of user models this information will be propagated to the other user models.

The research directions of integrating e-commerce with Data Mining, its architectural issues and challenges are discussed by Ansari et al. (2001). The paper proposes an integrated architecture for supporting the integration of e-commerce with Data Mining. Due to the proposed architecture the processes of pre-processing, cleaning and data understanding are significantly reduced. The data collection is performed at the application server layer as opposed to web servers with the goal of supporting the logging of data and metadata necessary for the knowledge discovery process. The proposed architecture includes data transformation bridges required to link the transaction processing system and customers' click streams to data warehouses for analysis purposes.

A context-aware and location-based mobile e-commerce server is proposed by Jin & Miyazawa (2002). It provides location-based and context-aware services to mobile users and helps the mobile e-commerce service providers to improve the effectiveness of their services, while targeting the real-time e-commerce services for mobile users. The proposed scheme focuses on the middleware technologies that enable context-aware services to mobile users, providing the services in a seamless way anytime and anywhere the users need them.

## 3. THE PROPOSED MODEL OF CONTEXT

Our proposed model of context is hierarchical. It consists of three levels: micro-, macro- and domain (Figure 1). The context information is obtained by means of mining the data from distributed DBMSs and the Web. The representative characteristics of each component of the proposed model of context are presented in Table 1.

The *micro-context* is composed of the user profile (name, gender, address, occupation etc.); the preferences of the user are needed to personalize and adapt the application to the needs of a particular user. At this level of context in our proposed model, the e-commerce application adapts to the customers' needs and interests. The benefit from this process for the user is convenience

*Figure 1. The proposed model of context for e-commerce system*

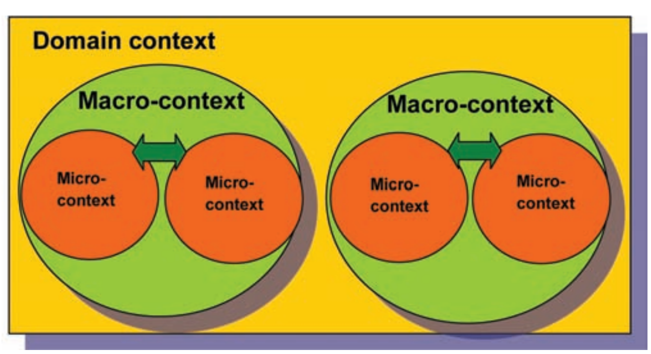


*Table 1. Representative characteristics of the proposed model of context*

| *Category* | *Representative Characteristics* |
|---|---|
| Micro-context | Customer profile (name, address, age, gender, education, preferences, personalization details etc.) location, time… |
| Macro-context | Knowledge about buying patterns of customers on the e-commerce site, most and least favourite items, social interactions (social networks), influential customers, social recommender systems … |
| Domain context | Knowledge about buying patterns of customers on the level of an e-commerce Community |

and friendliness of the e-store. (In this paper, the terms e-commerce store, e-store and online store are used interchangeably.) For the seller, on the other hand, this has the consequences of potential increase in sales as, if a user finds the shopping at the particular e-store convenient, he or she will most probably return to the store again.

The outcome of micro-context, i.e. the knowledge about particular user(s) becomes an input for the *macro-context* category of the model. In addition, the macro-context category also contains the information about social aspect of the e-commerce store (such as social groups, influential customers, and social recommender systems (Kim & Srivastava, 2007). At this level, the buying patterns of customers on a given e-commerce site are identified (e.g., most and least favourite products, association rules) by means of data mining. Macro-context can be used to predict buying activity of users of the site and to plan for inventory of products. The social aspect of e-commerce systems consists of the information about social interactions, influential customers, social recommender systems, i.e. this level of context considers relationships between the building blocks – micro-contexts.

Web stores that are specializing in the same domain (e.g., electronics, books) can have distributed databases and build data warehouses with the goal of creating *domain context.* For example, bestbuy.com, futureshop.com, tigerdirect.com can join to form a virtual e-commerce community. The performance of data mining is usually better on larger data sets, i.e. the knowledge obtained from mining the data available from a set of e-commerce stores can provide each store with useful insights into purchasing preferences. The data can be collected and analyzed in order to identify frequent patterns of purchased items, most and least popular items, etc. E-commerce sites can as well identify for themselves which stores in the domain are more popular and change their policy accordingly (e.g., efficient website design, free delivery, extended warranty, rewards etc.) to attract more customers to their stores. Manufacturers and suppliers can also be given access to the data warehouses for mining the data and can therefore benefit from the knowledge obtained from mining the available data. Thus, in our proposed model of context, the output of the previous level becomes an input for the following one.

## 3.1. Macro-Context: Extracting Social Groups

As already mentioned, macro-context contains the knowledge about social groups and interactions between the consumers of an e-store. As discussed by Kim & Srivastava (2007), to extract communities, one of the possible ways is to build a weighted network in which each link has a weight. The nodes (customers) in the network are separated into groups by maximizing the within-group link weights and minimizing between-group link weights. The weight of a link is defined as the strength of the social relationship based on the co-occurrence of nodes *i* and *j* on web pages. One of the ways to accomplish this is by using Point-wise Mutual Information (PMI):

$$PMI(i,j) = \log_2(P(i \wedge j) \,/\, (P(i)P(j))) \,. \qquad (1)$$

In (1), $P(i \wedge j)$ is the probability of nodes *i* and *j* to co-occur on the same site; $P(i)$ and $P(j)$ are the probabilities for nodes *i* and *j* to occur on the site alone, respectively. PMI is used as an indicator of statistical dependence of two entities, in this case, the customers. If two customers tend to co-occur on the same site, then PMI will have a high positive value. Otherwise, the value of PMI is zero (i.e., the two customers are statistically independent), or negative (i.e., if one of the customers appears on the web site, the other one tends to be absent).

The objective of extracting groups from social networks is to ensure that the groups contain consumers with similar interests "in order to maximize the word-of-mouth effect in an individual subgroup" (Kim & Srivastava, 2007) to ensure that when some of the customers are targeted for a product's marketing, they will in turn influence the decision making process of the customers in the same social group. However, we note that if only PMI is used as an indicator of users' similarities, then a social group may contain members with opposite interests (i.e., consumers *i* and *j* may have opposite opinions about a product, but still have a high value of PMI(*i*,*j*) because they tend to co-occur on the same sites).

We propose to combine user interaction information, which is based on PMI, together with the information about user preference similarity. Also, we propose to collect user review rating information and use it together with the user preference similarity and user interaction information with the goal of extracting social groups in networks. This way, social groups will include only the nodes that have similar preferences and interests. To be more precise, this way the links between two nodes that have similar preferences will have a high weight in the weighted network.

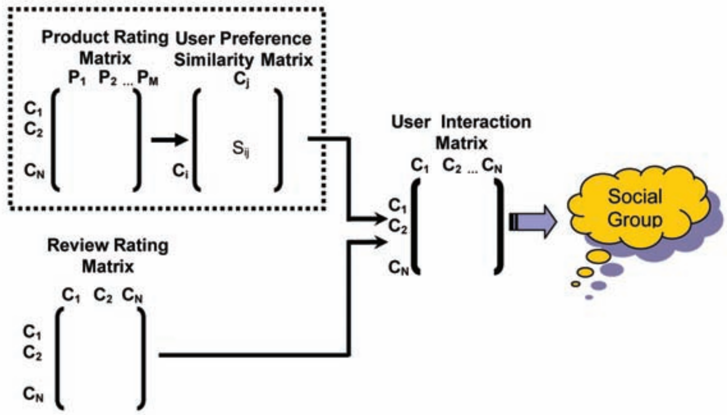
It is necessary to note that the user preference similarity and review rating, shown in Figure 3, provide complementary to each other information regarding the similarity of interests, preferences and tastes of customers *i* and *j*. The two matrices may be incomplete as neither all customers rate the products nor they rate each other's reviews. However, to use the information that is available in these matrices, will ensure the grouping of consumers based on the similarities of their preferences and not simply on co-occurrence.

Let $S_{ij}$ be the value of user preference similarity for users *i* and *j* (i.e., the corresponding element of the user preference similarity matrix for consumers *i* and *j*). After the proposed review rating matrix is constructed, let $R_{ij}$ be the corresponding value of the rating of customer *i* on customer *j*'s review regarding a given product. Then, the procedure of extracting groups from social networks can go through the following two-step process of selecting strongly connected nodes (as shown in Figure 2).

1. Calculate the co-occurrence measure (PMI) for nodes i and j;
2. *IF* (($S_{ij}$ != 0) *OR* ($R_{ij}$ > T)), then the link in the social network connecting the nodes *i* and *j* is assigned a high weight. Here $S_{ij}$ is preference similarity value; $R_{ij}$ – review rating value; T – threshold in review rating values (explained below).

For example, if a review evaluation is in the interval [1, 5], the threshold T can have value 4. If the evaluation of a review is in a verbal form, ranging from "not useful" to "very useful", the formula will be modified accordingly. The idea is, if a customer *i* rates customer *j*'s review as "useful" or "very useful", the link *ij* will have a high weight, so that the nodes are eventually grouped in a single group. With regards to the preference similarity matrix, if there is an element in the

*Figure 2. The proposed process of extracting social groups in a network that combines user interaction information with the information about user preference similarity and user review rating*




user preference similarity matrix (it is not zero), then again the users are grouped in a single social group. This way, social groups will include nodes with similar preferences/interests/tastes.

Moreover, by using the information from the review rating matrix, it is possible to identify the most influential customers (e.g., the customer, whose reviews were rated as helpful the most) and target them when marketing a new product.

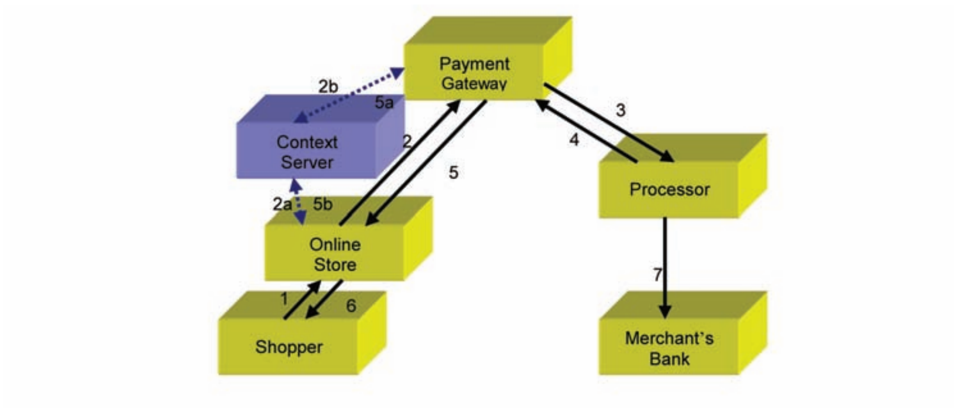
## 4. CHALLENGES

Many of the challenges of integrating context into an e-commerce system are inherited from those of data mining. The overhead associated with pre-processing, processing, storing, and communication represents the main drawback of a context-aware e-commerce system. A few measures could be taken in order to decrease the overhead, which are discussed below:

- Storing the data necessary for building the context after it has been processed is not needed (however, the records about purchasing activity will be stored for warranty issues, return policy etc.). Instead, snapshots of the information can be stored in a compressed form to reduce the demands on storage capacity.
- Using some schedule for data mining (there is no need to increment the context after every new transaction or a new social activity). That is, the e-commerce website can be interested in statistics for a month, quarter, year etc. This way, the processing computational cost will be reduced.
- Employing efficient algorithms for extracting association rules from databases (e.g., algorithms such as those presented by Agrawal et al. (1993, 1994)).
- Analyzing certain data online (from the streams), thus eliminating the need for its storage. For example, social interactions will be captured from the streams.

Privacy issue is becoming more important as the e-commerce stores start to capture social interactions among their consumers with the goal to increase sales by identifying most influential customers and targeting them when marketing a new product (Kim & Srivastava, 2007). The implication of this process is that customers' personal data may be used without them even knowing

*Figure 3. Credit card authorization process when using context servers*




about it. Privacy issues should be addressed on the micro-context level in our proposed model of context.

We classify the data mined in e-commerce systems as *personal* (name, address, age, gender, social groups etc.) and *anonymous* (most and least sold products, associations etc.). One way of addressing privacy issues in the systems could be ensuring that an e-commerce site only knows usernames of customers but does not know their true identities. The data constituting context can be stored at local and remote secure context servers, which support a security protocol (such as Secure Socket Layer, SHTTP) that encrypts and decrypts messages to protect them against third party tampering. We propose to collect and store some or all personal data at the remote context servers, while storing the anonymous data locally, at the e-commerce's site. Thus, personal data is isolated from e-commerce stores. Below we demonstrate a possible way of the credit card authorization process when using context servers.

## 4.1. A Scenario: Credit Card Authorization Process Using Context Servers

Figure 3 shows the entities that are involved in the credit card authorization process and the path of an online order. Yellow blocks and black solid arrows represent the typical (simplified) procedure of credit card authorization (Retrieved April 15th, 2008 from the following websites: http://wilson-web.com/wct4/images/process-ani.gif; http://help.yahoo.com/l/us/yahoo/smallbusiness/store/order/order-21.html).

Below are the steps that the process goes through:

1. *Shopper* submits an online order.
2. *Online Store* transmits credit card information securely, using *Payment Gateway* to *Processor*.
3. *Processor* checks if the card is over-drafted or stolen.
4. If everything is OK, *Processor* sends authorization number to *Payment Gateway.*
5. *Payment Gateway* sends the authorization number to *Online Store's* order form.
6. *Shopper* is notified about successful transaction.
7. Money is withdrawn from the credit card after the product is shipped.

The blue block and blue dashed arrows represent a potential implementation of the proposed method of using context servers that contain the personal information of consumers. The context server knows the mapping between the consumer's username and the corresponding data such as the real name, address, etc. The context server may learn this mapping information during a consumer's registration with the e-commerce store (with a redirection to the context server's web site). In this case, the step 2 is broken into two steps 2a and 2b, while the step 5 is broken into two steps 5a and 5b as described below:

2a. *Online Store* sends the order form to *Context Server* (with the username).
2b. *Context Server* transmits credit card information securely, using *Payment Gateway* to *Processor* (with the real name).
*5a. Payment Gateway* sends the authorization number to *Context Server*.
5b. *Context Server* sends the authorization number to the online store (with the username).

## 5. CONCLUSION

In this project we proposed a model of context for e-commerce systems. We also proposed a technique for extracting social communities while integrating user preferences and review rating information with the data about social interactions. It is important to have an accepted model of context in order to design and implement user-centric e-commerce systems including building distributed DBMSs over the cooperating e-stores, agreeing on the format of web sites, mining certain parameters from the streams etc. The ultimate goal of incorporating context with an e-commerce system is to tune/adapt/tailor the system to the needs of customers. The benefits are clearly on the levels of consumers, e-commerce stores and e-communities, as well as product manufacturers and suppliers. The main drawback is overhead associated with collecting, pre-processing, storing, and processing the data, etc. We attempted to list some of the challenges that need to be resolved when building context-aware e-commerce systems and propose some possible solutions, with a special emphasis on the privacy issues. We believe that our proposed model of context serves as the basis for the development of more intelligent e-commerce systems, adopting a user-centred approach.

## REFERENCES

Agarwal, R., & Srikant, R. (1994). Fast Algorithms for Mining Association Rules. In *VLDB*.

Agrawal, R., Imielinsko, T., & Swami, A. (1993). Mining Association Rules between Sets of Items in Large Databases. In *VLDB*.

Ansari, S., Kohavi, R., Mason, L., & Zheng, Z. (2001). Integrating E-Commerce and Data Mining: Architecture and Challenges. In *Data Mining*, ICDM.

Dey, A. (2001). Understanding and Using Context. *Personal and Ubiquitous Computing*, *5*(1).

Jin, L., & Miyazawa, T. (2002). MRM Server: A Context-aware and Location-based Mobile E-Commerce Server. In *Proceedings of WMC*.

Kim, Y. A., & Srivastava, J. (2007). Impact of Social Influence in E-Commerce Decision Making. In *ICEC*, 293-302.

Samulowitz, M. (2001). Designing a Hierarchy of User Models for Context-Aware Applications. In *Proceedings of the 2nd ACM international workshop on Data engineering for wireless and mobile access,* (pp. 20-26).

Schilit, B., Adams, N., & Want, R. (1994). Context-Aware Computing Applications. In *First International Workshop on Mobile Computing Systems and Applications*.

Tarasewich, P. (2003). Designing Mobile Commerce Applications. *Communications of the ACM*, *46*(12). doi:10.1145/953460.953489

Thawani, A., Gopalan, S., Sridhar, V., & Ramamritham, K. (2007). Context-aware Timely Information Delivery in Mobile Environments. *The Computer Journal*.

Vassilakis, C., Lepouras, G., & Skiadopulos, S. (2007). Mobile and Context-Aware e-Commerce: Issues, Challenges and Research Directions. *Journal of Electronic Commerce in Organizations*, Special Issue.

## KEY TERMS AND DEFINITIONS

**E-Commerce:** A division of trade, consisting of buying and selling products and services over an electronic system such as Internet.

**Context:** Any information that is relevant to the interaction between a user and computer system.

**Context-Awareness:** Awareness of a computer system of conditions and changes in the environment, including a user and the application itself.

**Social Network:** A social structure consisting of nodes representing individuals/organizations and links representing their interactions.

**Social Group:** A subset of a social network, which is grouped based on common interests and preferences of nodes.

**Data Mining (Knowledge Discovery):** A process of discovering and extracting patterns in data. It consists of the phases of pre-processing, reporting, exploratory analysis, visualization and modeling.

**Privacy in E-Commerce Domain:** The quality of protecting private information by an e-commerce store from unsanctioned intrusion.

**Point-Wise Mutual Information:** A measure of statistical dependence of two entities (e.g., customers of an e-commerce store).

# Chapter 104
# Efficient Service Task Assignment in Grid Computing Environments

**Angelos Michalas**
*Technological Educational Institute of Western Macedonia, Greece*

**Malamati Louta**
*Harokopio University of Athens, Greece*

## INTRODUCTION

The availability of powerful computers and high-speed network technologies is changing the way computers are used. These technology enhancements led to the possibility of using distributed computers as a single, unified computing resource, leading to what is popularly known as Grid computing (Foster, 2001).

The term Grid is adopted from the power Grid which supplies transparent access to electric power regardless of its source. Cloud computing, scalable computing, global computing, internet computing, and more recently peer-to-peer computing are well known names describing the Grid technology in distributed systems.

Grids facilitate the employment of various nodes comprising supercomputers, storage elements and databases that are distributed for resolving computational demanding problems in many disciplines of science and commerce (Foster, 2001). To utilize Grids effectively, an efficient allocation algorithm is needed to assign service tasks to Grid resources. Thus, assuming that a user wishes to perform a specific service task, which can be served by various candidate Grid nodes (CGNs), a problem that should be addressed is the assignment of the requested service task to the most appropriate Grid node. In this paper, the pertinent problem is called Service Task Allocation (STA).

This study is related to the pertinent previous work in the literature, since efficient resource utilization, load balancing and job scheduling are topics that attract the attention of the researchers, as computational Grids have become an emerging trend on high performance computing. Most studies in the field of resource allocation schemes aim at

DOI: 10.4018/978-1-61520-611-7.ch104

efficiently utilizing the otherwise unutilized computing power spread throughout a network. Different global objectives could be considered, such as minimization of mean service task completion time, maximization of resources utilization (e.g., CPU time), and minimization of mean response ratio, while in most cases load balancing among nodes is considered.

A high level problem statement addressed in the current version of this study may be the following. Given the set of candidate Grid nodes and their layout, the set of service tasks constituting the required services, the resource requirement of each service task in terms of CPU utilization, the characteristics of each Grid node, the current load conditions of each Grid node and of the network links, find the best assignment pattern of service tasks to Grid nodes subject to a set of constraints, associated with the capabilities of the Grid nodes. The proposed service task allocation scheme handles complex services composed by tasks requiring communication (i.e., message exchange) with other service components (e.g., databases). Care is also taken in case there is no resource with available spare capacity so as to accommodate a new service task on a congested system.

Our approach uses an Ant Colony Optimization algorithm (ACO) for service task allocation in Grid computing environments. ACO actions follow the behavioural pattern of real ants in nature, which travel across various paths marking them with pheromone while seeking for food. ACO is used to solve many NP-hard problems including routing, assignment, and scheduling. We assume each service task is an ant and the algorithm sends the ants to search for Grid nodes.

## BACKGROUND

Most studies in the field of resource allocation schemes aim at efficiently utillising the resources spread throughout a network. In most cases the problem is reduced to load balancing among specific nodes. Basic service task assignment strategies comprise the following (Balasubramanian, 2004): First, Round Robin, according to which the tasks are allocated to nodes by simply iterating through the nodes list. Second, Random, where the nodes to be assigned with the tasks are selected randomly. Third, Least Loaded in accordance with which the tasks are assigned to a specific node until a pre-specified threshold is reached. Thereafter, all subsequent requests are transferred to the node with the lowest load and the aforementioned steps are repeated. Fourth, Load Minimum, where the average load of the system is calculated. In case the load of a node is higher than the average node and of the least loaded node by a certain amount, all subsequent requests are transferred to the least loaded location.

According to the task farming paradigm (Andrews, 1991), a pool of tasks and one worker on each node of the system is considered. Each worker repeatedly claims a task from the pool, executes it and claims the next task. This way, the system load is efficiently distributed to the available resources. Considering dynamic, distributed controlled resource allocation, schemes in most cases follow three basic types (Agrawal, 1987): Sender-Initiated, where congested nodes (nodes where the load reaches a predefined threshold) take the initiative and probe other nodes in order to determine the most suitable node (e.g., least loaded node) for remote task execution, Receiver-Initiated, where lightly-loaded nodes search for work in a similar manner (probe other nodes in order to determine the node(s) that should be relieved from tasks e.g., the most loaded node), Symmetrically-Initiated, according to which both congested and lightly loaded nodes take the initiative. In (Lazowska 1986, Krueger 1988) the performance of these schemes is evaluated. The sender-initiated scheme is shown to perform better in light or moderate loaded systems, while the receiver-initiated paradigm is preferable at higher load conditions, under the assumption that the cost of transferring a task between the nodes is comparable for the two schemes. Both sender-initiated and symmetrically-initiated schemes become unstable at high load conditions, especially when the cost of probing other nodes is taken into account.

In general, many approaches have derived and encourage the necessity of adaptive switching between strategies (Svenson, 1992) and dynamic adjustment of decision parameters (e.g., node's load predefined threshold, time interval upon which load information exchange between the nodes should take place) (Xu, 1993). However, depending on the number of nodes in the network, the load balancing technique adopted, the network status, the time required and the complexity introduced, the resource allocation scheme itself may diminish the net benefit of the overall procedure. In (Eager, 1986), the relative benefits of simple versus complex load sharing policies are examined. Using an analytical model for a homogeneous network, the authors concluded that simple policies that require only a small amount of state information perform as well as complex policies.

Researchers also borrow notions from economic fields (particularly, dynamic pricing and game theory) in order to efficiently allocate network resources through the construction of market-based systems (Chavez, 1997). In (Buyya, 2002), a computational economy framework for resource allocation and for regulating supply and demand in grid computing environments is proposed. Specifically, economic models (commodity market models, posted pricing schemes, tender and auction mechanisms), system architectures and policies for resource management are provided for computational grids and peer-to-peer computing systems.

ACO algorithms are based in a behavioral pattern exhibited by ants and more specifically their ability to find shortest paths using pheromone, a chemical substance that ants can deposit and smell across paths. These algorithms have been emerged in the early '90s for the solution of optimization problems. One of the problems ACO tries to solve is the Generalized Assignment Problem (GAP), where a set of tasks $i \in I$ has to be assigned to a set of resources $j \in J$. Each resource has a limited capacity $a_j$. Each task $i$ assigned to resource $j$ consumes a quantity $r_{ij}$ of the resource's capacity. Additionally, the cost $d_j$ of assigning a task to resource $j$ is given. The objective is to find the minimum cost task assignment pattern. Care should be taken to assign tasks to resources with enough spare capacity. In case there is no resource with enough spare capacity, the task is assigned to any resource, producing in this way an infeasible assignment. The first ACO application to the GAP was presented by (Lourenco, 2002) and is called Max-Min Ant System (MMAS). Each service task is represented by an ant and the algorithm allocates ants to resources. The pheromone trail $\tau_j$ represents the desirability of assigning a task to resource $j$. Initially all pheromone trails are set to the inverse of the cost of the respective resource (i.e., $\tau_j(0) = 1/d_j$). Solutions are constructed iteratively by assigning tasks to resources. The probability according to which task $i$ is assigned to resource $j$ is given by:

$$p_j = \frac{\left[\tau_j\right]^a \left[n_j\right]^b}{\sum_k \left[\tau_k\right]^a \left[n_k\right]^b}$$

where $n_j = \tau_j(0) = 1/d_j$ is a heuristic value known a priori for the performance of resource $j$, and $a$, $b$ are two parameters, which determine the relative significance of the pheromone trail and the heuristic information, respectively. After each iteration, the task deposits pheromone on the trail chosen. The amount of pheromone located to a path depends on the feasibility of the solution. A feasible solution is followed by a deposit of 0.05 units of pheromone, whereas 0.01 units of pheromone are deposited when a solution is unfeasible. Several studies of task allocation in grid environments have been proposed since the Min-Max ACO.

(Yan, 2005) uses the basic idea of MMAS ACO. The pheromone deposited on a trail includes a) an encouragement coefficient when a task is completed successfully and the resource is released, b) a punishment coefficient when a job failed and returned from the resource and c) a load balancing factor related to the job finishing rate on a specific resource.

(Chang, 2009) uses a balanced ACO which performs job scheduling according to resources status in grid environment and the size of a given job. Local pheromone update function updates the status of a selected path after job assignment. Global pheromone update function updates the status of all existing paths after the completion of a job.

(Dornermann, 2007) presents a metascheduler which decides where to execute a job in a Grid environment consisting of several administration domains controlled by different local schedulers. The approach is based on the ant colony paradigm to provide good balance of the computational load. The information exchange protocol used is the Anthill framework (Babaoglou 2002) in which AntNests offer services to users based on the work of autonomous agents called Ants. A grid node hosts one running AntNest which receives, schedules and processes Ants as well as sends Ants to neighboring AntNests. State information carried by Ants is used to update pheromones on paths along AntNests. Additionally, Ants may carry jobs which have to be transferred and executed from one AntNest to another.

## METHODOLOGY FUNDAMENTALS

The STA process, as a first step, requires a computational component that will act on behalf of the user. Its role will be to capture the user preferences, requirements and constraints regarding the requested service task and to deliver them in a suitable form to appropriate Grid resource provider entities. As a second step, STA requires an entity that will act on behalf of a Grid resource provider. Each role will be to intercept user requests, acquire and evaluate the corresponding Grid nodes and network load conditions, and ultimately, to select the most appropriate Grid node for the realization of the task. Furthermore, a monitoring module is required. The monitoring module consists of a distributed set of agents, which run on each Grid node. Each agent is responsible for monitoring the load conditions and available resources of the Grid node and delivering them to the Grid resource provider related entity. Additionally, a distributed set of network provider related entities will be responsible for providing the Grid resource provider entity with network load conditions and managing the network connections necessary for resource provisioning.

The following key extensions are made so as to cover the functionality that was identified above. First, the Grid Resource Provider Agent (GRPA) is introduced and assigned with the role of selecting on behalf of the Grid resource provider the best service task assignment pattern. Second, the User Agent (UA) is assigned with the role of promoting the service request to the appropriate GRPA. Third, the Grid Node Agent (GNA) is introduced and assigned with the role of promoting the current load conditions of a CGN. Finally, the Network Provider Agent (NPA) is introduced and assigned with the task of providing current network load conditions (i.e., bandwidth availability) to the appropriate GRPA. In essence, the distributed set of the GNAs and NPAs forms the monitoring module. In other words, the GRPA interacts with the UA in order to acquire the user preferences, requirements and constraints, analyzes the user request in order to identify the respective requirements in terms of CPU, identifies the set of CGNs and their respective capabilities, interacts with the GNAs of the candidate Grid nodes so as to obtain their current load conditions and with the NPAs so as to acquire the network load conditions, and ultimately selects the most appropriate service task assignment pattern.

The GRPA applies an extended version of the MMAS-GAP in which a three step framework iteratively repeated on a set of tasks can be used to describe the proposed algorithm. The first step includes the selection of an unassigned task based on a priority function, and its assignment to the CGN with the maximum pheromone trail value. The second step applies a local search in order to improve the initial solution in case the system is congested and there are no resources with spare capacity so as to accommodate new service task assignments. Finally, in the third step, the pheromone level on paths is updated using the current optimal solution. Our approach is presented in a detailed manner in the next paragraph.

Regarding the system model, we consider a set of Grid nodes $GN$ and a set of links $L$. Each Grid node $n_i \in GN$ corresponds to a server, while each link $l \in L$ corresponds to a physical link that interconnects two nodes $n_i,\ n_j \in GN$. Our system operates in a multi-tasking environment, i.e., several tasks may be executed on a single Grid node sharing its resources (e.g., CPU utilization, memory, disk space). Let $D_i$ denote a set of Grid nodes grouped to form a domain. In essence, domains represent different network segments. A pattern for the physical distribution of the related software components to the service task assignment scheme is given in Figure 1. Each GRPA controls the Grid nodes of a domain. Each GNA is associated with each Grid node, while each NPA is associated with the network elements (e.g., switches or routers) necessary for supporting Grid Node connectivity. The GNA, NPA role (in a sense) is to represent the Grid nodes or network elements, respectively, and to assist GRPA by providing information on the availability of resources of the Grid nodes/network element. Domain state information (load conditions of the Grid nodes of the particular domain and link utilization) is exchanged between the GRPA and the GNAs/NPAs residing in the specific domain.

## The ACO Algorithm

In this paper an extended version of the MMAS-GAP ACO algorithm is used to solve the STA problem. During the construction of a solution, ants chose the CGN where the task should be assigned. The initial pheromone value of each CGN is given by the formula:

$$\tau_j(0) = CPU\_Speed_j \cdot (1 - CPU\_Load_j) \quad (1)$$

Pheromone trails are updated upon assignment of a task on a CGN and upon termination of a task according to the formula:

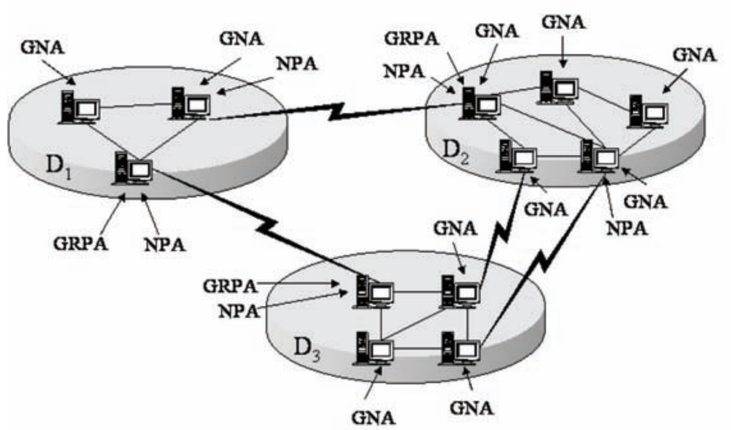
$$\tau_j^{post} = \rho \cdot \tau_j^{pre} + \Delta\tau_{ij} \quad (2)$$

where $\tau_j^{post}$ and $\tau_j^{pre}$ are the trail intensity from a task to CGN $j$ after and before the updating procedure. The excess in accumulation of pheromone is controlled by the use of the pheromone evaporation rate $\rho$ (where $0 \leq \rho \leq 1$). The latter also allows the algorithm to avoid wrong decisions taken in the past (Lourenco, 2002). $\Delta\tau_{ij}$ is the differentiation of the pheromone value a particular task *i* deposits on the path to CGN *j*. Specifically, the pheromone of a resource is reduced upon task assignment in relation to the task size and to the power of the resource. Adversely, the pheromone is refunded to the resource upon job termination. When task $i$ is assigned to CGN *j* $\Delta\tau_{ij} = -M$, while when task $i$ is completed and CGN $j$ is released $\Delta\tau_{ij} = M$. $M$ is a positive value relevant to the computation workload of the task. In the current version of this study:

$$M = \frac{Task\_Instructions_i}{CPU\_Speed_j \cdot (1 - CPU\_Load_j)} \quad (3)$$

The factor $Task\_Instructions_i$ is the number of instructions task $i$ contains. The $CPU\_Speed_j$ factor is the CPU speed of grid node $j$ while the

*Figure 1. System model and physical distribution of the service task assignment related software components*




$CPU\_Load_j$ factor refers to the CPU load of grid node $j$. In case $CPU\_Load_j$ approximates *1* the resource has not enough capacity and another assignment of a task on it should be avoided. The authors consider that $1 - CPU\_Load_j$ assumes the minimum value of 0.001, yielding thus a high value for parameter *M*, so that next tasks could not possibly be assigned on the specific resource. The desirability of assigning task $i$ to CGN $j$ is defined by the following formula:

$$des_{i,j} = \tau_j - Com\_Cost_{i,j} \quad (4)$$

Namely, a task $i$ is assigned to CGN $j$ in case $des_{i,j}$ takes the maximum value among all $j$ resources. In this expression the factor $\tau_j$ is the current trail intensity on CGN $j$. The factor $Com\_Cost_{i,j}$ is the cost of migration to CGN $j$, plus the communication cost introduced in case $i$ service task needs to interact with other service components (e.g., other service tasks or databases) residing on different grid nodes to accomplish its goal. It is defined as:

$$Com\_Cost_{i,j} = \frac{Task\_Size_i}{Bandwidth_j} + \sum_k m_{i,k} \cdot cc_{j,l} \quad (5)$$

In the above formula the volume of messages exchanged between service task $i$ and component $k$ for the accomplishment of task $i$ is represented as $m_{i,k}$, and the communication cost per unit message that is exchanged between grid nodes $j,l$ is represented as $cc_{jl}$ (we suppose that service task $i$ and component $k$ reside respectively on $j,l$ grid nodes). This later factor may be proportional to the distance (e.g., number of hops) between the two grid nodes and the load conditions (e.g., bandwidth availability) of the communication link interconnecting the two nodes.

According to equation (4) the desirability value is proportional to the pheromone $\tau_j$ minus the communication cost given by formula (5). The authors have decided to include in their model the $Com\_Cost_{i,j}$, so as to have a more integrated solution of the service task assignment problem. The additional cost from the interaction of a task with other software units needs to be considered, since most current services are composed by distinct collaborative components.

Local search takes place when there are no resources with enough spare capacity. In such a case, the task is assigned to a resource according to the initial pheromone values of the resources ( $\tau_j(0)$ ). Additionally, the initial pheromone values are also considered in case two or more resources have the maximum desirability value. In case of equal initial pheromone values, the task is assigned randomly to any of these resources.

Based on the aforementioned analysis, the grid node selection process, graphically illustrated in Figure 2, may be described as following:

**Step 1.** The UA component is acquainted with the preferences, requirements and constraints of user $u$ regarding service task $j$.

**Step 2.** The GRPA obtains from the UA user preferences, requirements and constraints concerning the requested task $j$.

**Step 3.** The GRPA retrieves from a database the set of candidate grid nodes for the completion of the service task $j$ as well as the CPU speed of each grid node.

**Step 4.** The GRPA computes for each service task the corresponding resources required for its completion in terms of the number of instructions the task contains.

**Step 5.** The GRPA interacts with the GNAs in order to obtain the current load conditions of each CGN.

**Step 6.** The GRPA contacts the NPAs in order to acquire the current load conditions of the communication links.

**Step 7.** The GRPA estimates the communication cost for service task j, on the basis of equation (5).

**Step 8.** The GRPA solves the appropriate instance of the service task assignment problem (equations (1)-(4)).

**Step 9.** End.

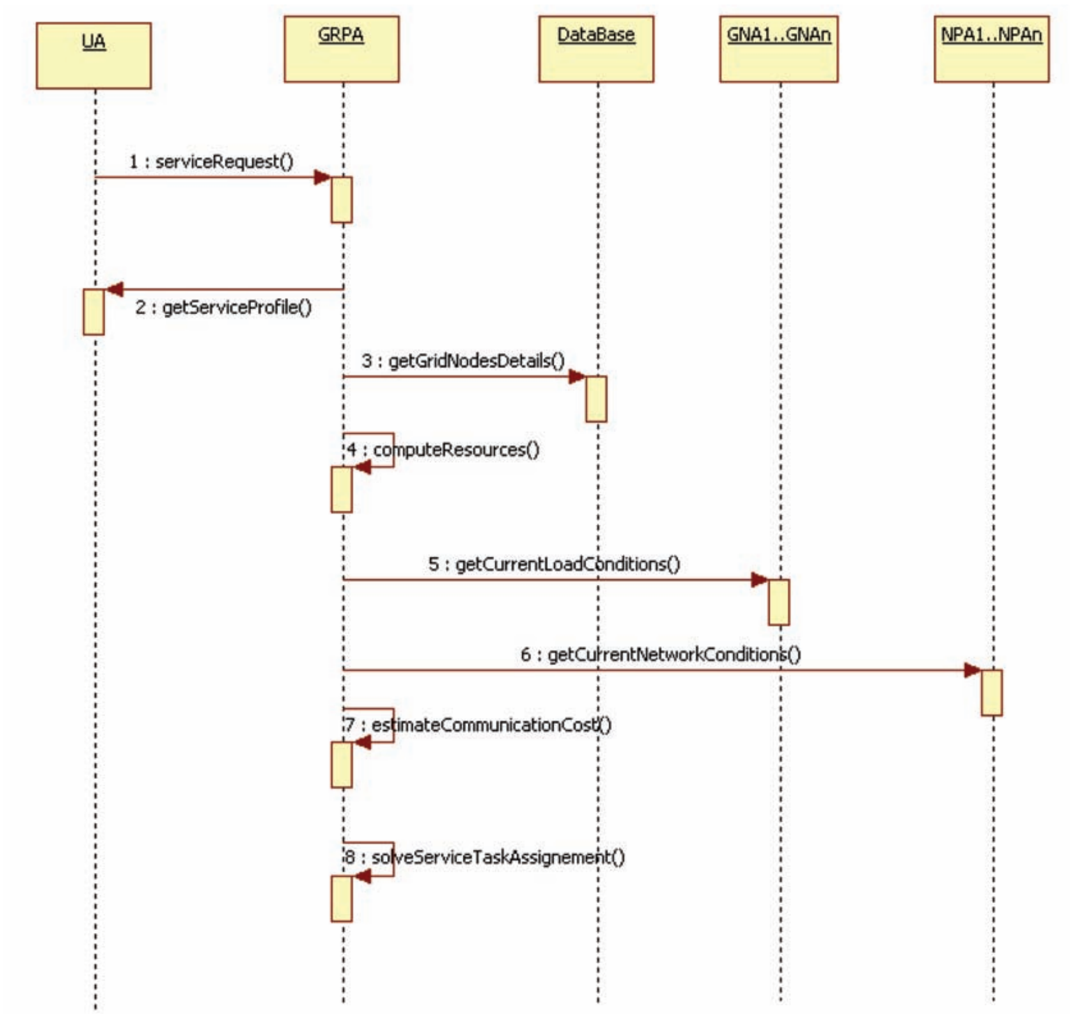
## EXPERIMENTAL RESULTS

In this section, indicative results are provided in order to assess the proposed framework, which allows for effective service task assignment in Grid environments. In order to test the performance of the service task assignment scheme, we conducted experiments on a simulated grid environment composed of six service nodes with the following configuration: three service nodes with 3GHz CPU and 2 GB RAM, two service nodes with 3,2GHz CPU and 2 GB RAM and one service node with 2,7GHz CPU and 1 GB RAM. All service nodes reside on a 100Mbit/sec Ethernet LAN, running the Linux Redhat OS.

Concerning the implementation issues of our experiments, the overall Grid Resource Provisioning System (GRPS) has been implemented in Java. The Voyager mobile agent platform (Voyager) has been used for the realisation of the software components as well as for the inter-component communication. To be more specific, the system components (UA, GRPA and the monitoring module GNAs, NPAs) have been implemented as fixed agents and the service task constituting the service as intelligent mobile agent, which can migrate and execute to remote service nodes.

To evaluate the efficiency of our service task allocation method the following experimental procedure has been followed which is similar to (Chang, 2009). We consider 1500 simple tasks each performing matrix multiplication of real numbers. The matrix sizes are varying from 400x400 up to 1000x1000. The task size depends on its matrix size and is about n x n x 4 bytes (each real number is represented by 4 bytes). The number of instructions that the task contains, can be drawn from task's complexity. Since matrix multiplication has $O(n^3)$ complexity, $2n^3$ instructions are estimated for a $n \times n$ matrix multiplication. Since communication cost is similar for all hosts only the computation workload of tasks is considered.

*Figure 2. Grid node selection process*



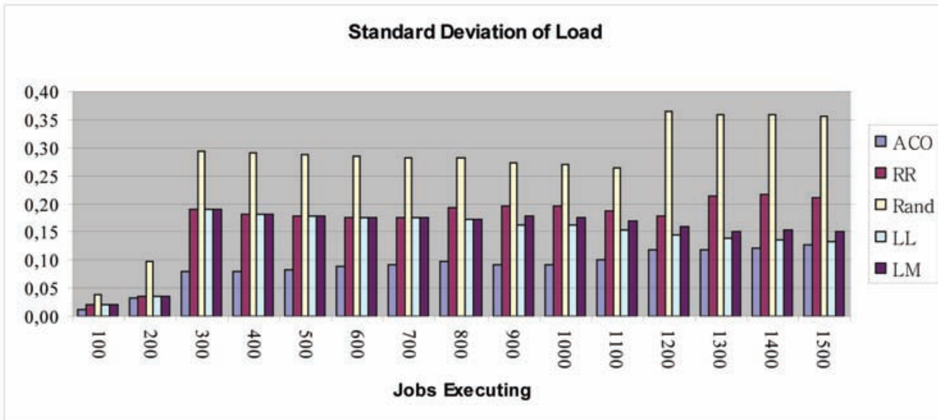

In our experiment we compared the proposed ACO service task allocation scheme with the round robin (RR), the random (Rand), the Least Loaded (LL) and the Load Minimum (LM) assignment algorithms. In order to measure the efficiency of each method we use the standard deviation of CPU load of CGNs. The load of each CGN is sampled after each task assignment and the standard deviation of each method is computed per 100 samples from 100 to 1500 tasks. The standard deviation is computed as:

$$\sigma = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(x_i - \overline{x})^2}$$

where $\sigma$ is the standard deviation $x_i$ is the CPU load of resource $i$ and $\overline{x}$ is the average load of all resources.

Figure 3 illustrates the standard deviation of each method. Low standard deviation values indicate that the system is better load balanced. From the obtained results, we observe a decrease in the standard deviation when the ACO service task assignment scheme is used which verifies that the load of CGNs is better balanced. At this

*Figure 3. Standard deviation of load for ACO, Round Robin, Random, Least Loaded and Load Minimum scheduling algorithms*




point it should be mentioned that the performance improvement is related to the number of tasks being executed on the Grid environment. It may be observed that for a small number of executing tasks (under 200 tasks) there is not significant improvement among different task assignment methods. However, in case more tasks exist in the system, methods such as ACO, Least Loaded and Load Minimum that need state information (e.g., CPU load) perform a lot better than simple allocation methods like Random or Round Robin.

## CONCLUSION

In this study the service task assignment problem in Grid computing environments has been addressed using an Ant Colony Optimization algorithm (ACO). Our objective is to find the best service task assignment pattern, i.e., an assignment of service tasks to Grid nodes that is optimal, given the current load conditions and number of service tasks being served by each Grid node. Experimental results indicate that the proposed framework produces good results in relatively simple contexts (e.g., when a task does not need interactions with other service components). Our scheme manages the load among Grid nodes effectively and performs better than other algorithms requiring similar state information.

Future work includes realization of further wide-scale trials, so as to experiment with the applicability of the framework presented herewith as well as the comparison of our scheme with alternative ACO scheduling algorithms. Moreover, evaluation of the performance of the proposed service task assignment scheme is required in complex contexts where interaction among software components is necessary.

## REFERENCES

Agrawal, R., & Ezzat, A. (1987). Location Independent Remote Execution in NEST. [Washington, DC: IEEE Computer Society.]. *IEEE Transactions on Software Engineering*, *13*(8), 905–912. doi:10.1109/TSE.1987.233509

Andrews, G. (1991). Paradigms for Process Interaction in Distributed Programs. [New York: Association for Computer Machinery.]. *ACM Computing Surveys*, *23*(1), 49–90. doi:10.1145/103162.103164

Babaoglu, O., Meling, H., & Montresor, A. (2002). Anthill: A framework for the development of agent-based peer-to-peer systems. In *Proc. of the 22th International Conference on Distributed Computing Systems* (pp. 15–22), Vienna, Austria. Washington, DC: IEEE.

Balasubramanian, J., Schmidt, D., Dowdy, L., & Othman, O. (2004). Evaluating the Performance of Middleware Load Balancing Strategies. In *Proc. of the 8th International IEEE Enterprise Distributed Object Computing Conference* (pp. 135- 146), Monterey, CA.

Buyya, R., Abramson, D., Giddy, J., & Stockinger, H. (2002). Economic models for resource management and scheduling in Grid computing. [). New York: Wiley InterScience.]. *Concurrency and Computation*, *14*, 1507–1542. doi:10.1002/cpe.690

Chang, R. S., Chang, J. S., & Lin, P. S. (2009). An ant algorithm for balanced job scheduling in grids. *The International Journal of Grid Computing: Theory . Methods and Applications*, *25*, 20–27.

Chavez, A., Moukas, A., & Maes, P. (1997). Challenger: A Multi-agent System for Distributed Resource Allocation. In *Proc. of the 1st International Conference on Autonomous Agents* (pp. 323- 331), New York.

Dörnemann, K., Prenzer, J., & Freisleben, B. (2007). A peer-to-peer meta-scheduler for service-oriented grid environments. In *Proc. of the first international conference on Networks for grid applications* (article no. 7), Lyon, France.

Eager, D., Lazowska, E., & Zahorjan, J. (1986). Adaptive Load Sharing in Homogenous Distributed Systems. *IEEE Transactions on Software Engineering*, *12*, 662–675.

Foster, I., Kesselman, C., Tuecke, S. (2001). The Anatomy of the Grid: Enabling Scalable Virtual Organizations. *International Journal of Supercomputer Applications, 15*(I 3), 200 – 222.

grid computing. In *Proc. of the2005International Conference on Machine Learning and Cybernetics, 5,* (18–21), 2957–2961.

Krueger, P., & Livny, M. (1988). A Comparison of Preemptive and Non-Preemptive Load Distributing. In *Proc. of the 8th International Conference on Distributed Computing Systems*, (pp. 123-130), San Jose, CA.

Lazowska, E., Eager, D., & Zahorjan, J. (1986). A Comparison of Receiver-Initiated Sender-Initiated Dynamic Load Sharing. *Performance Evaluation Review*, *6*(1), 53–68. doi:10.1016/0166-5316(86)90008-8

Lourenco, H., & Serra, D. (2002). Adaptive search heuristics for the generalized assignment problem. *Mathware and Soft Computing*, *9*, 209–234.

Svenson, A. (1992). Dynamic Alternation between Load Sharing Algorithms. In *Proc. Of the 25th Hawaii International Conference on system sciences,* (vol. 1, pp. 193-201), Hawaii, USA.

Voyager Platform. (n.d.). Recursion Software Inc. Retrieved from http://www.recursionsw.com/

Xu, J., & Hwang, K. (1993). Heuristic Methods for Dynamic Load Balancing in a Message-Passing Multicomputer. *Journal of Parallel and Distributed Computing*, *18*, 1–13. doi:10.1006/jpdc.1993.1039

Yan, H., Qin, X., Li, X., Wu, M., (2005). An improved ant algorithm for job scheduling in

## KEY TERMS AND DEFINITIONS

**Grid Computing:** A distributed network of high performance computers, storage elements, sensors and collaboration environments accessed transparently by users. Access to resources is conditional based on factors like authorization, trust, negotiation and resource-based policies.

**Job Scheduling:** An optimization problem in computer science specifying which jobs should be assigned to specific resources at particular times.

**Service Task Allocation:** The way tasks are chosen, coordinated and assigned to resources.

**Load Balancing:** A technique to spread work between two or more computers, network links, CPUs, hard drives, or other resources in order to get optimal resource utilization, maximize throughput, and minimize response time.

**Ant Colony Algorithm:** Ant colony algorithms follow the behavioural pattern of real ants in nature which travel across various paths marking them with pheromone while seeking for food. These kinds of algorithms are used to solve many NP-hard problems including routing, assignment, and scheduling.

**Generalized Assignment Problem:** In this problem a set of tasks $i \in I$ has to be assigned to a set of resources $j \in J$. Each resource has a limited capacity $a_j$. Each task $i$ assigned to resource $j$ consumes a quantity $r_{ij}$ of the resource's capacity. Also the cost $d_j$ of assigning a task to resource $j$ is given. The objective is to find a task assignment pattern which has minimum cost. Care should be taken to assign tasks to resources with enough spare capacity. In case there is no resource with enough spare capacity, the task is assigned to any resource, producing in this way an infeasible assignment.

# Chapter 105
# Policy Driven Negotiation to Improve the QoS in Data Grid

**Ghalem Belalem**
*University of Oran (Es Senia), Algeria*

## INTRODUCTION

Data grids have become an interesting and popular domain in grid community (Foster and Kesselmann, 2004). Generally, the grids are proposed as solutions for large scale systems, where data replication is a well-known technique used to reduce access latency and bandwidth, and increase availability. In splitting of the advantages of replication, there are many problems that should be solved such as,

- The replica placement that determines the optimal locations of replicated data in order to reduce the storage cost and data access (Xu et al, 2002);
- The problem of determining which replica will be accessed to in terms of consistency when we need to execute a read or write operation (Ranganathan and Foster, 2001);
- The problem of degree of replication which consists in finding a minimal number of replicas without reducing the performance of user applications;
- The problem of replica consistency that concerns the consistency of a set of replicated data. This consistency provides a completely coherent view of all the replicas for a user (Gray et al 1996).

Our principal aim, in this article, is to integrate into consistency management service, an approach based on an economic model for resolving conflicts detected in the data grid.

The reminder of the article is organized as follows. The next section describes the fundamental principles of pessimistic and optimistic consistency approaches. Section 3, is devoted to the description of the model used in our consistency management service. In section 4, we describe our consistency

DOI: 10.4018/978-1-61520-611-7.ch105

management service and its algorithms for replicas in data grid. It is based on the economic model (Buyya and Vazhkudai, 2001). An evaluation and comparison of our proposition with other approaches are presented in Section 5. Section 6 briefly presents related pioneering works for resolution of the conflicts among the divergent replicas. Finally, Section 7 concludes this work by some future tracks.

## APPROACHES TO CONSISTENCY MANAGEMENT

Data replica is made up of multiple copies, on separate computers. It is a significant technology which improves availability and execution. But the various replica of the same object should be coherent. There are many consistency models, which neither offer the same performances nor impose the same constraints to the application programmers.

The replica consistency management can be done either in a synchronous way by using what is known as pessimistic algorithms, or in an asynchronous way by employing what is designated as optimistic algorithms.

1. The Pessimistic Approach forbids any access to a replica provided that it is up-to-date (Saito and Shapiro, 2005). This allows guaranteeing a strong consistency, and so avoiding any problem linked to the stage of reconciliation. A basic protocol, called RAWA (Read Any Write All) (Zhoun et al. 2004) consists in obtaining an exclusive bolt on all the copies before affecting a writing (respectively reading) on one of the copies. The availability of the readings is improved with protocol ROWA (Read Once Write All) (Goel et al. 2005). The readings lock and access only one copy, while the write access mode continues to lock and modify all the copies. Nevertheless, this protocol is blocked in the event of breakdowns. Another strategy of replication is proposed by the vote protocol family by Quorum (Rodrigues and Raynal, 2003). The transactions are sent to a group of copies which vote (to decide which update is the most recent: writing or reading). Here, we can raise three major weaknesses of this type of approach:
    - It is very badly adapted to vague or unstable environments, such as mobile systems or grids at strong rate of change;
    - It cannot support the update cost when the degree of replication is very high;
    - It is unsuitable for environments which require data sharing such as collaborative environments.
2. The Optimistic Approach: This approach authorizes access at any time to any replica. In this way, it is then possible to access a replica which is not necessarily coherent (Saito and Shapiro, 2005). So, this approach tolerates a certain difference between replicas. Although it does not guarantee strong consistency as in pessimistic case, it enjoys, nevertheless, certain number of advantages which we can summarize as follows:
    - They improve availability: This is because the access to data is never blocked;
    - They are flexible as regards the network management which does not need to be completely connected so that the replicas are completely accessible;
    - They can support a large number of replicas since they do not require high synchronization among replicas;
    - Its algorithms are well-adapted to large scale systems.

*Table 1. Characteristics of pessimistic and optimistic approaches*

| Characteristics | Pessimistic | Optimistic |
|---|---|---|
| Synchronization | Immediate | Delayed |
| Consistency | Strong | Weak |
| Access time | Significant | Rapid |
| QoS | Good | Mediocre |
| Detection and resolution conflicts | No | Yes |
| Size of applications | Small or average | Large scale |
| Availability | Weak | Strong |

The synthesis of the comparative study of these approaches is represented by Table1 (Belalem and Slimani, 2007).

## MODEL FOR CONSISTENCY MANAGEMENT SERVICE

In our study, we have proposed a Grid model as a collection of n sites with different computational facilities and storage subsystem (see Figure 1). As regards replica consistency management in data grid, we have suggested a service of consistency management which takes a lot of advantage of the traditional pessimistic and optimistic approaches (Belalem and Slimani, 2007). This service is based on a hierarchical model with two levels: level 0 is physical and comprises the replica localization. Level 1 is logical and represents various replica managers: each manager is responsible for one part of level 0.

In our work, we consider a grid as a collection of distributed collections of Computing Elements and Storage Elements. These elements are linked together through a network to form a Site or a Cluster (Figure 2).

Sites are in turn linked together to form a grid. Replicas are stored on Storage Elements and are accessible from Computing Elements. Our model presented in Figure 3 is described as follows:

1. Level 0: in this level, we find sites that compose a grid. Each site contains a set of Computing Elements (CE's) and Storage Elements (SE's). Replicated data are stored in SE's and accessed from CE's via reading or writing operations.

*Figure 1. The system model of a data grid*

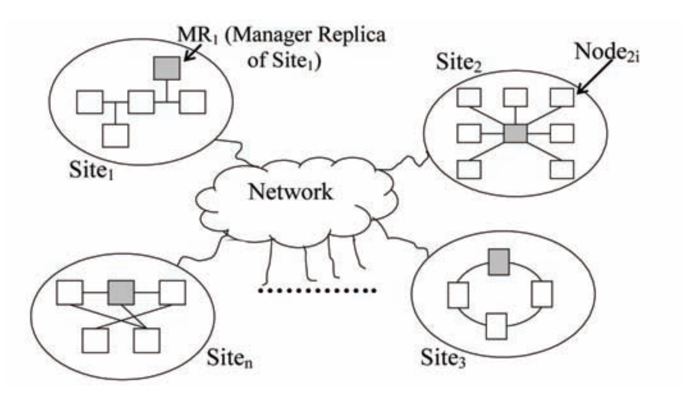
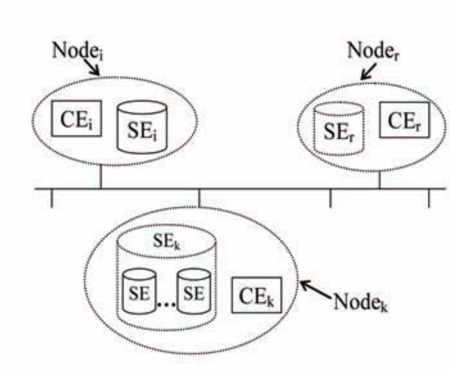


*Figure 2. Architecture of considered site*




2. Level 1: in this level, we define *p* replica manager (*RM)* each one corresponds to each site of a grid. The principal functions of the replica manager of the same object (see Figure 4), within a site, are defined as follows: *(i)* To update, by a mechanism of propagation, the various replicas of the same object within the site with which it is associated and detect a conflict situation; *(ii)* To cooperate with the other managers of the sites to obtain global consistency of Data Grid.

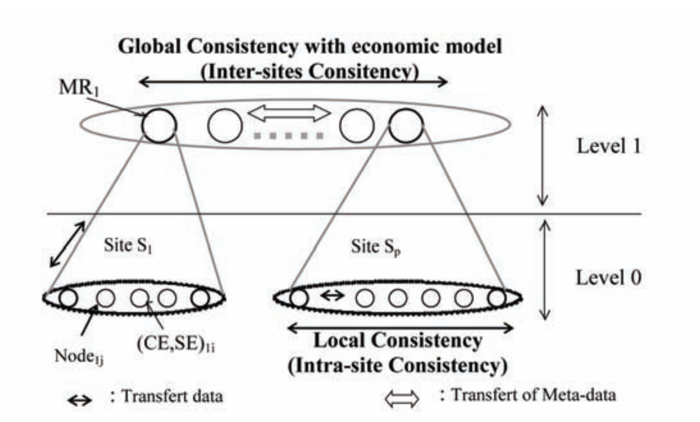
## CONSISTENCY MANAGEMENT WITH AN ECONOMIC MODEL

According to (Saito and Shapiro, 2005), the designers of replicated systems for large scale systems had to choose either the pessimistic consistency, with its associated performance overheads, or the optimistic consistency, with no guarantees as for the probability of conflicting writes or stale read. Between the two extremes (see Figure 5), we present a service for data grid consistency management.

The proposed service for consistency management uses an economic model combined with several models. The latter are employed in the domain of market economy in order to resolve conflicts encountered between replicas. This service of proposed consistency management begins with a preliminary stage which consists in making a pre-processing before the service is started. This preliminary stage is composed of three phases (see Figure 6):

a. The phase of collection of information: to have a life on the status of the site, the manager replicas (*MR*) collects information on each data (metadata) periodically each node containing replicas of this data. This

*Figure 3. Model proposed for consistency management service*



information represents the version of the vector of each replica, the timestamp, the origin of the update.

b. The phase of information analysis: this step, based on the information collected to calculate a set of measures that we have used, allows, for example, the average standard deviation, distance, the number divergence average per site, the number conflict average per site.

c. The phase of decision: From the metrics generated by the analysis phase, the management

Figure 4. Principal functions of MR

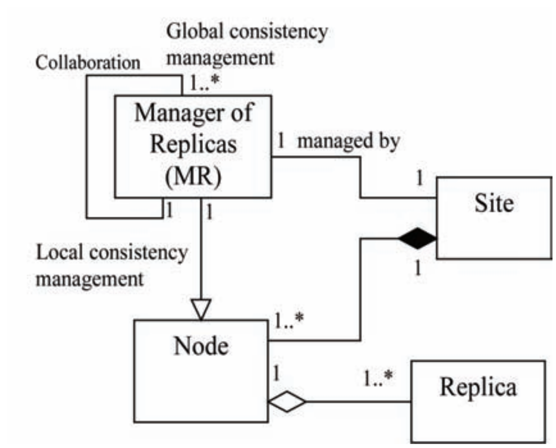



Figure 5. Position of our approach

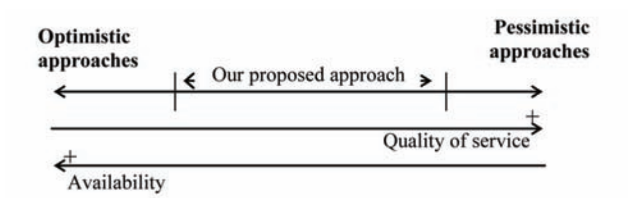
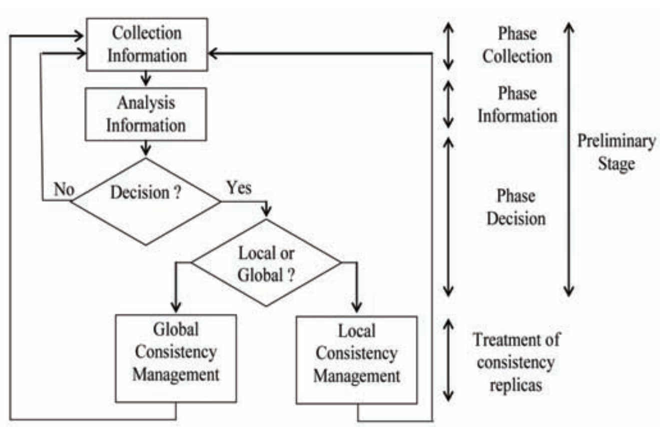



Figure 6. Preliminary stage



service consistency decides or not on the trigger the spread of updates, and on intra-or inter-site locations.

The proposed management service consistency consists of two services (see Figure 7), the first service takes care of the local level (consistency in service intra-site), it enables the convergence of replicas of the same site. The second sub service ensures consistency of data grid replicas, it allows to find a consensus between the sites to push their replicas. We can say that the service under the management of the overall system coherence (consistency inter-sites). These two sub-services are complementary (Belalem and Slimani, 2007) and have as a principal objective to make the whole replicas converge towards the global reference replica of Data Grid.

The main measures used in our work are summarized in Table 2.

Several events can trigger the process of inter-sites consistency service, for example:

1. If one or more sites are in a critical situation (see Algorithm 1);
2. If after each period chosen for consistency inter-sites (periodically).

## 1 Intra-Site Consistency

The essential goal of intra-site of consistency management is to make the data replicas, stored in the same site, converge towards local reference replica. One of two main strategy replications that can be chosen for each site to accommodate requests from users:

- Intra-site of consistency management with a single-master strategy: The process of

*Figure 7. Diagram of consistency management service*

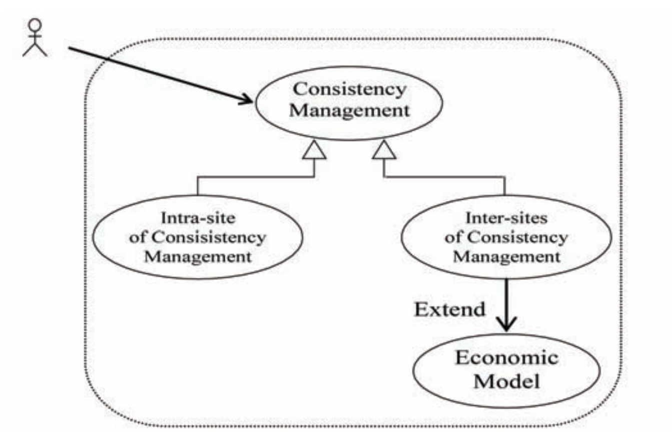



*Table 2. Measures and their definitions*

| Measure | Definition |
|---|---|
| $n_i$ | Number of replicas of same object inside $Site_i$ |
| $D_i$ | $Version_{max}$ - $Version_{min}$ of replicas inside $Site_i$ |
| $\tau_i$ | Rate of number of conflicts inside $Site_i$ |
| $\sigma_i$ | Standard deviation of $Site_i = \sqrt{1/n_i \sum_{t=1}^{n_i} (V_{it} - \overline{V}_i)^2}$ where $\overline{V}_i$ is average version inside $Site_i$ |

intra-site consistency management, with a single-master strategy (Goel et al. 2005), starts by selecting a replica master among all the replicas stored in the nodes of a given site. The node with this replica will be called the manager of replicas of a given file inside a site. In the single-master strategy, a request of a client of writing type, as for a given file, should be carried out only on this master, whereas a request of reading can reach any replica of this file.

- Intra-site of consistency management with multi-master strategy: For intra-site of consistency management with multi-master strategy, a request of a client, type reading or writing, can be carried out on any node with a replica of the file called upon by the request. When a client subjects a request $Req_i(k)$ from a site $S_i$ using replication multi-masters strategy, then this request will be able to reach any replica $p$ of the object $O_k$ of a node of the site $S_i$.

We can summarize the various stages of intra-site consistency sub-service by the Intra-Site Algorithm Consistency (Algorithm 2).

## 2 Inter-Site Consistency

The main objective of sub-service for the inter-site consistency management is to converge replicas of data grid to a reference replica, using models of market economy.

A site is in a critical situation if its versions replicas of the same object are too dispersed. In this case, it is called a site in crisis. The main stages of this consistency are represented in Figure 8.

If the trigger event is then checked, one of the two situations is encountered:

- One or more sites are in a crisis situation, ie, the manager (*MR*) of aftershocks following the analysis of information collected has said that the information collected is much dispersed. Because of this situation,

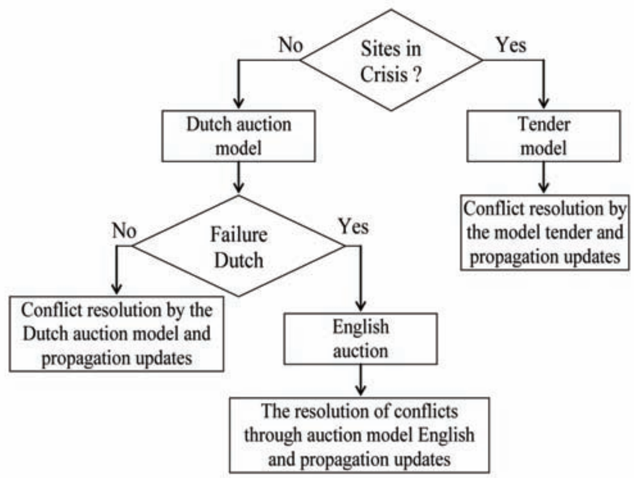
*Algorithm 1 Critical_Situation*

Input $MR_i$
Let $D^m$ Distance tolerated between the versions of replicas
/*$\tau^m$: Rate of conflicts number tolerated */
Begin
Calculate: $\tau_i$, $\sigma_i$; $D_i$ for $MR_i$
If($\tau_i > \tau^m$) or ($\sigma_i > \varepsilon$) or ($D_i > D^m$)
Then return (Critical_Situation ←True)
// Site $MR_i$ is crisis situation
Else return (Critical_Situation ← False)
End

*Algorithm 2 Intra-Site Consistency*

**Begin**
/ * Is a request arriving at the site controlled by $MR_1$ */
**Switch** (Strategy) **Do**
**Case** Single Master: **If** Master = free **Then** treatment of the request of the customer
    **Else** to deposit the request in the queue of the site
**Case** Multi Master: **If** ∃Master = free **Then** treatment of the request of the customer
    **Else** to deposit the request in the queue of the site
**EndSwitch**
**If** Critical_situation($MR_i$)
**Then** Algorithm Inter-sites consistency (***Figure** 7*)
/* $Site_i$ in Crisis */
        **Else** Propagate of updates.
**End**

*Figure 8. The main stages of inter-site consistency*




| *Algorithm 3 Call_Tender* |
|---|
| Calculate $\tau_i$, $D_i$, $\sigma_i$ /* measurements of $i^{th}$ MR */ |
| candidates ← false, Nbr_candidates ← 0 |
| /* Nbr_candidates represents the sites candidates which can help the site in crisis */ |
| /* A site is called stable if is not in crisis */ |
| **for all** elements of the group of sites in crisis **do** |
| $Representative_a$ ← *MR* of site in crisis |
| j ← 1 |
| **repeat** |
| $Representative_b$ ← representative of the stable site |
| **if** ($\lvert\tau_a - \tau_b\rvert < \varepsilon$) $\vee$ ($\lvert D_a - D_b\rvert < \varepsilon$) $\vee$ ($\lvert\sigma_a > \sigma_b\rvert < \varepsilon$) **then** |
| Nbr_candidates ← Nbr_candidates+1 |
| **end if** /* Where $\varepsilon << 1$ */ |
| j ← j +1 |
| **until** j ≥ Number of elements of the group of stable sites |
| **if** (Nbr_candidates > 1) **then** |
| candidates ← true |
| Algorithm Negotiation /* Negotiation of candidates */ |
| **else** |
| Propagation of the updates of the stable site to the sites in crisis |
| **end if** |
| **end for** |

| **Algorithm 4 Negotiation** |
| --- |
| $\tau_I$, $D_i$, $\sigma_i$ /* measurements of $i^{th}$*MR* for stable site*/ |
| winner ← first of all sites stable /* Candidate supposed winner */ |
| $\tau_I$, $D_i$, $\sigma_i$ /* measurements of $i^{th}$*MR* */ |
| /* Where $MR_i \neq$ winner |
| no_candidate ← false |
| **for all***MR* – { winner } do |
| **if** $(\tau_i < \tau_{winner}) \wedge (D_i < D_{winner}) \wedge (\sigma_i < \sigma_{winner})$ **then** |
| winner ← reprensentativei |
| **end if** |
| winner propagates its updates with the sites in crisis ¶ |
| **end for** |

the decision to trigger the sub-service the overall coherence is made. In this situation, an economy model type tender is better (see Algorithm Call_Tender).

The result of this algorithm can be as follows:

- Several *MR* are candidates that offer their services to sites in crisis, then a negotiation (see algorithm 4) is underway among them. Close trading, a permanent site is selected sites to assist in crisis, and the propagation of information concerning its replies to critical sites;
- If one *MR* selected by the algorithm tender, which will spread its information to the sites in crisis.

The negotiation process called by the algorithm of the invitation to tender allows selecting the best stable candidate which solves the critical situation of a site in crisis (Algorithm 4).

Either a chosen period in advance is reached and no site of the data grid is in crisis, then the chosen economy model has been that of the Dutch auction (Algorithm 5).

If no candidate is selected as the most favourable then we will make use of the economy model of English auctions (Algorithm 6).

## EVALUATION AND EXPERIMENTAL RESULTS

In order to validate and evaluate our approach of consistency management of replicas in comparison with the pessimistic and optimistic approaches, we have carried out series of experiments of which results and interpretations are covered in this section. To analyze the results related to the experimentation of our approach, we have used four metrics to know the response time, the divergences number and conflicts number among the replicas. To carry out the various experiments of our approach, we have fixed certain number of parameters of simulation of which the values are defined in Table 3. These parameters are common to all the simulations which have carried out the simulator OptorSim (Bell et al 2003) with Pentium CoreDuo 1GB.

### 1 The Study of Performances of our Approach

To study the behaviour of average response time of the approach proposed by the pessimistic approaches, we have conducted several simulations, including the following parameters: 10 sites, 100 nodes, 10 files. Figure 9 shows the change in average response time depending on the number of requests. In this series of simulation, we vary

| **Algorithm 5 Dutch_Auction** |
|---|
| representative$_{max}$ ← *MR* having the most recent version |
| version_reserves /* the average of all vectors of versions */ |
| $\tau_i$, $D_i$, $\sigma_i$ /* measurements of i$^{th}$*MR* */ |
| no_candidate ← false |
| **for all***MR* – {representative$_{max}$} **do** |
| **if** ($\tau_{max} > \tau_i$) ∨ ($D_{max} > D_i$) ∨ ($\sigma_{max} > \sigma_i$) **then** |
| **if** version$_i$ ≤ version_reserves **then** |
| no_candidate ← true |
| **else** |
| representative$_{max}$ ← $MR_i$ |
| no_candidate ←false |
| **end if** |
| **end if** |
| **end for** |
| **if** (no_candidates = false) **then** |
| representative$_{max}$ propagates the updates with the whole of representatives |
| **else** |
| Algorithm English Auction |
| **end if** |

| **Algorithm 6 English Auction** |
|---|
| representative$_{min}$ ← *MR* having the oldest version |
| version_reserves /* the average of all vectors of versions */ |
| $\tau_i$, $D_i$, $\sigma_i$ /* measurements of i$^{th}$*MR* */ |
| **for all***MR* – {representative$_{min}$} ***do*** |
| **if** ($\tau_{min} > \tau_i$) ∨ ($D_{min} > D_{local\_i}$) ∨ ($\sigma_{min} > \sigma_i$) **then** |
| representative$_{min}$ ← $MR_i$ |
| **end if** |
| **end for** |
| representative$_{min}$ propagates the updates with the whole of the representatives |

the number of requests from 100 to 500 by a step of 100.

In this series of simulation, we set the number of requests from customers to 100 and we vary the number of replicas from 20 to 100 by steps of 20. We can notice from Figure 10, that the performance achieved is always better than the pessimistic approaches. We can also see from this figure, Rowa and Quorum become very quickly impassable when the degree of aftershocks increases and the passage aspect scale is well-supported by the proposed approach, the fact that its development remains linear.

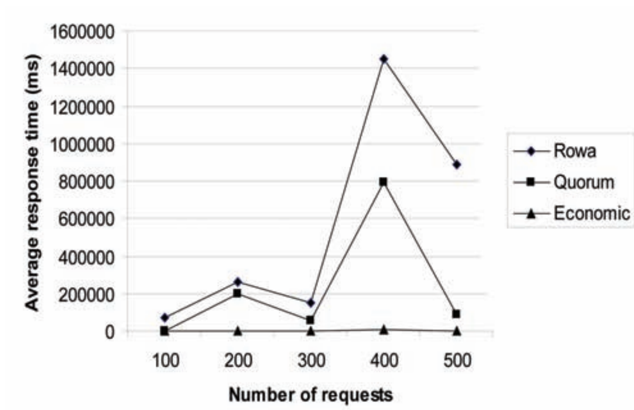
## 2 The Study of QoS of our Approach

In this second category of experimentation, we have focused our simulations to study the quality

*Table 3. Simulation parameters*

| Simulation parameters | Interval |
|---|---|
| #Sites | [5..50] |
| #Nodes | [10..500] |
| Bandwidth inter-sites | [100..1000] Mb/s |
| Size of data (file) | [100..10000]MB |
| #Requests | [20..500] |
| #Replicas | [1..100] per data |

*Figure 9. Average response time/ Number of requests*




replicas. We have conducted several simulations, with the following parameters: 10 sites, 100 nodes, 10 files, 100 requests and have varied the number of replicas from 20 to 100 by steps of 20.

In order to position our approach, we have found it interesting to compare from one point of view of QoS, compared with an optimistic approach that solves previous conflicts and divergences, and have compared the hybrid approach (Belalem and Slimani, 2007), which periodically solve divergences and conflicts among basically randomly chosen replicas.

Figure 11 shows clearly that the number of divergences generated by our proposal is very low compared to the two (Optimistic and Hybrid) approaches. This improvement achieved by our approach, is estimated to average 87% compared to the Optimistic approach and 29% compared with the hybrid approach.

Figure 12 shows the change in the average number of the conflicts, varying the number of aftershocks. The results show that the approach is still better than the two approaches compared. We can note that in the worst case, our approach has obtained a gain of 95% compared to the optimistic approach and 38% compared with the hybrid approach. We note also that aspect passage scale is supported by the proposed approach, since it remains almost linear throughout the evolution of the number of requests.

## RELATED WORK

One of the hardest problems in the consistency management is the choice of the technique of reconciliation that makes the divergent replicas converge. Reconciliation is the activity which

*Figure 10. Average response time/ Number of replicas*

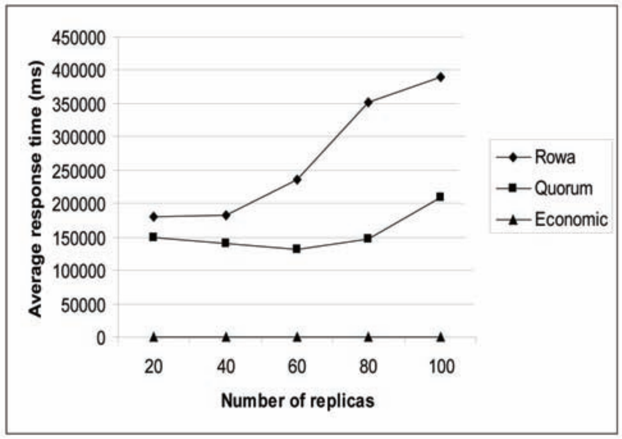



*Figure 11. Average divergences number / Number of replicas*

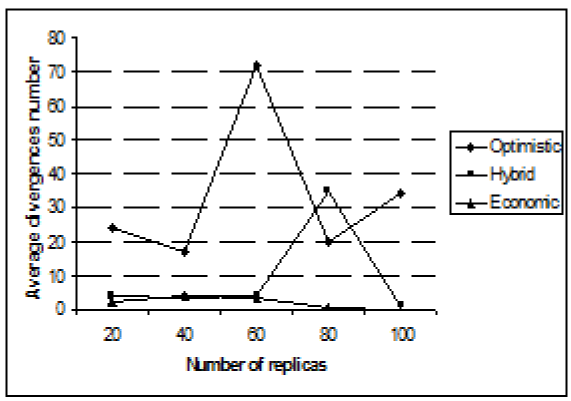
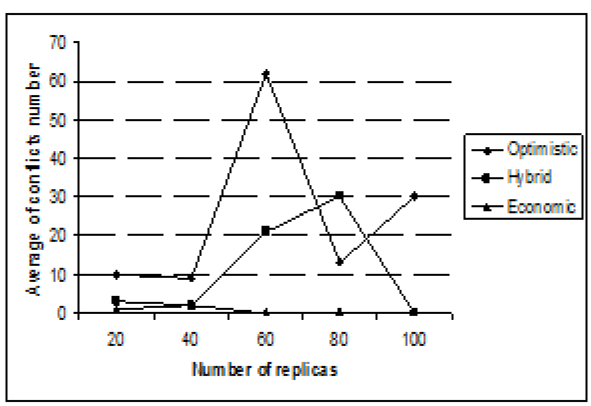



*Figure 12. Average conflicts number / Number of replicas*



detects and solves conflicts, to converge towards the same state. Several works proposed different techniques to produce a new coherent value of the replicas of the same object. Coda (Kistler and Satyanarayanan 1992) was among the first hoarding systems, employing the user profiles to decide what to hoard and requiring user intervention for conflict resolution. In Bayou, (Petersen et al. 1996), a system which is conceived for the collaborative applications in the mobile environments and uses the optimistic replication for weak coherence, the coherence of replicas east guarantees thanks to an epidemic diffusion of the updates among the writers. If a conflict emerges, the waiters, in Bayou, proceed by fusion of the writing requests according to a quite selected scheduling. In the system, IceCube (Kermarrec et al. 2001) uses the reconciliation based on semantic specificities of the application and the intention of the user. He amalgamates the newspapers compared to the recorded operations and aims to minimize the conflicts. In the work presented in (Vidot et al. 2000), the authors use the technology of the operational transforms by exploiting the semantic properties of the operations such as causality for serializability in order to lead to the coherence of a divided object. Instead, the work presented here is based on less constraining assumptions about data semantics and thus their ability to reconcile inconsistent data.

## CONCLUSION AND FUTURE WORK

The main problem introduced by the replication techniques is maintaining consistent replicas. In Data Grid environment, strong consistency is not adapted due to their prohibitive cost. Weak consistency approaches can be used in these systems by tolerating the divergences among the replicas for, at least, some period of time. In these divergence situations, reconciliation poses many problems and, in particular, in the mechanisms of conflict resolution among the replicas. In this paper, we have presented a consistency management service in the data grids. This service can use and combine economic models for conflict resolution among the replicas. Our policy driven negotiation is composed of a local intra-site consistency sub-management service and inter-site consistency management sub-service. Our mechanism proposed is very promising in large scale environments. By its no-blocking aspect of all the requests (rarely), it allows increasing performance by reducing the time response and provides improvement in the quality of service. There are number of directions which, we think, are interesting and worth for further investigation. We mention:

- Development of the Web service for consistency management of replicas: We propose to integrate our approach in the form of Web service in the Globus environment by using technology WSDL (Foster and Kesselmann, 2004);
- In the current version of our approach, we have placed the replicas randomly. It is worthwhile to explore the possibility of making a static or dynamic placement to improve QoS in the data grid (Haddad and Slimani, 2007);
- Load balancing: From this point of view, and for improving even more performances and the quality of service of our approach, we propose to extend it by a service of load balancing (Li and Lan 2005*),* which allows to balance the requests on the various sites of Data Grid.
- To consider the factor of time during the negotiation phase, i.e., to define intervals of time during which decisions should be made to us.

## REFERENCES


Belalem, G., & Slimani, Y. (2007). A hybrid approach to replica management in data grids. [IJWGS]. *International Journal Web and Grid Services*, *3*(1), 2–18. doi:10.1504/IJWGS.2007.012634

Bell, W. H., Cameron, D. G., Millar, A. P., Capozza, L., Stockinger, K., & Zini, F. (2003). Optorsim - a grid simulator for studying dynamic data replication strategies. *International Journal of High Performance Computing Applications*, *17*(4), 403–416. doi:10.1177/10943420030174005

Buyya, R., & Vazhkudai, S. (2001). Compute power market: Towards a market-oriented Grid, CCGRID'01. *First International Symposium on Cluster Computing and the Grid (pp.* 574-581), Brisbane, Australia.

Foster, I., & Kesselmann, C. (Eds.). (2004). *The Grid 2: Blueprint for a new computing infrastructure* (Elsevier Series in Grid Computing). San Francisco: Morgan Kaufmann Publishers.

Goel, S., Sharda, H., & Taniar, D. (2005). Replica synchronisation in grid databases. [IJWGS]. *International Journal Web and Grid Services*, *1*(1), 87–112. doi:10.1504/IJWGS.2005.007551

Gray, J., Helland, P., Neil, P. O., & Shasha, D. (1996), The dangers of replication and a solution. *In ACM SIGMOD International Conference on Management of Data,* (pp. 173-182), Montreal, Quebec, Canada, 4-5 June 1996. New York: ACM Press.

Haddad, C., & Slimani, Y. (2007). Economic model for replicated database placement in Grid. *In Proceedings of* Seventh *IEEE International Symposium on Cluster Computing and the Grid (CCGrid'07)* (pp. 283-292), Rio de Janeiro, Brazil.

Kermarrec, A.-M., Rowstron, A., Shapiro, M., & Druschel, P. (2001). The IceCube approach to the reconciliation of divergent replicas. *PODC '01: Proceedings of the twentieth annual ACM symposium on Principles of distributed computing* (pp. 210-218), Newport, RI.

Kistler, J. J., & Satyanarayanan, M. (1992). Disconnected operation in the coda file. *ACM Transactions on Computer Systems*, *10*(1), 3–25. doi:10.1145/146941.146942

Li, Y., & Lan, Z. (2005). A survey of load balancing in grid computing. *High Performance Computing and Algorithms*, ( . *LNCS*, *3314*, 280–285.

Petersen, K., Spreitzer, M., Terry, D., & Theimer, M. (1996). Bayou: replicated database services for world-wide applications. In *EW 7: Proceedings of the 7th workshop on ACM SIGOPS European workshop* (pp. 275-280), Connemara, Ireland.

Ranganathan, K., & Foster, I. (2001). Identifying Dynamic Replication Strategies for a High-Performance Data Grid. In *GRID* (pp. 75–86).

Rodrigues, L., & Raynal, M. (2003). Atomic broadcast in asynchronous crash-recovery distributed systems and its use in quorum-based replication. *IEEE Transactions on Knowledge and Data Engineering*, *15*(5), 1206–1217. doi:10.1109/TKDE.2003.1232273

Saito, Y., & Shapiro, M. (2005). Optimistic replication. *ACM Computing Surveys*, *37*(1), 42–81. doi:10.1145/1057977.1057980

Vidot, N., Cart, M., Ferrié, J., & Suleiman, M. (2000). Copies convergence in a distributed real-time collaborative environment. In *CSCW '00: Proceedings of the 2000 ACM conference on Computer supported cooperative work* (pp. 171-180), Philadelphia, PA.

Xu, J., Li, B., & Li, D. (2002). Placement problems for transparent data replication proxy services. *IEEE Journal on Selected Areas in Communications*, *7*, 1383–1398.

Zhoun, W., Wang, L., & Jia, W. (2004). An analysis of update ordering in distributed replication systems. *Future Generation Computer Systems*, *20*(4), 565–590. doi:10.1016/S0167-739X(03)00174-2

## KEY TERMS AND DEFINITIONS

**Dutch Auction:** A Dutch auction referred specifically to a type of auction that starts with a high price that keeps going down until the item sells. This is the opposite process to regular auctions, where an item starts at a minimum price and bidders wrestle over it by increasing their offers.

**English Auction:** Bidding starts with a low price, and is raised incrementally as progressively higher bids are solicited, until either the auction is closed or no higher bids are received.

**Multi-Master Strategy:** In this strategy, a system supporting several masters per object.

**Quorum:** In general allow writes to be recorded only at a subset (a write quorum) of the up nodes, so long as reads are made to query a subset (a read quorum) that is guaranteed to overlap the write quorum.

**Single Master Strategy:** In this strategy, a system supporting one master per object.

**Data Grid:** A data grid is a grid computing system that deals with data — the controlled sharing and management of large amounts of distributed data.

**Economic Model:** An approach can be employed for managing resources in data grid for services that end-user consumes. Pricing based on the demand of users and the supply of resources is the main driver in the competitive.

# Section 11

# E-Business:

## Issues, Challenges, and Opportunities

# Chapter 106
# Understanding the Dimensions of the Broadband Gap:
## More than a Penetration Divide

**Maria Rosalia Vicente**
*University of Oviedo, Spain*

**Ana Jesus Lopez**
*University of Oviedo, Spain*

## INTRODUCTION

Over the last decade the Internet has brought about significant changes in the economies and societies worldwide. It has changed communication habits, adapting incrementally to the needs of the users of the networks. It has created a world-wide web of knowledge sharing, creativity, and collaboration and has fostered globalization. In this context, new and traditional players are adapting to the challenges through new business models.

Nowadays, the diffusion of broadband is providing the basis for the transition to the Internet of the future. In the next years the development of very high-speed networks will permit the launch of new interactive media and content services. The widespread expansion of low cost wireless broadband will allow the Internet to become more pervasive (European Commission, 2006).

While the broadband market is developing rapidly worldwide, there are notable signs of a broadband gap both between and within countries. According to Eurostat, in January 2008 broadband penetration rates across Europe varied from 7.6% in Bulgaria to 35.76% in Denmark. Differences are visible not only in terms of penetration rates but also in speeds and prices, among others.

Therefore, the development of an accurate picture of the broadband gap requires taking into account several issues in addition to penetration. Within this context, our paper focuses on the analysis of the European broadband gap by means of multivariate statistical methods, and in particular, factor and cluster analyses.

DOI: 10.4018/978-1-61520-611-7.ch106

## BACKGROUND

As the diffusion of Information and Communication Technologies (ICT) has taken place the issue of the digital divide has emerged to occupy a central position on both international and national forums.

According to the OECD (2001) "the term digital divide refers to the gap between individuals, households, businesses, and geographic areas at different socio-economic levels with regard both to their opportunities to access information and communication technologies and to their use of the Internet for a wide variety of activities".

The digital divide is a complex, multifaceted, and evolving concept. At first the issue of the digital divide was understood in binary terms: the gap between ICT "haves" and "have-nots". But as the number of Internet users has grown, the digital divide has progressively shifted from an "access" divide to a more complex "use" divide that can be indirectly observed through the diversity and variety of Internet use, and the very heterogeneous abilities of individuals to find information online in an efficient and effective way (Hargittai, 2002; OECD, 2008a).

Broadband has had a very significant effect on this variety of Internet use. High-speed connections have opened up a huge range of interactive applications and services, with more and more user-generated content being uploaded and shared.

Therefore, the broadband gap should not be seen as a mere penetration divide. Above all, it is a divide in the range of services people can access and use. And, more fundamentally, it suggests how future divides in wealth may take shape, as broadband is increasingly determining the ability of individuals, firms, and nations to create future wealth.

## FRAMEWORK AND CASE OF THE STUDY

### Framework

Over the last years most discussions about broadband policy have focused on the issue of penetration. While "getting connected" is an essential first step, there are many other factors involved in the deployment of broadband. As Flamm et al. (2007) pointed out: only ten years ago, it made sense to ask, who had Internet access and who did not? Now we ask: how fast is your connection? How fast is fast? And what services can you access to?

Then, it becomes clear that a country cannot properly assess its progress or know how to raise its international standing in broadband if it only pays attention to penetration figures (Wallsten, 2008).

Thus, the development of a meaningful framework to analyze the broadband gap should start by recognizing its nature as a general purpose technology: broadband has allowed the launch of a whole bunch of new services in all sectors, which benefits may extend everywhere and to anyone (households, business, etc.). Nonetheless, the appropriability of such benefits depends on at least two factors: the quality of the connections, and individuals' digital skills. Moreover the diffusion of broadband is affected by the price of access which depends on both the competition in telecommunications market and the investment in this sector. Likewise, infrastructure influences the propensity to use advanced communication technologies and services.

In this context, the measurement of how well a country leverages broadband capabilities requires the evaluation of all these factors, comparing them with other nations.

*Table 1. Description of variables and codes*

| Code | Variables |
|---|---|
| BB | Broadband lines per 100 inhabitants |
| BB_RURAL | % of rural population connected to broadband Internet |
| COMP | Platform competition = new entrants' lines over total number of broadband lines * % of population connected to broadband |
| PRICE_1 | Median price offer in the [1 – 2] Mbit/s basket |
| PRICE_2 | Median price offer in the [2 – 8] Mbit/s basket |
| SPEED | Weighted average of national broadband speeds (in kbps) |
| HIGH_SPEED | % of subscribers to speeds of 2 Mbit/s or more |
| E-GOVERM_B | % of enterprises filling in official forms online |
| MUSIC_ONLINE | % of individuals downloading music/video/games (last 3 months) |
| SOFTWARE | % of individuals downloading software (last 3 months) |
| E-GOVERM_I | % of individuals who have used the Internet for filling in official forms (last 3 months) |
| E_COMM | % of individuals purchasing online (last 3 months) |
| E_BANKING | % of individuals using ebanking (last 3 months) |
| E_SKILLS | % of individuals with basic digital skills (having performed at least 1 Internet-related activity) |
| PC | % of households with access to a computer at home |
| ICT_EXP | ICT expenditure per capita (in Euros) |

## Case of the Study

Within the described framework, our analysis of the broadband gap has focused on the current Member States of the European Union (EU-27). We pay attention to this area because the Union has implemented a successful broadband strategy over the last years, outstripping the United States. However, some signs of fatigue are being detected: growth in penetration is slowing down and there are increasing gaps between countries in terms of penetration, speed, and price. Hence, there is a need to analyse the underlying conditions in the Member States in order to assess the EU-27 readiness to progress in the development of broadband. Furthermore, once the best-performing countries have been identified, some lessons can be learnt from the strategies they had followed.

With this aim, we use a set of sixteen indicators (Table 1), which report to the year 2008 and are provided by the European Commission (2008b) and Eurostat (2009). Almost the same variables have been used to develop an index on European broadband performance (European Commission, 2008a).

## METHODOLOGY AND RESULTS

While the first attempts to measure the broadband gap focused on penetration rates, soon the efforts turned to the development of composite indicators in order to capture the multiple dimensions of the gap and provide an easy-to-interpret comparison of broadband adoption among countries.

Following the trail of previous research (Economist Intelligence Unit, 2007; ITU, 2006; Orbicom, 2005; UNCTAD, 2006), several authors constructed indices for broadband performance (Cisco, 2008; Correa, 2007; Ford et al., 2007). Such composite indicators have revealed as a useful tool in policy analysis and public communication since they are able to summarise complex and multifaceted issues such as the

*Table 2. Results of factor analysis*

| Factor | Eingenvalue | Percent of variance | Cumulative percent of variance |
|---|---|---|---|
| **1** | **8.72** | **54.49** | **54.49** |
| **2** | **1.82** | **11.40** | **65.89** |
| **3** | **1.41** | **8.79** | **74.68** |
| **4** | **1.02** | **6.40** | **81.08** |
| 5 | 0.88 | 5.52 | 86.60 |
| 6 | 0.58 | 3.60 | 90.20 |
| 7 | 0.51 | 3.17 | 93.37 |
| 8 | 0.38 | 2.35 | 95.72 |
| 9 | 0.17 | 1.08 | 96.80 |
| 10 | 0.16 | 1.03 | 97.83 |
| 11 | 0.12 | 0.76 | 98.59 |
| 12 | 0.10 | 0.61 | 99.20 |
| 13 | 0.07 | 0.42 | 99.62 |
| 14 | 0.03 | 0.18 | 99.80 |
| 15 | 0.02 | 0.10 | 99.90 |
| 16 | 0.02 | 0.10 | 100.00 |

Note: Extraction method: Principal Components. Extracted factors are marked.

broadband gap. However, their use has also some limitations: they might give a simplistic picture of a country' situation disguising serious failings in some of the dimensions, and furthermore rankings depend largely both on which variables are included and which ones are excluded from the index, and on the weights given to the variables (OECD, 2008b).

Given such drawbacks, some authors have tried to provide supplementary instruments to the usual approach of composite indicators to measure the digital divide. In this regard, multivariate techniques have been shown to be very useful (Trkman et al., 2008; Vicente & López, 2006). On this basis, we use factor analysis to summarize in a small number of dimensions both demand-side and supply-side components of broadband deployment in the EU-27. Then we employ cluster techniques to identify groups of countries with similar level of broadband development.

## Factor Analysis

Factor analysis is a multivariate method that addresses the problem of analyzing the structure of interrelationships among a number of variables by defining a set of common underlying dimensions, known as factors (Harman, 1980).

In our analysis both the Bartlett test, with an associated probability of less than of 1%, and the Kaiser-Meyer-Olkin measure, with a value over 0.7, suggest that there are some strong correlations between variables and, therefore, that the data is adequate for this technique.

Table 2 shows the results of the analysis. Factors are ranked according to the share of explained variance: factor 1 explains almost 55% of the variation in the original variables; factor 2 explains 11%, and so on. Following the eigenvalue criterion, we retain those factors with eigenvalues greater than 1, which explain 81% of the total variance.

*Table 3. Varimax rotated factor matrix*

| Variables | Factor 1 | Factor 2 | Factor 3 | Factor 4 |
|---|---|---|---|---|
| E_BANKING | **0.92** | 0.06 | 0.16 | 0.20 |
| SOFTWARE | **0.91** | -0.03 | 0.14 | -0.06 |
| E_SKILLS | **0.90** | 0.21 | 0.11 | 0.16 |
| E-GOVERM_I | **0.87** | 0.08 | 0.25 | 0.08 |
| PC | **0.86** | 0.28 | 0.26 | -0.08 |
| BB | **0.85** | 0.29 | 0.35 | 0.08 |
| E_COMM | **0.80** | 0.22 | 0.35 | -0.05 |
| MUSIC_ONLINE | **0.79** | 0.07 | 0.06 | 0.38 |
| ICT_EXP | **0.66** | 0.47 | 0.48 | -0.10 |
| BB_RURAL | **0.61** | 0.35 | 0.43 | -0.09 |
| E-GOVERM_B | **0.53** | 0.08 | -0.27 | 0.01 |
| HIGH_SPEED | 0.08 | **0.92** | 0.07 | 0.16 |
| SPEED | 0.26 | **0.84** | -0.09 | 0.14 |
| PRICE_2 | -0.24 | -0.12 | **-0.79** | 0.01 |
| PRICE_1 | -0.15 | 0.31 | **-0.78** | -0.39 |
| COMP | 0.09 | 0.28 | 0.11 | **0.88** |

Note: Variables are marked according to factor loadings

In order to facilitate the interpretation of the extracted factors, we have used the varimax rotation on the factor loadings matrix so that each factor has high loadings (correlations) on few variables (Table 3).

We observe that Factor 1 has significant positive loadings on eleven of the original variables. In particular, it represents the percentage of individuals banking and downloading software online, as well as the population with basic Internet skills. It also corresponds to the use of e-government, broadband and computer penetration, and the take-up of several online services and applications. Therefore Factor 1 is related to the use of services online and ICT penetration.

Factor 2 has positive loadings both on broadband speed and the percentage of subscribers to speeds of at least 2 Mbit/s. Hence Factor 2 is related to the speed of Internet connections.

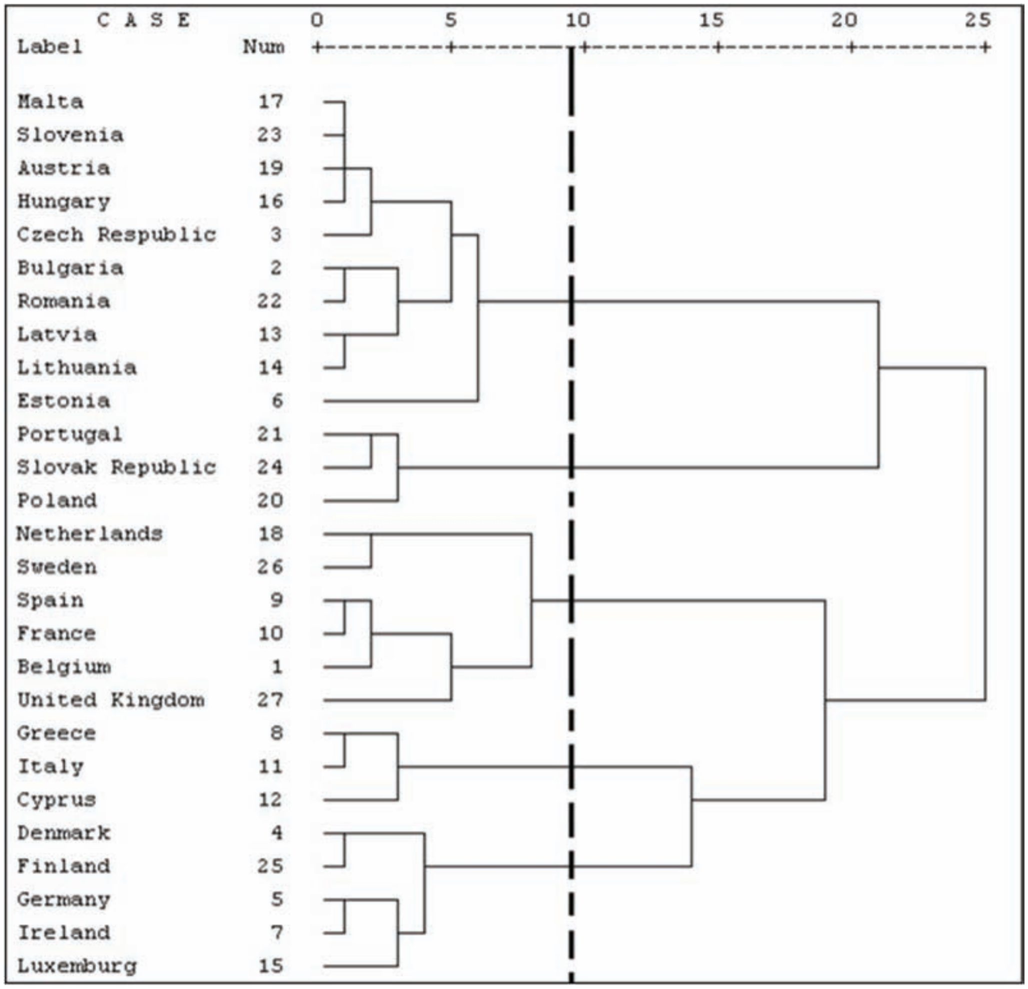
Factor 3 has negative loadings on the two variables related to the price of connecting to the Internet, and finally Factor 4 is related to competition with a positive loading on this variable.

## Cluster Analysis

On the basis of country scores on each of the four extracted factors, we have run a hierarchical cluster analysis in order to identify homogeneous groups of nations in terms of broadband development (Hair et al., 1995).

Figure 1 shows the resulting dendogram, that is, the graphical representation of the cluster analysis solution. The horizontal axis indicates the linkage distance while the vertical axis arrays the countries. From left to right the dendogram shows the formation of a large number of clusters when relatively small levels of dissimilarity among countries are used. Literature recommends stopping the formation of clusters when the dendogram makes a big jump. This place is marked on the dendogram with a broken line and leads to a five-clustered solution.

*Figure 1. Dendogram and identified clusters*




Note: Cluster analysis has been run by means of the squared Euclidean distance and Ward's linkage method.

Table 4 shows the principal differentiating characteristics of the five identified clusters. The main feature of countries in cluster 1 is that competition in broadband markets seems not to have been fruitful yet in terms of lowering prices, providing better quality of services, and therefore stimulating the use of online services. Note that the averages for Factors 1-3 are all negative, in contrast to the positive value for Factor 4. Cluster 2 is characterized by the high prices of broadband as the average value for Factor 3 is -2.12, the lowest in the five clusters. Meanwhile, Cluster 3 includes the countries which are better positioned in broadband (note that all factors have positive averages). Cluster 4 consists of three countries from Southern Europe where the lack of competition appears not to have led to high broadband prices. This might be the case of countries where, given the lack of competition, public policy has intervened to lower prices, though this action has not yet produced results in terms of fostering ICT use. Finally, cluster 5 includes a set of countries with low competition and speed. Despite the fact that the low levels of these two factors seem not to be affecting ICT diffusion (note the positive

*Table 4. Descriptive statistics of the identified clusters*

| | Cluster 1 (N=10) | | Cluster 2 (N=3) | | Cluster 3 (N=6) | | Cluster 4 (N=3) | | Cluster 5 (N=5) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Mean** | **S.D.** | **Mean** | **S.D.** | **Mean** | **S.D.** | **Mean** | **S.D.** | **Mean** | **S.D.** |
| ***Factor 1*** | -0.49 | 0.78 | -0.18 | 0.16 | 0.37 | 0.89 | -1.01 | 0.11 | 1.25 | 0.77 |
| Factor 2 | -0.59 | 0.77 | 0.38 | 0.99 | 1.11 | 0.75 | 0.06 | 0.94 | -0.42 | 0.71 |
| Factor 3 | -0.08 | 0.38 | -2.12 | 0.85 | 0.64 | 0.82 | 0.87 | 0.61 | 0.15 | 0.44 |
| Factor 4 | 0.78 | 0.50 | -0.64 | 0.25 | 0.51 | 0.75 | -1.47 | 0.50 | -0.92 | 0.40 |

average of Factor 1), if they persist they could cause problems for the future development of broadband.

## FUTURE RESEARCH DIRECTIONS

The measurement of the broadband gap has posed a big challenge in the ICT field. While broadband penetration rate is the basic indicator to asses a country's performance, it also gives a too simplistic picture since there are several other factors involved in the broadband gap. Thus, a country with good broadband penetration but with poor quality is in danger of falling behind in the new wave of interactive and media-rich online services and networks (Vicente & Gil-de-Bernabé, 2010).

In our analysis we use advertised speed as a proxy for broadband quality. Although a better measure would gauge the actual speeds which consumers experience (as opposed to advertised speeds) reliable data on actual speeds are not yet available for most countries. Further research is needed in this area in order to properly assess what elements determine the quality experience for users and how to measure them.

In line with this, a critical point to address is the analysis of the wireless broadband gap. Broadband is increasingly offered over wireless technologies and this type of connection is likely to become even more important than wired. Therefore, it is crucial for countries to assess how well they are performing in the diffusion of wireless technologies.

## CONCLUSION

In this chapter we have approached the analysis of the broadband gap as a multidimensional issue by means of multivariate methods. In order to deal with such multidimensionality we have used factor analysis on a set of sixteen indicators related to broadband diffusion across the EU-27.

Factor analysis has revealed four dimensions in the broadband gap: the first one related to online services and ICT penetration, the second one to broadband speed, the third one to prices, and finally the fourth one to competition.

Furthermore, cluster analysis has shown that the broadband gap is far from reflecting a simple North-South divide or Old versus New Member States. For instance, Spain is positioned among the countries with a better performance in broadband deployment, while some Northern and Central European countries are below the average in what refers to speed and competition.

Overall, our analysis points out that the process of broadband diffusion is not the consequence of a single action, rather it is the result of the interplay between different factors and approaches that must be all taken into account in order to design successful strategies. In particular, the six best performing countries have in common that they established early robust national strategies to foster the diffusion of this technology. For instance, the United Kingdom launched its national plan for high-speed networks as early as 2001 with the target of having the most extensive and competitive broadband market in the G7 by 2005. Likewise, France implemented the plan "Broadband for Everyone" in 2001 with special focus on rural areas (Atkinson et al., 2008). Moreover, all these successful policies coordinated actions across agencies, put real resources behind them, and promoted both supply and demand.

Although it is difficult to transfer experiences from one nation to another because of the socio-economic and political differences, some lessons for the future can be learnt from these best-performing countries. In this sense, it is worth highlighting the importance to shape policies that stimulate both sides of the market: even the most robust supply-side policies will not produce alone universal broadband usage. On one hand, it is crucial to improve digital literacy and access. For instance, both Sweden and Spain subsidized personal computer purchases for companies that bought computers for their employees' personal use, with the result of a huge increase in computer penetration. On the other hand, competition has to be stimulated and financial incentives are needed. The identified best-performing nations have effectively used financial incentives to spur broadband, especially in rural areas where it is expensive for providers to deploy broadband networks. For example, Sweden allocated more than $800 million for that goal, reaching over 90% of rural coverage.

Finally, it is important to notice that such efforts should also not neglect the issue of quality and wireless access, since the future of broadband deployment goes through higher-speed and higher-capacity wireless networks able to support the next generation of web applications.

## REFERENCES


Atkinson, R. D., Correa, D. K., & Hedlund, J. A. (2008). *Explaining International Broadband Leadership*. Washington, DC: The Information Technology and Innovation Foundation.

Cisco. (2008). *The Broadband Quality Score*. Retrieved October 1, 2008, from www.sbs.ox.ac.uk/downloads/Broadband_Quality_Study_press_presentation.pdf

Correa, D. K. (2007). *Assessing Broadband in America: OECD and ITIF Broadband Rankings*. Washington, DC: The Information Technology and Innovation Foundation.

Economist Intelligence Unit. (2007). *The 2007 e-readiness rankings*. Retrieved April 30, 2008, from http://www.eiu.com

European Commission. (2006). *Bridging the broadband gap*. Brussels: European Commission.

European Commission. (2008a). *Communication on future networks and the internet*. Brussels: European Commission.

European Commission. (2008b). *Indexing broadband performance*. Brussels: European Commission.

Eurostat (2009). *Information Society Statistics*. Retrieved November 30, 2008, from http://www.ec.europa.eu/eurostat

Flamm, K., Friedlander, A., Horrigan, J., & Lehr, W. (2007). *Measuring broadband: Improving communications policymaking through better data collection*. Washington DC: Pew Internet & American Life Project.

Ford, G. S., Koutsky, T. M., & Spiwak, L. J. (2007). *The Broadband Performance Index: A policy-relevant method of comparing broadband adoption among countries*. Retrieved October 14, 2008, from http://www.phoenix-center.org

Hair, J. F., Jr., Anderson, R. E., Tatham, R. L., & Black, W. C. (1995). *Multivariate Data Analysis with Readings*. London: Prentice Hall International.

Hargittai, E. (2002). Second-level digital divide. Differences in people's online skills. *First Monday, 7*(4). Retrieved October 14, 2007, from http://www.firstmonday.dk

Harman, H. H. (1980). *Modern Factor Analysis*. Madrid: Saltés (in Spanish).

ITU. (2006). *Digital Opportunity Index*. Retrieved January 30, 2009, from http://www.itu.int/doi

OECD. (2001). *Understanding the digital divide*. Paris: OECD.

OECD. (2008a). *Broadband and the economy*. Paris: OECD.

OECD. (2008b). *Handbook on constructing composite indicators. Methodology and user guide*. Paris: OECD.

Orbicom. (2005). *From the digital divide to the digital opportunities. Measuring infostates for development*. Montreal: Orbicom.

Trkman, P., Blazic, B. J., & Turk, T. (2008). Factors of broadband development and the design of a strategic policy framework. *Telecommunications Policy*, *32*(2), 101–115. doi:10.1016/j.telpol.2007.11.001

UNCTAD. (2006). *The digital divide report: ICT diffusion index 2005*. New York: UNCTAD.

Vicente, M. R., & Gil-de-Bernabé, F. (2010). (article in press). Assessing the broadband gap: From the penetration divide to the quality divide. *Technological Forecasting and Social Change*.

Vicente, M. R., & López, A. J. (2006). A multivariate framework for the analysis of the digital divide: Evidence for the European Union-15. *Information & Management*, *43*, 756–766. doi:10.1016/j.im.2006.05.001

Wallsten, S. (2008). Understanding International Broadband Comparisons. *Technology Policy Institute Papers*. Retrieved October 14, 2008, from http://www.techpolicyinstitute.org

## ADDITIONAL READING

Cava-Ferreruela, I., & Alabau-Muñoz, A. (2006). Broadband policy assessment: A cross-national empirical analysis. *Telecommunications Policy*, *30*, 445–463. doi:10.1016/j.telpol.2005.12.002

Chinn, M. D., & Fairlie, R. W. (2007). The determinants of the global digital divide: a cross-country analysis of computer and internet penetration. *Oxford Economic Papers*, *59*(1), 16–44. doi:10.1093/oep/gpl024

Cilan, Ç. A., Bolat, B. A., & Coskun, E. (2009). Analizing digital divide within and between member and canditate countries of European Union. *Government Information Quarterly*, *26*, 98–105. doi:10.1016/j.giq.2007.11.002

Distaso, W., Lupi, P., & Manenti, F. (2006). Platform competition and broadband uptake: Theory and empirical evidence from the European Union. *Information Economics and Policy*, *18*, 87–106. doi:10.1016/j.infoecopol.2005.07.002

Firth, L., & Mellor, D. (2005). Broadband: Benefits and problems. *Telecommunications Policy*, *29*, 223–236. doi:10.1016/j.telpol.2004.11.004

Flamm, K., & Chaudhuri, A. (2007). An analysis of the determinants of broadband access. *Telecommunications Policy*, *31*, 312–326. doi:10.1016/j.telpol.2007.05.006

Fransman, M. (2006). *Global Broadband Battle-Why the US and Europe Lag While Asia Leads*. Stanford, CA: Stanford Business Books.

Grubesic, T. H. (2008). Spatial data constraints: Implications for measuring broadband. *Telecommunications Policy*, *32*, 490–502. doi:10.1016/j.telpol.2008.05.002

Hargittai, E. (2003). The Digital Divide and what to do about ir. In D.C. Jones (Ed.), *The New Economy Handbook* (pp. 821-839). San Diego, CA: Oxford Press.

Horrigan, J. B., Stolp, C., & Wilson, R. H. (2006). Broadband utilization in space: Effects of population and economic structure. *The Information Society*, *22*, 341–354. doi:10.1080/01972240600904290

IDATE. (2008). *Broadband coverage in Europe*. Retrieved October 14, 2008, from http://www.idate.org.

Lehr, W., Crandall, R., & Litan, R. (2007). The Effects of Broadband Deployment on Output and Employment: A Cross-sectional Analysis of U.S. Data. *The Brookings Institution: Issues in Economic Policy*, 6.

Lehr, W., Smith-Grieco, T., & Woo, G. R. (2008). *Broadband Metrics Best Practices: Review and Assessment*. Cambridge, MA: Massachusetts Institute of Technology.

Menou, M., & Taylor, R. (2006). A "Grand Challenge": Measuring Information Societies. *The Information Society*, *22*(5), 261–267. doi:10.1080/01972240600903904

NTIA. (2008). *Networked Nation: Broadband in America 2007*. Washington, D.C.: United States Department of Commerce.

OECD. (2005). *Guide for measuring the information society*. Paris: OECD.

OECD. (2007). *Catching-up in broadband. What will it take?* Paris: OECD.

Partnership on measuring ICT for development (2008). *The Global Information Society: a Statistical View*. New York, NY: United Nations.

Preston, P., Cawley, A., & Metykova, M. (2007). Broadband and rural areas in the EU: From technology to applications and use. *Telecommunications Policy*, *31*, 389–400. doi:10.1016/j.telpol.2007.04.003

Prieger, J. E. (2003). The supply side of the digital divide: Is there equal availability in the broadband internet access market? *Economic Inquiry*, *41*(2), 346–363. doi:10.1093/ei/cbg013

Savage, S. J., & Waldman, D. (2006). Broadband Internet access, awareness, and use: Analysis of United States household data. *Telecommunications Policy*, *29*, 615–633. doi:10.1016/j.telpol.2005.06.001

Vicente, M. R. (2008). *Indicators of the Information Society. Approaching ICT diffusion*. Madrid: Euroeditions.

Vicente, M. R., & López, A. J. (2008). Some empirical evidence on Internet diffusion in the New member States and Candidate Countries of the European Union. *Applied Economics Letters*, *15*(3), 1015–1018. doi:10.1080/13504850600972352

Wallsten, S. (2006). *Broadband and Unbundling Regulations in OECD Countries* (Working Paper 06-16. Washington, D.C.: AEI-Brookings Joint Centre for Regulatory Studies. Waverman, L., Dasgupta, K., & Tonkin, J. (2008). *The Connectivity Scorecard*. Retrieved November 15, 2008, from ≤http://www.connectivityscorecard.org>.

## KEY TERMS AND DEFINITIONS

**Broadband:** This term usually refers to high-speed access to the Internet.

**Cluster Analysis:** A set of algorithms and methods which aim is to identify homogeneous subgroups of cases in a population.

**Composite Indicator or Index:** A mathematical combination of a set of indicators.

**Digital Divide:** The gap in the access and use of information technologies between individuals, businesses or territories.

**Digital Skills or E-Skills:** The learned capacity to use information and communication technologies, and to search for information online in an efficient and effectively way.

**Factor Analysis:** A multivariate technique that can be used to either identify the underlying dimensions for a set of variables, or to determine whether the information can be summarized in a smaller number of factors.

**ICT:** Information and communication technologies.

# Chapter 107
# E-Inclusion:
## European Perspectives Beyond the Digital Divide

**Bridgette Wessels**
*University of Sheffield, UK*

## INTRODUCTION

The development of Information and Communication Technologies (ICT) is part of a reshaping of socio-economic life that is resulting in new forms of inclusion and exclusion. The use of ICT in economic activity is situated within global capitalism that is based on a networked organisation of production processes and patterns of consumption. This networked organisation of social and economic life is facilitated by an infrastructure based on ICT, which form part of an e-economy and information society (Castells, 2001). In order for economies to be competitive in a global market they need to be connected into the ICT infrastructure and they require a labour force that has the education and skills to work in an e-economy. From the point of view of ordinary people their life chances are linked to having the capability to work in the e-economy to ensure employment. Furthermore as ICT becomes embedded in political and cultural communication, individuals need access and skills in ICT to participate in their societies. These dimensions of change are creating concerns in policy-making communities and user groups regarding ensuring inclusion in the e-economy and for social cohesion more generally as societies undergo change. The focus of academics and policy-making groups first addressed the concept of a digital divide between those who have access to ICT and those that do not. However, this idea has now been extended into the concept of e-inclusion. In this article, the author first outlines the background to the emergence of the term and its definition and provides the policy response by the European Union. She then considers the problems, controversies and issues of the concept. This is followed by a discussion of some possible solutions, policy recommendations, and suggests areas of further research. The article concludes by

DOI: 10.4018/978-1-61520-611-7.ch107

emphasizing the multi-dimensional dynamic of e-inclusion that requires co-ordinated action by policy-makers, industry and user communities.

## BACKGROUND

The term e-inclusion was officially coined in policy discourse in a European Union Ministerial Declaration signed in Riga on 11 June 2006. In this Declaration e-inclusion (with 'e' standing for electronic) is defined as:

*both inclusive Information and Communication Technologies and the use of ICT to achieve wider inclusion objectives. It focuses on participation of all individuals and communities in all aspects of the information society. eInclusion policy therefore, aims at reducing gaps in ICT usage and promoting the use of ICT to overcome exclusion, and improve economic performance, employment opportunities, quality of life, social participation and cohesion* (European Commission, 2006, p. 1).

The rationale behind the term is that strategies that seek to promote e-inclusion should aim to prevent social and economic exclusion, especially of already disadvantaged people, due to divergences in knowledge and use of ICT. The history of the term is rooted in both academic and policy concerns about a digital divide that distinguishes between those who have access to ICT and those who do not and how that divide reinforces existing inequalities.

There is as specific European approach to the development of ICT in European Society. The vision is one of European Information Society that involves 'achieving ubiquitous and accessible information resources as a foundation for economic growth and development [in which] information is becoming a central feature of social and cultural life' (Mansell & Steinmuller, 2000, p. 453). This vision is articulated in policy documents as early as the 1994 Report of the Members of the High Level Group on the Information Society, which set a strategy for the development of ICT in the Europe Union. The report stated that the widespread use of ICT has the potential to 'build a more equal and balanced society', 'reinforce social cohesion' and provide a 'wider choice of services' (1994: 6). The main risk is creating a two-tier society of haves and have-nots, in which only some have access to ICT and the skills to use it, and thus enjoy its benefits (1994: 6). Given this scenario policy focuses on ensuring ICT access and skills for all. The Riga Declaration in 2006 supports the priority of ensuring equal access to ICT as well as providing opportunities for people to develop the relevant skills to use it in order to participate fully in society.

It is possible to trace the emergence of e-inclusion from the idea of a digital divide, which shows that the use of ICT is unequal in society (Castells, 2001). Research shows that those who are well educated and have high socio-economic status are the early adopters of ICT (Castells, 2001; Haddon, 2004). Furthermore, those who speak English are better positioned to take advantage of ICT because English is the language of the World Wide Web (Castells, 2001). Users from this social background are better positioned through advantages in education, economic and cultural capital to participate in an e-economy. Castells (2001) argues that the digital divide is not simply about those who have access to ICT and those who not. He states that the digital divide refers to the difference between actors with varying levels of capacity of Internet usage that 'adds a fundamental cleavage to existing sources of inequality and social exclusion in a complex interaction' (Castells, 2001, p. 247). Changes in the demographics of society, such as an ageing population, the desires of those with disabilities to participate in society and the rise of multi-cultural society interact with the dynamics of inclusion. Furthermore, the needs of the regeneration de-industrialised regions as well as addressing ongoing global inequalities are dimensions in the dynamics of exclusion.

Castells (2001) points out that although access to ICT is a fundamental prerequisite, the complexity of the digital divide stems in the development of a knowledge gap between peoples. This refers to the way in which those with access to good quality ICT and who have the skills to use ICT to a high level accrue knowledge that improves their engagement in economic activity and participation in political, civic and cultural life. Norris (2000) supports this argument by pointing out that these dynamics are embedded within existing social, political and global inequalities, which compound the potential of ICT to enhance participation. These observations show how the use of ICT interacts with other forms of inequality that widen existing divisions in society. Wessels (2009) develops this observation further by focusing on the way in which access, skills and knowledge of ICT is situated within the dynamics of inclusion and exclusion. Approaches to the contemporary dynamics of poverty and marginalisation focus on social exclusion. Social exclusion is understood to emerge when dimensions such as unemployment, poor education, unsupported ageing and disability, unequal gender and ethnic relations, and poor health and local environments limit the life chances of individuals. The ways in which some, or all, of these dimensions interact produce situations of exclusion. Social exclusion is therefore multi-dimensional because it is the way in which dimensions interact that produces situations of exclusion (Steinert & Pilgram, 2007). Wessels (2009) argues that access to ICT and ICT capabilities are part of these dimensions, alongside access to education, employment, social support and a well-resourced environment. In relation to inclusion, the argument is that if individuals, groups and regions have access to the relevant resources, including ICT, they can overcome situations of exclusion and participate in economic activity and social renewal and maintenance.

Through the earlier debates about the digital divide, it is now recognized that strategies to overcome a digital divide are not simply about access to ICT (Castells, 2001; Wessels, 2008, 2009). Rather, strategies involve the development of skills, improving literacy including digital literacy, generating relevant e-services, and fostering capacity and creativity in developing participation in various Internet related communication, activity, and knowledge-generation (Wessels, 2008, 2009). This understanding extends the notion of a digital divide into the area of e-inclusion within the dynamics of information society. To mobilise information society and to facilitate e-inclusion means there needs to be an onus on providing training and supporting participation in ICT related activity in the areas of work, political participation, and cultural and everyday life (Wessels, 2008). These resources need to be organised at local, regional, national and supra-national levels (Wessels, 2009). The EU Riga Declaration focuses on e-inclusion and it covers the following areas.

- E-inclusion needs to address the needs of older workers and elderly people by enhancing active participation in the society and economy and self-expression through innovative ICT enabled access to goods, services and content.
- E-inclusion strategies need to reduce geographical digital divides by facilitating affordable access to ICT networks, terminal equipment, content and services everywhere and particularly in remote, rural areas and regions lagging behind
- E-inclusion programmes need to enhance eAccessibility and usability by addressing the needs of users including those with disabilities and producing eAccessibility standards based on inclusive design.
- E-inclusion involves improving digital literacy and competences through education systems tailored to the needs of groups at risk of exclusion due to their circumstances,

capacities and special needs such as the unemployed, immigrants, people with low education levels, people with disabilities, and elderly, as well as marginalised young people.
- Promote cultural diversity in relation to inclusion by fostering pluralism, cultural identity and linguistic diversity in the digital space in order to improve the possibilities for economic and social participation and integration, creativity and entrepreneurship across all groups.
- Promote inclusive eGovernment through accessible public web sites (compliant with W3C common web accessibility standards) with services that are user-centric, inclusive and secure based on the rights and obligations of democratic processes (European Commission, 2006, pp. 2-5).

## ISSUES, CONTROVERSIES, PROBLEMS

The main issue to address is the links (structural and phenomenological) between e-inclusion and situations of social exclusion that includes a clear understanding of the role of ICT within those situations. This means addressing the structural dynamics of social exclusion (Bryne, 1999) in which ICT plays a role. The structural aspects of exclusion are embedded in post–Fordism, globalization and neo-liberalism. ICT's specific networked and flexible characteristics are ideal in underpinning the networked organisation of free-market global capitalism. The consequences of these trends include more flexible patterns of work and greater job insecurity, as well as lessening power of nation states to manage national economies. These factors combine to erode the capacities of national welfare states to provide a minimum level of social and economic security for citizens who are made unemployed, are sick or who need social support (Burrows and Loader and 1994; Roche, 1992). A phenomenology of exclusion points to different dimensions: such as political exclusion (via citizenship), economic exclusion (through lack of means), social exclusion (through isolation), and cultural exclusion (through deficits in education). ICT is increasingly embedded within these domains of activities and thus if people cannot access and use ICT they are at greater risk of exclusion across all these dimensions as well as being relatively unprotected from economic crisis in the cycles of capitalism.

To address exclusion therefore involves addressing these structural and phenomenological concerns. This means addressing the support people need to engage in flexible labour markets as well as the training and skills they need to work in the e-economy. It also involves developing strategies to ensure the regeneration of locales and regions that have few local services and offer little opportunity for their residents. In this context Steinert and Pilgram (2007) argue that, rather than discussing 'exclusion', the focus should be on 'participation'. They posit that access to quality resources is key to enabling individuals to participate in society (Steinert & Pilgram 2007). Given the ways in which ICT is becoming embedded in economic and social life, it is a key resource for participation – social, economic, political and cultural – thus ICT resources are embedded within the multi-dimensionality of exclusion.

This argument enriches debates on the digital divide, which can reduce complex issues of exclusion to divides in digital capacities of various kinds, rather than tracing the social relations of exclusionary situations and the role of the Internet within those relations. It starts to elucidate what an individual or group is excluded *from*, and what resources are needed for him/her and/or groups to participate. This is significant across the dimensions of social life because the character of inequality varies across cultures, as does the meaningfulness of technologies (Wyatt et al., 2000). Therefore, one can start to address e-inclusion through the lens of participation by making the link between exclusions and socio-economic trends within types of information society developments. And in particular one can start to consider the needs of different social groups in order for them to participate in society and ICT developments within society.

## SOLUTIONS AND RECOMMENDATIONS

The Riga Declaration (hereafter called 'Declaration') sets out possible solutions and recommendations for bridging social exclusion with e-inclusion.

To address geographical divides means facilitating affordable access to ICT networks and terminal equipment, content and services. Places particularly at risk of geographical divides are remote and rural areas and regions lagging behind information society developments. This divide is addressed by promoting new technologies, cooperation between the public and private sector and by supporting networking, benchmarking and exchange of experiences between countries and regions. A core policy aim is to reduce the disparities in Internet access between all regions, especially broadband in under-served locations as well as public Internet access points. For instance the Declaration aims to achieve broadband reach for at least 90% of the EU population by 2010. To this effect, the EU will use its Structural Funds and its Rural Development Fund. National i2010 broadband strategies will be updated to provide additional guidance and targets regarding coverage and connectivity in public administrations, schools, health centres and other key locations (European Commission, 2006, p. 3).

To ensure that ICT is accessible for all, eAccessibility provisions need to be written in EU legislation on electronic communications and terminal equipment. This needs to be supported by partnership approaches between voluntary, public and private sector actors in implementing eAssessible services. European eAccessibility standards and common approaches must be implemented in public procurement for ICT products and services. Common requirements and standards for accessible and usable ICT hardware, software and services must be established that are supported by user involvement. The aim should be to facilitate accessibility and usability of ICT products and services for all, with a special focus on people with disabilities. This will be achieved by accessible digital content on all platforms, interoperable assistive technologies, and mainstreaming inclusive design and design for all in the development of ICT products and services. Key aspects to achieve this are research, professional training, centres and networks of excellence, user involvement, labelling, and conformity assessment. Links between mainstream ICT industry and the assistive technologies sector needs to be facilitated, and a European curriculum on design for all should be promoted (European Commission, 2006 p. 3).

To address digital literacy the Declaration states that countries should develop both formal and informal education systems that build on existing initiatives as well as develop new ones. These actions should be tailored to the needs of groups at risk of exclusion, because of their social circumstances or their capacities and special needs. This is especially the case for those who are situated in conditions of: unemployment; immigrant positions; low educational levels; disability; old age; marginalised positions of young people. Digital literacy and supporting education needs to contribute to the employability and working conditions of people in these situations. These initiatives, where appropriate, should be undertaken in partnerships with the private sector and in conjunction with initiatives on basic education and media literacy in the areas of life-long-learning, e-skills, and digital user rights. Regular upgrading of ICT competences also need to be facilitated so that the workforce can efficiently cope with technical and economic developments. These actions need to be supported by appropriate qualification schemes, which should represent levels of digital literacy and be recognized trans-nationally in line with the European Commission orientations on Key Competences for Life Long Learning (European Commission, 2006, p. 4).

To foster pluralism, cultural identity and linguistic diversity in digital communication and spaces requires promoting the creation of accessible digital content, and wide and cross-national access to digital information and cultural heritage in support of European integration. This also includes fostering multilingual and local content throughout Europe, as well as European values of freedom, tolerance, equality, solidarity and democracy. The focus on pluralism extends to improving the possibilities for economic and social participation for immigrants and minorities by using ICT to enable integration, creativity and entrepreneurship thus stimulating their participation in information society. Tailored ICT training and support will be development improve the employability and productivity of minorities (European Commission, 2006, p. 4).

In relation to the risks the elderly face of exclusion, the Declaration argues that the full potential of the internal market of ICT services and products for the elderly must be addressed to overcome fragmented services by promoting interoperability through standards and common specifications. Attention must be paid to improving the employability, working conditions and work-life balance of older workers. This includes developing ICT that can easily be used everywhere including at home. It also includes training older workers with the provision of training coming from the public, private sectors and from civil society. More generally, innovations in ICT enabled access to goods, services, and content must enhance the active participation of older people in society and in the economy, as well as supporting self-expression. The developments of ICT must increase the quality of life, autonomy and safety of older people while respecting privacy and ethical requirements. This can be done through independent living initiatives, the promotion of assistive technologies, and ICT enabled services for integrated social and healthcare, including personal emergency and location-based services (European Commission, 2006, p. 2).

To support participation in political processes requires ensuring that all public web sites are accessible by complying with the relevant W3C common web accessibility standards and guidelines. The EC requests that the private sector to do likewise, and to consider accessibility principles from the outset of the web development process, and to develop the appropriate authoring tools and software. This should support the design and delivery of key services and public service policies in a user-centric and inclusive way. This involves using channels, incentives and intermediaries that maximise benefits and convenience for all so that no one is left behind. Part of this development is to promote user rights and obligations towards public administrations and regarding participation in democratic processes (European Commission, 2006, p. 4).

## FUTURE RESEARCH DIRECTIONS

E-business requires a skilled labour force and a range of consumers for e-services and products. For e-commerce to flourish it needs a stable and inclusive society supported by strong democratic process. E-inclusion is therefore an important aspect underpinning e-business. To support e-inclusion further research is needed in:

- User-centred design for eAccessibility, in particular developing design-in-use approaches in community based projects and with those groups who are hard to reach.
- Understanding training in ICT education for different groups in society, with special attention focusing on the educational needs and environments outside of formal educational settings. A key area is gaining an

understanding of how to create new spaces for learning in integrated on- and offline environments.

- Promoting and exploiting multi-cultural content in digital spaces, with research focusing on community based forms of producing content and on providing platforms and environments for the exchange of cultural content in cyberspace.
- How to develop cross-sector partnerships for the delivery of e-services and e-government: research needs to address the ways in which established partnerships can innovate in order to develop progressive services in line with user needs and web advancements.
- Constructing business and service models in providing universal broadband infrastructure and services. Research needs to address the legal and regulatory issues of universal access to shared broadband and the ethics of using and sharing information and content.

## CONCLUSION

The notion of e-inclusion extends the idea of the digital divide to address the dynamics of social exclusion within an e-economy and information society. E-inclusion links structural and phenomenological aspects of exclusion that includes the role of ICT within the dynamics of exclusion. It focuses on participation as a route to inclusion, which informs policy solutions and recommendations. For example, the Riga Declaration aims to foster participation by focusing policy on e-accessibility, user-centred design of ICT and services, and training and support to improve ICT skills for different groups in society. The Declaration acts as an exemplar case that can be adapted to meet specific local, regional and national needs by other policy makers. The main point is that the concept of e-inclusion is important because it goes some way to address the role of ICT to foster participation in economic activity and in supporting social cohesion.

## REFERENCES


Burrows, R., & Loader, B. (Eds.). (1994), *Towards a Post-Fordist Welfare State?* London: Routledge.

Byrne, D. (1999). *Social Exclusion.* Buckingham, UK: Open University Press.

Castells, M. (2001). *The Internet Galaxy: reflections on the Internet, business and society,* Oxford, UK: Oxford University Press.

Dutton, W. (2001): *Society on the Line – Information Politics in the Digital Age,* Oxford, UK: Oxford University Press European Commission (2006). *The Riga Ministerial Declaration on eInclusion.* Retrieved from ec.europa.eu/.../events/ict_riga_2006/doc/declaration_riga.pdf

Haddon, L. (2004). *Information and Communication Technologies and Everyday Life.* Oxford, UK: Berg.

Mansell, R., & Steinmueller, W. (2000). *Mobilizing the Information Society: strategies for growth and opportunity.* Oxford: Oxford University Press.

Members of the High Level Group on the Information Society. (1994, May 26). *Europe and the Global Information Society: Recommendations to the European Council*. Brussels: European Commission.

Norris, P. (2000). *Digital Divide: Civic Engagement, Information Poverty, and the Internet Worldwide.* New York: Cambridge University Press.

Roche, M. (1992). *Rethinking Citizenship, Welfare, Ideology and Change in Modern Society.* Cambridge, UK: Polity Press.

Steinert, H., & Pilgram, A. (2007). *Welfare Policy from Below: Struggles Against Social Exclusion in Europe.* Aldershot, UK: Ashgate.

Wessels, B. (2008). Generating Agency within Regional Communities to Foster E-inclusion: The Case of South Yorkshire, UK. *European Journal of E-practice*, *3*, 1–11.

Wessels, B. (2009). *Understanding the Internet: a socio-cultural perspective.* Basingstoke, UK: Palgrave.

Wyatt, S., Henwood, F., Miller, N., & Senker, P. (Eds.). (2000). *Technology and In/equality: Questioning the Information Society.* London: Routledge.

## KEY TERMS AND DEFINITIONS

**Information and Communication Technology (ICT):** ICT can be defined as 'all kinds of electronic systems used for broadcasting, telecommunications and computer-mediated communication' (Dutton, 2001, p.7). Examples include: 'personal computers, video games, interactive TV, cell phones, the Internet [and] electronic payments systems (Dutton, 2001, p.3).

**Information Society:** There is debate about an exact definition of information society but in general terms it refers to society in which the creation, distribution, diffusion, use, integration, and manipulation of information is a significant economic, political, and cultural activity.

**Digital Divide:** Generally speaking, the term digital divide addresses the difference between actors with varying levels of access and capacity of Internet usage that 'adds a fundamental cleavage to existing sources of inequality and social exclusion in a complex interaction' (Castells, 2001, 247).

**E-Inclusion:** The Riga Ministerial Declaration (11 June 2006) defines e-inclusion as 'inclusive Information and Communication Technologies (ICT) and the use of ICT to achieve wider inclusion objectives and policies aiming at both reducing gaps in ICT usage and promoting the use of ICT to overcome exclusion'.

**E-Economy:** There is debate about the exact meaning of the term but in general terms an e-economy is an economy that is characterized by extensive use of the Internet and information technology.

# Chapter 108
# Importance of Electronic Record Preservation in E-Business

**Helena Halas**
*SETCCE, Slovenia*

**Tomaž Klobučar**
*SETCCE and Jožef Stefan Institute, Slovenia*

## INTRODUCTION

The development of information and communication technology (ICT) and the rapid increase of e-business have led to a rapid growth of the number of produced and exchanged electronic documents. The documents range from simple receipts to complex legal contracts and service level agreements. More and more types of documents are required to be preserved for longer periods of time, for example, due to legal reasons or as evidence of a business activity. Although electronic records are created and managed in an electronic form through their entire lifecycle, they are usually printed at the end and preserved in paper form to be legally valid. This has led to a situation where paper archives are becoming too complex to be effectively managed, and need to be replaced with electronic record preservation systems. Properly preserved electronic records have equivalent legal value as records in the paper form and can be used as evidence material in court. Advanced organizations use document management systems (DMSs) for managing large numbers of electronic records. For example, a mobile phone operator creates user contracts in an electronic form or converts them from paper, preserves the contracts as long as required by the law, and disposes them after that. Unfortunately, DMSs frequently do not provide adequate technologies for integrity and authenticity provisions, which are critically important for long-term electronic record preservation in business organizations. More advanced electronic records preservation technologies are therefore required.

When introducing a solution for electronic records preservation in an organization it is important to choose a solution that suits the organization's characteristics and needs in accordance with exist-

DOI: 10.4018/978-1-61520-611-7.ch108

ing legislation. Examples of different approaches are the implementation of electronic preservation within the organization, outsourcing part of the archiving service, or completely outsourcing the archiving service. Characteristics that may have a significant impact on a decision about the appropriate solution are, for example, the type and size of an organization, defined e-business processes, type and quantity of electronic documents, etc.

The main purpose of this book chapter is to analyze electronic records preservation for business organizations from an organizational perspective. The main focus is not on technologies, but on organizational possibilities for an electronic record preservation solution, such as outsourcing the service, implementation on an organization's own IT infrastructure as well as others. The importance of electronic record preservation in today's and future e-business environment is discussed, and the advantages and disadvantages of electronic archives are presented. The main goal of the chapter is to point out what an organization needs to take into consideration when introducing an electronic record preservation solution.

## BACKGROUND

Electronic record preservation, in general, refers to the preservation of electronic records which originate in electronic form or are properly digitalized from a paper form. According to the ISO (2001), records are information created, received, and maintained as evidence and information by an organization or individual, in pursuance of legal obligations or in the transaction of business activities. Electronic records are records in electronic form created by a software application or as a result of digitization. The preservation process starts at the time of record creation or reception and continues throughout the entire record lifecycle to its preservation or disposal. It is inevitably linked with the records management field (European Commission, 2008).

Different standards that define technological approaches for the management of electronic records have been recently developed, for example US-DoD 5015.2, DOMEA, or NOARK4, but they mostly discuss the electronic preservation problem from a governmental perspective of specific countries. MoReq (Model requirements for the management of electronic records) is an international standard designed for any kind of organization (governmental or otherwise) and its main purpose is to unify the functional requirements for the management of electronic records for EU members. Updated and extended in 2008 MoReq2 (European Commission, 2008) is meant to become an internationally recognized standard, which would replace current national standards inside different European countries.

Over the last several years, a lot of effort has been spent on defining, improving, and evaluating electronic preservation strategies from a technical point of view. Although most of the challenges associated with electronic preservation are not technical but organizational (Asproth, 2005), this aspect has not been investigated much. Barbedo (2000) claims that existing organizational and administrative problems hinder implementation of electronic preservation. Most of the research into electronic record preservation was done by libraries, archives or museums that are facing different set of problems than business organizations. For libraries (archives, museums) preservation is their primary activity and they are more concerned with strategies for providing preservation for long periods of time, as the material they handle is mostly archival and therefore needs to be preserved permanently. Besides, libraries are focused on receiving and accessing records, copyrights, cooperation with other institutions, etc. On the other hand, preservation in business organizations mostly supports their business activity and core business processes, and helps them to meet legal requirements. For business organizations it is of great importance that records are not changed or lost or accessed by unauthorized persons.

There currently exist a few approaches for the evaluation and selection of the electronic record preservation solutions for business organizations. The methodology developed within the PLANETS projects can be used to evaluate various alternatives with respect to specific requirements (Becker et al., 2007). It originates from the DELOS approach for evaluating and selecting an electronic preservation solution and is based on an adapted version of utility analysis, which can be used for choosing an optimal preservation solution for each individual situation. The PLANETS methodology primarily supports the selection of the most suitable preservation strategy for long-term preservation and does not deal with other problems of electronic preservation. Although the importance of processes and financial aspects of the problem is realized, the main focus is still on the technology.

The DIRKS methodology defines a strategic approach designed to assist organizations to improve their management of records and information (National Archives of Australia, 2001). It is based on the Australian Standard AS 4390-1996 and the International Standard ISO 15489. This methodology offers a structured approach for developing an electronic preservation solution. It consists of eight steps: (1) preliminary investigation, (2) analysis of business activity, (3) identification of preservation requirements, (4) assessment of existing systems, (5) identification of strategies for preservation, (6) design of preservation system, (7) implementation of the system, and (8) review. The methodology requires many resources and much time and is therefore not very suitable for smaller organizations. It leads organizations through the process of establishing electronic preservation but does not provide them with directions for deciding which solution to choose. Also, it has been designed to be used in different types of organizations and is therefore quite general. Finally, the methodology does not discuss the option of outsourcing the entire electronic preservation service.

BURO research (Ball. et al., 2002) studied the concept of outsourcing from the perspective of libraries, museums and archives. This research provides a weighted decision matrix, recommended for judging an organization's potential for outsourcing. The purpose of the matrix is to gather information for making a decision whether an organization should outsource its record preservation. The matrix appears to be useful for assessing the suitability of services for outsourcing. But outsourcing is treated at a general level and therefore factors that influence a decision are also treated in a general manner. The concept has been developed for libraries, archives and museums only that, as said before, are faced with other problems of electronic preservation that are not relevant to business organisations.

## INTRODUCTION OF ELECTRONIC PRESERVATION IN ORGANIZATION

While classic archiving is a one time action, electronic preservation is a continuous process and is tightly connected with the entire record lifecycle from its creation to recordkeeping and disposal. As an electronic record can easily be manipulated it is important to protect its integrity and authenticity throughout the whole preservation period which can span over 100 years or more if required by the law, directives or internal organizational policies. This means that the required preservation period can be much longer than the lifetime of the electronic storage medium, software components and record format. Because of obsolescence of technologies (e.g. media readers), storage media (e.g. disk, CD-ROM) or record formats (e.g. Wordstar, Word, PDF/A, TIFF) the preserved records can become inaccessible or unreadable after some time. The problem is addressed by preservation strategies, such as technology emulation, information migration, and encapsulation (Lee et al., 2002).

With the introduction of an ICT environment the concept of record preservation requirements

*Table 1. Advantages and disadvantages of paper and electronic records*

| Format | Advantages | Disadvantages |
|---|---|---|
| **Paper** | - Familiar and convenient for use<br>- Requires no special hardware or software for reference<br>- Portable in reasonable quantities<br>- Archiving is a one time action<br>- Well established legislation | - Can tear or get worn out (active stage)<br>- Ineffective and costly distribution<br>- Considerable amount of space for storage is required<br>- Costly archiving space<br>- No immediate and continuous availability<br>- Difficult to organize for effective retrieval<br>- Difficult to control<br>- Can be lost or stolen<br>- Simultaneous use is not possible |
| **Electronic** | - Faster creation, rapid distribution<br>- Reducing the duration of life cycle<br>- Lower costs of creation and distribution<br>- Rapid access<br>- Superior references functionality (active stages)<br>- Searching by multiple attributes, content<br>- Can be accessed by multiple users at once (simultaneously)<br>- Better cooperation between employees<br>- Easy control and traceability<br>- Not damaged by use<br>- Backup copies ensure continued availability (in case of loss, damage or stealing of storage media)<br>- Reduced storage space<br>- When properly preserved, they are valid as evidence in court | Obsolescence of storage media, record formats…<br>Inadequate, not unified legislation<br>Preservation is a continuous process<br>No experience, tradition |

has fundamentally changed (Chen, 2001). Although they have fundamentally the same goal the processes of classic and electronic preservation differ significantly. The main differences that should be taken into consideration when introducing electronic preservation are presented in (Table 1).

## Factors for Selection of an Electronic Record Preservation Solution

The decision process for the selection of an electronic record preservation solution is very complex, as it depends on many technical and organizational attributes. An organization can implement a solution on its own infrastructure or outsource the service. It can also decide to implement electronic preservation partially in-house and outsource only some services (for instance capturing paper records). On the other hand it can decide to preserve all received or created records electronically or just those that originate electronically. In this section we present some of the external and internal factors that influence the decision. The external factors can be legislation, existence of supply market, or customers, partners, contractors, while internal factors reflect organizational needs, wants and capabilities that must be taken into consideration when defining preservation requirements.

### External Factors

**Legislation**

Technologies have made considerable progress in the field of electronic preservation. But like in many other areas of interest, laws are changing too slowly to keep up with the evolution of these technologies (Boudrez, Dekeyser & Dumortier, 2005). Establishment of legislation that regulates the legal validity of electronically preserved records and other data is the primary condition that needs to be fulfilled, so that organizations can start considering the use of electronic record preservation.

Legislation in the field of electronic preservation differs among countries and in some of them is still not well regulated. Hodge and Frangakis (2004) in their research discuss countries that enacted legislation about digital publications. The research does not perfectly cover the field of electronic preservation in e-business but it indicates that many countries are aware of the importance of electronic preservation and if they have not already enacted related laws they probably have a legislative process in place.

**Customers, Partners, and Contractors**

Customers' preferences and expectations, and the characteristics and requirements of an organization's partners or contractors must be taken in consideration. A great majority of people are used to doing business in traditional ways and do not use modern technologies for electronic commerce, such as electronic signatures, and see no need for change. On the other hand, for organizations (legal individuals), which operate with large numbers of documents every day or conduct e-business, electronic preservation may present an important or even indispensable part of their business. When an organization is making a decision about electronic preservation, it should pay attention to the involved parties, especially if they play an important role in its business.

**Development of Supply Market**

If there are no prospective preservation solutions or services on the market there is no possibility to provide electronic preservation for an organization. Today, many technical solutions for electronic preservation are available on the market and also many suppliers of outsourcing services exist. The challenge is to choose the solution that really provides records integrity and authenticity and to choose the most appropriate solution for a specific organization.

## Internal Factors

Organizations need to focus on the following characteristics that may influence the decision for an electronic record preservation solution:

- Cultural:
  - Organization strategies and policy

Organizations may have a strategy to focus their resources on their core business and to outsource other activities. This is typical for organizations where information technology, computing and/or communications, are not core line of business, or are not in an area in which the organization has a competitive advantage (Worthington, 1997).

- Organizational:
  - Type and size of the organization
  - Sphere of activity
  - Preservation business process characteristic (core or supporting)
  - Types and amount of documents the organization wants to preserve
  - Document flows of existing business processes
  - Frequency of repeated need for and usage of archived documents
  - Consequences if documents are lost or can not be reached immediately

In a business organization, documents preservation supports business processes. In general, the establishment of in-house electronic preservation solution is more appropriate for larger organizations, while smaller organizations might consider the possibility of outsourcing the service. If the organization operates in the ICT area or some other area, which requires good ICT support, investments in establishing infrastructure for electronic preservation could be significantly lower than outsourcing. Such organizations should consider the establishment of their own preservation solution. The same hold true for organizations that operate with sensitive or secret information and do not want or are not permitted to transfer documents to a third party.

The types and quantity of documents that need to be preserved have a greater influence on the decision to implement electronic preservation in business operations than on the selection among different options. Frequency of repeated usage of preserved records and the consequences if records are lost are more important than the technical aspects of the solution but may also affect the organizational aspect of the solution. Preservation services providing frequent and prompt access to preserved records are more expensive and therefore the organization might determine that it is more optimal to implement the preservation solution in-house.

- Financial/economic:
  - Costs and benefits of the project
    - budget, human resources and time
    - time of capital return
    - tangible and intangible benefits
  - Risks to which the organization will be exposed if it adopts particular solution

When calculating the resources needed for an in-house electronic preservation solution the initial investment costs should be considered as well as costs for maintenance and management. On the other hand, the initial investment for outsourcing the service is generally not needed or is insignificant, but costs could increase over time and with the growth of preserved material.

- Functional/technical:
  - Service delivery and performance
  - Ease to specify service
  - Identified opportunities for outsourcing aspects of the project
  - Organization's existing ICT infrastructure
  - Ease with which the proposed solution can be integrated with existing systems and processes
  - Available resources and expertise for the project
  - The amount of user support and training required for each solution

If the preservation service is outsourced efficient and effective delivery and performance must be assured. Different preservation requirements across an organization may make the possibility of outsourcing difficult, as requirements can not be well defined. To implement and manage an electronic preservation solution expertise and staff are required. If they are not available in-house, they can be obtained through the use of consultants. Lack of expert knowledge and experience could lead to the selection of an inappropriate or inadequate solution as well as difficulties during its implementation, maintenance or management. Therefore, the organization should consider on outsourcing the service.

## Solutions for Organizational Aspects of Electronic Preservation

Organizations have different options for the preservation of electronic records. The decision for selecting the most appropriate solution should be based on the characteristics of a specific organization. One possibility is to implement an in-house solution, which may significantly affect infrastructure costs and return on investment. Organizations such as financial institutions, insurance companies and governmental institutions should consider such an option as well as other large scale organizations in which easy access to records and the validity of these records are strongly coupled to the organization's key business processes. The opposite approach is to outsource the entire service, which may be the most appropriate solution for the middle and small-sized organizations in terms of cost savings and optimization of operation. Furthermore, the entire service of electronic preservation can be separated into partial services, which are in the domain of one or more providers or are implemented by the organization itself.

Outsourcing of the service (partial or entire) seems to be the most likely solution for a majority of organizations because of the required expertise and complex and expensive infrastructure needs. The costs of an outsourced electronic preservation solution are usually lower than the costs of acquiring, implementing and maintaining an in-house solution. Because of professional expertise and field experience, external providers are able to provide superior, secure and reliable services. They are also better able to follow technological changes and adapt or modernize their solution if necessary. No additional employment and almost no training of human resources are needed by an organization that outsources the preservation function.

## FUTURE RESEARCH DIRECTIONS

Future research will be directed towards further classifying the factors that influence the decision of business organizations on making an electronic preservation solution. Furthermore, the implementation methodology of selected solutions should be investigated. One of the issues that still need to be discussed is an evaluation of the return on investment. Some researches claim that electronic preservation is a significant source of savings (Rusbridge, 2006), while others say that establishment of electronic preservation increases total costs (Granger, Russell & Weinberger, 2000). Analyzing the costs of electronic preservation is complicated as the field is relatively new and the process is not yet well-understood (Lavoie, 2003). In addition, preservation costs are a function of many variables and cost implications are difficult to characterize. Electronic preservation is an investment decision, where expenditure in the current period is made on the belief that benefits will occur in some future period. The return on investment may take forms other than the direct financial benefits. Although it may be too early to make meaningful comparisons of the costs between traditional and electronic preservation it is clear that the costs of digital preservation will be different and will require ongoing resources (Granger, Russell & Weinberger, 2000).

## CONCLUSION

In this chapter we have discussed, from an organizational perspective, possible alternatives for implementing electronic record preservation in a business organization, and presented several factors that may influence the decision on choosing appropriate preservation solution. Organizational problems may hinder implementation of electronic preservation. Therefore this aspect must be dealt with more in detail. Electronic preservation is rarely introduced into organizations because of a lack of expertise and experience. Guidelines or directives for organizations to reach a decision on the most appropriate preservation solution should be available. As organizations are typically limited by available human resources, finances and time, the process of selecting and implementing a solution should not be too difficult and time consuming.

## REFERENCES

Asproth, V. (2005). Information Technology Challenges for Long-Term Preservation of Electronic Information. *International Journal of Public Information Systems, 1*, 27-37. Retrieved February 17, 2009 from http://www.ijpis.net/issues/no1_2005/IJPIS_no1_2005_p3.pdf

Ball, D., Barton, D., Earl, C., & Dunk, L. (2002). *A study of outsourcing and externalisation by libraries, with additional reference to the museums and archives domains*. Resource Research Project. Bournemouth, UK: Bournemouth University.

Barbedo, F. (2000). The SIADE Project: A Portugeses Experience on Electronic Records. In V. L. Sarno, (Ed.), *Authentic records in the electronic age,* (pp. 71-84). Vancouver: Instituto italiano di cultura.

Becker, C., Strodl, S., Neumayer, R., Rauber, A., Bettelli, E. N., & Kaiser, M. (2007). Long-Term Preservation of Electronic Theses and Dissertations: A Case Study in Preservation Planning. In *Proceedings of the 9th Russian Conference on Digital Libraries (RCDL'2007),* Pereslavl, Russia.

Boudrez, F., Dekeyser, F., & Dumortier, J. (2005). *Digital archiving: the new challenge?* K.U. Leuven: Interdisciplinary Center for Law & Information Technology (ICRI).

Chen, S. S. (2001). The Paradox of Digital Preservation. *IEEE Computer Society Press*, *34*(3), 24–28.

European Commission. (2008). *Model Requirements for the Management of Electronic Records – MoReq2 Specification*. Bruxelles, Luxemburg: IDABC Programme, CECA-CEE-CEEA.

Granger, S., Russell, K., & Weinberger, E. (2000). *Cost Elements of Digital Preservation*. Draft. Retrieved November 24, 2008 from http://www.leeds.ac.uk/Cedars/colman/CIW01r.html.

Hodge, G., & Frangakis, E. (2004). *Digital preservation and permanent Access to Scientific Information: The State of the Practice*. Report, The International Council for Scientific and Technical Information (ICSTI) and CENDI US Federal Information Managers Group.

ISO (2001). *Information and documentation – Records management – Part 1: General*. International Standard ISO 15489-1.

Lavoie, B. F. (2003). *The Incentives to Preserve Digital Materials: Roles, Scenarios, and Economic Decision-Making*. White paper, OCLC Online Computer Library Center, Inc.

Lee, K. H., Slattery, O., Lu, R., Tang, X., & McCrary, V. (2002). The State of the Art and Practice in Digital Preservation. *Journal of Research of the National Institute of Standards and Technology*, *107*(1), 93–106.

National Archives of Australia (2001). *DIRKS – A Strategic Approach to Managing Business Information*. Commonwealth of Australia: National Archives of Australia.

Rusbridge, C. (2006). Excuse Me… Some Digital Preservation Fallacies? *Ariadne, 46*. Retrieved March 5, 2009 from http://ariadne.ac.uk/

Worthington, T. (Ed.). (1997). *Outsourcing and contracting out of IT products and services*. Australian Computer Society. Retrieved February 25, 2009 from http://www.acs.org.au/president/1997/outsrc/paper.htm

## ADDITIONAL READING

Ball, D. (2003). A weighted decision matrix for outsourcing library services. *The Bottom Line*, *16*(1), 25–30. doi:10.1108/08880450310464036

Blanchette, J.-F. (2004). Defining Electronic Authenticity: An Interdisciplinary Journey. *Proceedings of the International Conference on Dependable Systems and Networks (DSN04), Florence, Italy* (pp. 228-232).

Blanchette, J.-F. (2004). The Digital Signature Dilemma: To Preserve or Not to Preserve? *Proceedings in the IS&T's 2004 Archiving Conference* (pp. 221-226). Springfield, Virginia: The Society for Imaging Science and Technology.

Center for Information Policy. (2005). *Best Practices in Electronic Records Management*. Maryland, USA: University of Maryland, Center for Information Policy.

Council of Australasian Archives and Records Authorities (2006*). Digital archiving in the 21st century*. Commonwealth of Australia: Council of Australasian Archives and Records Authorities.

Cunningham, P., & Fröschl, F. (1999): *Electronic Business Revolution: opportunities and challenges in the 21st century*. Berlin: Springer Verlag.

Digital Preservation Coalition. (2007). *Preservation Management of Digital Materials: The Handbook*. Digital Preservation Coalition. Retrieved on March 3, 2009 from http://www.dpconline.org/graphics/handbook/.

Dumortier, J., & Van den Eynde, S. (2002). *Electronic Signatures and Trusted Archival Services.* K.U. Leuven: Interdisciplinary Center for Law & Information Technology (ICRI).

EMC. (2007). *Managing Storage: Trends, Challenges and Options (2007-2008), EMC perspective*. Massachusetts, USA: EMC Corporation.

Forum, D. L. M. (1997*). Guidelines on best practices for using electronic information: How to deal with machine-readable data and electronic documents* (Updated and enlarged edition). Italy: European Communities.

Francis, R., Gibbs, R., Harrari, L., Heazlewood, J., Hills, B., Leask, N., et al. (1998). Electronic Archiving – a 100 Year Experiment. *Proceedings of the Third Document Computing Symposium, Sydney, Australia*.

Gladney, H. M. (2006). Principles for Digital Preservation. *Communications of the ACM*, *49*(2), 111–116. doi:10.1145/1113034.1113038

Hedstrom, M. (2003). *It' about a time: research in challenges in digital archiving and long term preservation.* Final report, The National Science Foundation and The Library of Congress.

Hodge, G. M. (2000). Best Practices for Digital Archiving: An Information life Cycle Approach. *D-Lib magazine, 6(1)*. Retrieved on February 2,2009 from http://www.dlib.org/dlib/january00/01hodge.html.

InterPARES Project. (2002). *The Long-term Preservation of Authentic Electronic Records: Findings of the InterPARES Project*. Preservation Task Force Report.

Jerman Blažič, A., Džonova Jerman, B., & Klobučar, T. (2007). Long-term trusted preservation service using service interaction protocol and evidence records. *Computer Standards & Interfaces*, *29*(3), 398–412. doi:10.1016/j.csi.2006.06.004

Libon, O. Van den Eynde, S. (2000). *European Electronic Signature Standardization Initiative (EESI)* - *Trusted Archival Services.* Final report. K.U. Leuven: Interdisciplinary Center for Law & Information Technology (ICRI).

National Archives of Australia (2004). *Digital Recordkeeping: Guidelines for Creating, Managing and preserving Digital Records*. Commonwealth of Australia: National Archives of Australia.

Peterson, M. Zasman, G., Mojica, P., & Porter, J. (2007). *100 Year Archive Requirements Survey*. Storage Networking Industry Association (SNIA).

Rauch, C., & Rauber, A. (2004). Preserving Digital Media: Towards a Preservation Solution Evaluation Metric. *Proceedings of the 7th International Conference on Asian Digital Libraries (ICADL'04), Shanghai* (pp. 203 – 212).

Sanett, S. (2002). Towards Developing a Framework of Cost elements for Preserving Authentic Electronic Records into Perpetuity. *College & Research Libraries*, *63*(5), 388–404.

The National Electronic Commerce Coordinating Council. (2002, December). *Creating and Maintaining Proper Systems for Electronic Record Keeping*. Presented at the NECCC Annual Conference. New York.

Wallace, C., Pordesch, U., & Brandner, R. (2007). *Long-Term Archive Service Requirements*. The IETF Trust.

Williams, R. F., & Ashley, L. J. (2007). *Electronic Records Management Survey*. White paper. Chicago, USA: Cohasset Associates, Inc.

Yeung, T. A. (2004). *Digital Preservation: Best Practice for Museums*. Canada: Minister of Public Works and Government Services.

## KEY TERMS AND DEFINITIONS

**E-Business (Electronic Business):** Any business processes that rely on an automated information system.

**Record Lifecycle:** basic concept in records management. It is a way of looking at how records are created and used.

**Document Management System (DMS):** Computer system used to track and store electronic documents.

**Records:** Information created, received, and maintained as evidence and information by an organization or person, in pursuance of legal obligations or in the transaction of business.

**Electronic Records:** Records in electronic form created by software application or as a result of digitization.

**Electronic Preservation:** Preservation of electronic records which originate in electronic form or are properly digitalized from paper form.

**Preservation Process:** Process from the time of record creation or reception through its entire lifecycle to its preservation or disposal.

**Authenticity:** Means that the record is what it purports to be.

**Integrity:** Referring to the fact that a record is complete and unaltered.

**Outsourcing:** Subcontracting a process to a third-party.

# Chapter 109
# Electronic Commerce Prospects in Emerging Economies:
## Lessons from Egypt

**Sherif Kamel**
*The American University in Cairo, Egypt*

## INTRODUCTION

The information and communication technology (ICT) evolution is aggressively affecting many nations around the world, forcing changes and transformations to business and socioeconomic development plans, reflecting major implications on different economies and contributing to the notions of globalization and the evolution of the global digital economy irrespective of time and distance barriers. ICT is driving the radical transformation and change for individuals, organizations and societies from the marketplace to the cyberspace helping the realization of the digital economy, outsourcing and global outreach. In a fast changing global environment, speed, competition and catering for various diversified cultural elements become key factors for development and growth in the reengineered business environment where electronic commerce (E-commerce) applications promise to grow in volume helping the digital economy to mature and dominate.

Egypt, as a developing nation with an economy in transition, started to invest in building its ICT infrastructure since 1985 as a vital tool for development and leading to availing opportunities for E-commerce to grow. This article describes the emergence of E-commerce in Egypt since the mid 1990s and its implications in the marketplace including the challenges faced relating to social, technological, financial, cultural and legal issues and the efforts exerted by different stakeholders including the government, the private sector and the civil society to diffuse E-commerce in Egypt.

## BACKGROUND

Over the last few decades, ICT became vital as a platform for business and socioeconomic development (Kamel, 2000; American Chamber of Commerce in Egypt, 2002). Moreover, the Internet became an

DOI: 10.4018/978-1-61520-611-7.ch109

important medium for information acquisition and knowledge dissemination across the globe (Kamel, 1995), leading to the formulation of the global information society and creating the digital economy with its growing trends such as competing in time, customer relationship management and smart communities (Kamel et al, 2009).

Since 1985, Egypt has invested in its ICT infrastructure targeting the build-up of its national information infrastructure (NII) to become the platform for the development of all sectors based on timely, relevant and accurate information. During the period 1985-1995, a public-private partnership (PPP) helped realize the establishment of Egypt's information highway (Kamel, 1995). The program embedded the establishment of hundreds of informatics projects and centers in different government, public and private sector organizations as well as the development and improvement of all the building blocks of the information infrastructure such as people, technology (hardware and software), networks, information and knowledge management aspects (Kamel, 1999). In 1991, the government began an economic reform program aiming at transforming the Egyptian economy from centrally planned, inward looking economy to one that is market-based and internationally oriented (Kamel and Hussein, 2001). The government policy focused on the removal of price distortions and obstacles to investment and trade and worked on a plan to introduce smooth and effective processes for the reformation of the financial sector in an attempt to plug-in the one-stop shop approach in the ways business is being developed and managed. The highlights of the program included deregulation of foreign exchange, budget deficit financing, gradual removal of government subsidies to cut down on expenditures, implementation of a privatization program, introduction of a capital market law, abolishment of investment licensing and the revision of the trade policy through the reduction of the level of tariffs of the GATT (Kamel and Hussein, 2001).

In the following phase, the government of Egypt was eager to apply and diffuse emerging ICT to join the world in the development and realization of the global digital economy. This has taken a further boost with the appointment of a cabinet in 1999 that was geared towards investment in the development of an economy that capitalizes on the benefits of ICT and that looks at ICT as a vehicle for socioeconomic development (Azab et al, 2009). ICT was identified as a priority at the highest policy level and a new cabinet office was established namely the ministry of communications and information technology (MCIT) leading to more investments and infrastructure build-up (Kamel, 2005a). Thus, the growth of the ICT industry took massive steps during the period 1999-2009 in different aspects including human, information, legislation and infrastructure (Kamel et al, 2009).

Egypt is a regional hub linking the Mediterranean, Europe, Asia and the Middle East. With a population of over 78 million, it is the most populous country in the region (www.idsc.gov.eg). About 28% of its population is enrolled in educational programs (schools and universities); 58% are under the age of 25 and 19 million represent its workforce; around 5.7 million are working for the government sector. Egypt is witnessing its reincarnation into a modern, liberal and private sector-led market driven economy. The current economic growth rate stands at 4.1 annually with an inflation of 11.6%. Estimates show that unemployment is standing at 8.8% and the labor force is growing at around 2.7% annually (www.amcham.org.eg). Egypt is undergoing a liberalization program of its public sector, investing heavily in its human capital, encouraging foreign direct investment (FDI) and using innovative ICT as a platform for business and socioeconomic development for example as an important engine for job creation (ITU, 2008). The government in collaboration with the private sector through a variety of PPP models is restructuring many of its major economy sectors such as education, health, government reform as well as working on closing both inter and intra digital divides (www.idsc.gov.eg). Moreover, based on a national ICT plan and a revisit of a number of short-term plans, Egypt set its targets for 2007-2010 through an amended ICT strategy that addresses three main pillars, ICT sector reform, ICT reform and development and ICT industry development (Kamel, 2009a).

Within the ICT spectrum, the Internet is a major driving force of change in the global market place (Kamel, 1995). It is a global information highway linking countries like Egypt with the rest of the world (Bell, 1998). It promises to change the way people live, work, study, and get entertained amongst other diverse implications. The growth of the number of Internet users has been stunning and it is expected to continue to rise as the world becomes more aware of the opportunities enabled by the Internet (Cerf, 1999). In the case of Egypt, with an economy relying 92% on small and medium-sized enterprises (SMEs), the Internet and E-commerce can empower SMEs to become global players without the resources of a multinational corporation (ITU, 2008).

## IMPLICATIONS OF INTERNET GROWTH ON GLOBAL E-COMMERCE

The phenomenal growth of the Internet has certainly been one of the driving forces for the introduction and diffusion of E-commerce worldwide. The Internet with its massive innovative capacities will no doubt boost efficiency and enhance market integration domestically and globally, especially in developing countries that are most disadvantaged by poor access to information. However, it is important to note that it can also have negative implications for nations that will not have access to information (Kamel et al, 2008). The Internet, as an output of the ICT evolution, is the largest network of computers in the world, providing a wealth of information and knowledge. E-commerce is one of the most important topics in today's global business environment. Consequently, understanding the degree to which the Internet will change business and society is a vital research topic. The global society is currently witnessing a phase of transition from an information age that was physical to an information age that is digital (Lynch and Lundquist, 1996).

## INTERNET EVOLUTION IN EGYPT

The 21st century promises to bring to the world more innovations, more opportunities and more challenges. Therefore, countries around the world, including Egypt, should be prepared for a more competitive global marketspace that is information and knowledge driven. The global Internet market today is estimated to have over 1.6 billion users with over 2.1 billion mobile users; all are potential consumers for E-commerce and mobile commerce applications. However, the Internet users in developing countries only constitute a small percentage of the total global users around 18.6% (www.internetworldstats.com) reflecting the fact that the current distribution of Internet access needs to be restructured so that members of different societies benefit from the digital revolution.

Internet penetration has grown rapidly since its inception in Egypt in the early 1990s, mainly because of a number of government and private sector initiatives. In April 2009, the number stands at 14.1 million subscribers reflecting a modest penetration rate of 15.2% and around 593,042 fixed broadband subscribers. In terms of mobile penetration, there are 38.06 million subscribers (around 50.7% penetration rate) benefiting from the competition of three mobile operators. Internet access is well diffused in the major cities spread across Egypt's 28 provinces. Penetration in the remote and underprivileged communities is less indicating relative cases of intra digital divide. In that respect, the government is encouraging

Internet access via its multi-stakeholders PPP initiative namely, "IT clubs" throughout Egypt (www.egyptictindicators.gov.eg). IT clubs are government-funded IT centers, often attached to sport or youth clubs, offering Internet access and basic computer classes. The network of clubs grew from 30 in 1999 to 1,751 in December 2008. IT clubs are diffused across urban and rural areas with more concentration among the underprivileged segments across the different provinces, they represent the Internet café model for them (Kamel, 2005b). Internet Cafés are popular in Egypt with over 1,200 cafés established since 2000 and mainly common in Cairo and Alexandria (www.mcit.gov.eg).

It is important to note that rapid growth has been encouraged by government-led "free Internet models" services, which started in January 2002, when the country had fewer than 750,000 Internet users (EIU, 2007). Conceived as a partnership between Telecom Egypt (TE), the national fixed-line carrier, and a variety of private-sector Internet service providers (ISPs), the free Internet model is available in all of Egypt's provinces stretching to over 1 million square kilometers. With free Internet, dial-up users can log on anytime for the cost of a local phone call, which is about 0.02 US dollars for six minutes. TE turns over 70% of the value of each Internet call to the appropriate ISP. The new model, overtime, contributed to rapid attrition among the nation's 110+ ISPs. Unlike the dial-up free Internet model, broadband diffusion has not been successful and despite the revisited prices (currently standing at around 17 US dollars per month for a 256-kbps line), the model is offered through another PPP model in collaboration with the major private-sector ISPs controlling 95% of the broadband market.

## ELECTRONIC COMMERCE IN EGYPT

Developed nations as opposed to developing nations have been showing solid and growing improvements with respect to their economies when it comes to E-commerce implications (Javalgi et al, 2005). Such fortunate realization is not shared with developing nations in general and with Egypt in specific (Elbeltagi, 2007) whereas the development of E-commerce in developing nations has been less promising than expected (ITU, 2008). E-commerce is still in its infancy in Egypt and for many entrepreneurs in the developing world, online buying and selling is still far from being a reality. In 1998, a national E-commerce committee was founded by the Internet Society of Egypt with representatives from different stakeholders. The committee was mandated to set the framework to introduce and diffuse E-commerce within the community. The committee launched Egypt's E-commerce initiative in September 1999 however, a number of challenges hindered the growth of E-commerce and its realizations of its full potentials such as local culture, politics, and ICT infrastructure, adequacy, completeness and readiness (Elbeltagi et al, 2005; Stahl and Elbeltagi, 2004).

More specifically, a limited credit card community of about 2 million cards whereas Egypt is a classical case of a cash-oriented society, consumer mistrust of online transactions and a lack of legal clarity have been blamed for the stunted development of E-commerce (Kamel and Abdel Ghaffar, 2003 and 20042004). Moreover, the low overall rates of computer penetration standing at 4.27 per 100 inhabitants despite the PC for every home initiative launched in 2002 and restructured to PC2010 that targets a penetration volume of 4 million PCs by 2010 (www.mcit.gov.eg). It is important to note that given the fact that computer penetration is much higher within the business community than among the general population, it is envisioned that there is greater potential for B2B than B2C businesses. A typical example is the success of speedsend.com, which is a B2B platform, established in 2001 and pioneered the electronic procurement industry in Egypt through a customized web-based ecosystem (Kamel, 2009b;

*Table 1. Telecommunication sector liberalization process (www.arabdev.com)*

| Overview of the Telecommunications Sector Liberalization Process | |
|---|---|
| 1854 | Establishing the National Organization for Telecommunications |
| 1881 | Purchasing the Eastern Telephone Company and Development of the Telephone and Telegraph Authority |
| 1957 | Establishing the Egyptian Telecommunication Organization (ETO) |
| 1982 | Creating the Arab Republic of Egypt National Telecommunication Organization (ARENTO) |
| 1998 | Founding of Telecom Egypt (TE) |
| 1998 | Establishing of the Telecommunications Regulatory Authority (TRA) |
| 1999 | Establishing the Ministry of Communications and Information Technology (MCIT) |
| 2003 | Creating the National Telecommunications Regulatory Authority (NTRA) |

Pani and Agrahari, 2007). Moreover, culturally, people like to go to stores and interact with suppliers preferring the social bond that could come out of such transactions. In other words, the problem is both infrastructural and cultural (Loch et al, 2003). Finally, in some locations, according to Loch et al (2003) culture could be a barrier to using the Internet since many could think and feel threatened by how the Internet will affect family and community life.

MCIT was mandated to create a vibrant IT industry and Egypt, over the last decade 1999-2009 has seen massive developments and growth in the ICT sector. These have been reflected positively in the overall growth of the sector, which exceeded 20% in the last two years and contributed to overall GDP growth by more than 7% (Fayed, 2009). According to the minister of ICT, the sector has transformed itself from a sector looking for support and subsidies to a sector contributing tangibly and intangibly to the economy with a total of 5.2 billion US dollars received by the treasury since early 2006 (Kamel, 2007). The ICT sector has also served as a role model for other sectors of reform and liberalization, capitalizing on a free market economy and catering to different social groups and interests. Table 1 demonstrates the liberalization process of the telecommunication sector that paved the way for a possible platform for E-commerce. It is important to note that the liberalization process of the telecommunication sector in Egypt is linked to the nation's economic reform program that was initiated in 1991 and that has been set as a World Summit on the Information Society (WSIS) priority (www.arabdev.com). Moreover, Egypt has signed the World Trade Organization (WTO) Basic Telecommunications Agreement (BTA), which sets up a framework for the integration of its ICT sector with the global economy[1].

The government plan was mainly to encourage private sector participation, increase ICT-related investments and create ICT-related job opportunities. The objective is to use ICT to raise the standards of living of individuals at the micro level and to create a prosperous society at the macro level (Elbeltagi, 2007). In that respect, and despite the various successful achievements across the sector, when it comes to E-commerce applications, the market growth has not been as successful as other elements of the ICT sector.

## Electronic Commerce Readiness in Egypt

The extent of E-commerce readiness is governed by the degree of ICT diffusion and the institutionalization of an encouraging E-commerce environment (ITU, 2008). First, although computer penetration and access to the Internet has been growing steadily over the last years, it will take some time until a critical mass is realized.

*Table 2. Barriers to electronic commerce in Egypt (ECATT, 2000)*

| |
|---|
| **Lack of Awareness of Added Value**<br>Availability of considerable skepticism regarding the added value of E-commerce due to lack of interest by firms and users for online presence and shopping, respectively, due to lack of access or for security reservations. |
| **Suitability of Products for Distribution**<br>Not all products can be found on the Internet. Statistics indicate that for many online shoppers in the Arab region (Egypt included), in 48% of the cases the main reason for buying online is the lack of product availability in the local market, followed by ease of purchase (45%), convenience of comparing products online (32%), comparing prices (24%) and ease of payment (21%). There is a lack of existence of well-established distribution networks to support remote products distribution. |
| **Costs and Performance**<br>The limitations of narrow band access have hampered E-commerce evolution. Moreover, online shopping is perceived by many as an expensive pastime for Internet users rather than an efficient alternative to traditional shopping. |
| **Data Security**<br>Compared to private value added networks, the Internet causes considerable security concerns due to its open architecture, necessitating specific technological measures to make data exchange secured and reliable, which are costly. There is a need to improve security and for allowing alternative payment methods to complement the use of credit card, such as cash on delivery, which suits the local consumer and allows for building trust and alleviating consumer concerns with regard to exchanging payment details over the Internet. |
| **Consumer Protection**<br>In B2C, building trust requires measures that protect consumers from fraud and entitles them to consumer protection rights when buying from shops and retail outlets. There is a need to enhance buyers' awareness and to engage trust in online shopping. A vital user's concern lies in the collection of personalized data about shoppers in databases that may be used for purposes beyond the consent of the shopper, which needs to be dealt with in an appropriate copyright statement and could take the form of a new law for intellectual property rights relevant to the issues of the software industry. |
| **Lack of Critical Mass**<br>Online marketplaces work better with more consumers and suppliers involved. In Egypt, the market is still relatively small and in its early stages of development. Respectively, the problem is the lack of buyer demand to make online selling a viable and sustainable option but the situation is gradually improving though diversification in market segments that might have not been accessible through traditional retail outlets. |

Second, a legal infrastructure governing business and financial transactions and protecting consumer rights cannot be taken for granted. However, it is readily apparent that the difficulties surrounding E-commerce in Egypt have more to do with traditional ways of conducting business than with legal barriers such as the cash-based society. Moreover, the fact that there is a limited credit card community, with their restricted use online because of banks regulations and the issuance of specific credit cards for online purchases is not helping much in building trust among the community in the digital economy. When linked to the theoretical framework and the model, the demand side is rather weak due to special concerns of weak institutions in other related fields. Table 2 demonstrates the barriers to electronic commerce in Egypt following the measures adopted by the benchmarking telework and E-commerce in Europe report (ECATT, 2000).

## Establishing Information Technology Industry Development Agency

In 2004, the government established the Information Technology Industry Development Agency (ITIDA) to stimulate E-commerce growth by availing a regulatory environment and bolstering intellectual property rights-IPRs (www.itida.gov.eg). ITIDA is perceived as a regulator and a vehicle to promote ICT development based on an export-oriented strategy. Amongst a variety of different roles, ITIDA is responsible to grant licenses to certificate service providers (CSP) also called certificate authority (CA). In the initial phase, four companies were licensed in 2006 namely Security and Network Services, Egypt Trust, Advanced Computer Technology, and Misr for Central Clearing, Depository and Registry (EIU, 2007). Moreover, ITIDA is responsible for protecting electronic IPRs based on the measures of the 1982 IPRs law addressing software applications and electronic data as items subject to copyright protection (EIU, 2001).

## Electronic Signature Law

In 2004, the government issued law 15 on electronic signatures (eSignatures) and the central bank of Egypt (CBE) licensed 12 banks to provide electronic banking services including phone and mobile banking such as the online service offered by Citibank and HSBC as well as Internet banking services since July 2007. However, the scope of transactions that can be conducted online is still relatively limited. For example, Citibank allows customers to pay their mobile-phone bills online if they are customers of Vodafone Egypt (EIU, 2007). The eSignature law provides for fines of 15,000-150,000 US dollars for faking or intentionally misusing eSignatures or electronic documents. All entities engaged in E-commerce in Egypt will have to be licensed by ITIDA. It is important to note that the eSignature law adds nothing to existing legislation concerning contracts or dispute resolution, hence; ITIDA will provide technical consultation for E-commerce or electronic-signature disputes (EIU, 2007).

## Modernizing National Postal Authority

The government started a full-fledged process to modernize the National Postal Authority (NPA) as one of the major government initiatives that is part of the overall planning process of launching E-commerce capabilities being the main delivery and distribution arm. NPA is building a network to connect its 3,000 branches throughout Egypt's 28 provinces. The potential envisioned through PPP is the introduction of electronic postal services in addition to new applications in postal banking. The location of the different branches especially in 4,000 villages and remote areas could help transform the classical developing nations-like current digital divide situation so that its communities become socially and economically included in the community (Kamel, 2009a). Postal services are well-respected brands in most countries around the world offering physical transport network, with E-commerce such services could be optimized in terms of efficiency and global exposure with timely information to different customers about their shipments (ITU, 2008).

## Electronic Commerce Cases

ICT can help in alleviating poverty, improving access to healthcare, fairly distributing resources, and strengthening participation in decision-making processes. Therefore, the impact of the Internet, as an ICT tool, should not be measured only in terms of absolute numbers of connected individuals and but more in terms of contribution to social and economic progress, development and growth. Therefore, one needs to address the opportunities that the Internet with its various engines holds for Egypt because E-commerce as a platform for business provides unprecedented opportunities for increasing trade, promoting investment, facilitating business transactions, providing a larger and more varied market and supplying an unparalleled marketing tool (EIU, 2001). Moreover, as Egyptian companies learn how to use the E-commerce ecosystem, they will become more efficient and more profitable (Bell, 1998).

There are a number of Internet start-ups, although limited, but have become extremely popular, given the need and efficiency in providing their services (Kamel and Hussein, 2004). These include, but not limited to, B2B and B2C examples such as careerEgypt.com (employment), yallabina.com (entertainment), otlob.com (food delivery), filgoal.com (sports), bayt.com (real estate) and Kings Hotel (tourism). The number of websites is estimated to be around 7000 based in Egypt where less than 15% are purely dedicated for E-commerce and of those, less than 50 have established strong names and recognized from the market. This could include a mixture of those using purely online transactions or a blended model of traditional and unconventional transactions, especially for payment purposes (Kamel and Abdel Ghaffar, 2004). It is important to note that despite the presence of the above examples of Internet start-ups, efforts to turn these into wide-ranging E-commerce websites have been notably unsuccessful (EIU, 2007).

## CHALLENGES

For E-commerce to realize its targeted objectives; there are a number of challenges that need to be faced that relate to a variety of social, technical and financial elements. With respect to social challenges, there is lack of awareness, training, trust, resistance to change and the language barrier. Awareness is considered a major deterrent including customer and organizational awareness of the benefits of the Internet. When comparing mobile diffusion to Internet usage in Egypt, it is clear that for the same expenses mobile users are increasing remarkably indicating that affordability is not an issue, in fact Internet access is less costly and more reliable making it viable for mobile commerce to penetrate the market if the proper ecosystem is provided (Kamel and Fikry, 2007). The lack of training is also a major obstacle where people are not prepared to handle operations in a cyber environment, which creates confusion for those accustomed to traditional systems when they are introduced to innovative techniques. The lack of trust remains another challenge with respect to electronic payment systems, and doing business with people never seen before. Resistance to change is a factor that has more of a cultural aspect where people find it so difficult to change their habits, and which relates to an organizational factor that is the gap between senior managers who are usually computer illiterates and younger generations represented in middle managers and technical staff who are advocates of ICT. Finally, there is the language barrier to comprehend the content of the web where the majority of Egyptians can only read and write Arabic while over 82% of the websites are in English.

With respect to technological challenges, there is still the problem of relatively weak resources with respect to the telecommunications infrastructure. This includes bandwidth cost with low capacity level leading to long time for access and downloading. With respect to financial challenges, there is the lack of efficient and secured electronic payment systems coupled with a limited credit card community due to the lack of awareness of the use and benefits of credit cards representing a primary challenge since credit cards are the primary method of setting consumer transactions over the Internet. There is also the issue of customs and taxation which is another barrier for E-commerce diffusion and where the position of the government reflect the belief that the use of information networks should not be given any preferential treatment in trading as opposed to traditional methods. I.e. the imposition of taxation on products bought over the Internet remains a viable option, especially that Egypt, as an economy, relies on taxes and custom duties as a dependable source of income. The above-mentioned challenges need to be dealt with strategically at the national level and through proper allocation of resources, many of which need to be transformed into opportunities that can enable the development of a solid infrastructure of E-commerce in Egypt.

## CONCLUSION

E-commerce holds many opportunities for Egypt at different levels including business, social and economical. With emerging and innovative ICTs, the availability of enabling environments and ecosystems for development, competition and growth sets the stage for diffusing business processes, global trading communities, and new revenue streams that could have positive implications on the economy. For Egypt, E-commerce represents an opportunity to keep pace with the developed world and to leverage its developmental plans using ICT and online applications by capitalizing on a young, skilled and ambitions population. The next phase should witness more coordination between different constituencies including the government, the private sector and the civil society to provide a platform that blends awareness, adoption, diffusion and adaptation of ICT capitalizing on the potentials of E-commerce while catering to the local values, norms and cultures of the community. This can help avoid creating gaps within the society and will help realize the critical mass required for a successful online community interacting digitally and benefiting from the marketspace to prevail.

## REFERENCES


American Chamber of Commerce in Egypt. (2002). Information Technology in Egypt. *Business Studies and Analysis Center. American Chamber of Commerce in Egypt*. (2009). Retrieved April 10, 2009, from www.amcham.gov.eg

*ArabDev*. (2009). Retrieved May 20, 2009 from www.arabdev.com

Azab, N. A., Kamel, S., & Dafoulas, G. (2009). A suggested framework for Assessing Electronic Government Readiness in Egypt. *Electronic . Journal of E-Government*, *7*(1), 11–28.

Bell, D. (1998, December). Egypt online. *PC-World Egypt*.

Cerf, V. (1999, April). *The Internet is for everyone*. Speech to the Computers, Freedom and Privacy Conference.

Economist Intelligence Unit-EIU. (2001). *Egypt: E-business marketplace*. Retrieved December 10, 2008, from www.ebusinessforum.com

Economist Intelligence Unit-EIU. (2007). *Egypt: Overview of e-commerce*. Retrieved January 15, 2008, from www.ebusinessforum.com

Egypt, I. C. T. Indicators. (2009). *Egypt ICT Indicators, Ministry of Communications and Information Technology.* Retrieved April 14, 2009, from www.egyptictindicators.gov.eg

Elbeltagi, I. (2007). E-commerce and Globalization: An Exploratory Study of Egypt. *Cross Cultural Management: an International Journal*, *14*(3), 196–201. doi:10.1108/13527600710775748

Elbeltagi, I., McBride, N., & Hardaker, G. (2005). Evaluating the Factors Affecting DSS Usage by Senior Managers in Local Authorities in Egypt. *Journal of Global Information Management*, *13*(2), 42–65.

European Commission-ECATT. (2000). *Benchmarking Telework and e-commerce in Europe.* Final Report, Information Society Directorate General, Brussels. Fayed, S. (2009). The Net Exporter. *Business Monthly*, *26*(1), 54–58.

*Information and Decision Support Center*. (2009). Retrieved March 10, 2009 from www.idsc.gov.eg

*Information Technology Industry Development Agency*. (2009). Retrieved February 10, 2009 from www.itida.gov.eg

International Telecommunication Union-ITU. (2008). E-Commerce as a Key Facilitator for SME Competitiveness. *WSIS Follow-Up and Implementation: Action Line Facilitation Meeting E-Business,* Geneva, May 22.

Internet World Statistics. (2009). Retrieved April 5, 2009 from www.internetworldstats.com

Javalgi, R. G., Wickramasinghe, N., Scherer, R. F., & Sharma, S. K. (2005). An Assessment and Strategic Guidelines for Development e-commerce in Asia. *International Journal of Management*, *22*(4), 523–532.

Kamel, S. (1995). Information Superhighways: A Potential for Socioeconomic and Cultural Development. In *Proceedings of the 6th IRMA Conference*, Atlanta, GA, May 21-24.

Kamel, S. (1999). Building the African Information Infrastructure. *Journal of Scientific and Industrial Research, Special Issue on Management of Information Technology Organizations and Beyond,* March-April, (pp.118-144).

Kamel, S. (2000). Electronic Commerce in Egypt. In M. Khosrow-Pour, (Ed.), *Managing Web-Enabled Technologies in Organizations: a Global Perspective*, (pp. 210-232). Hershey, PA: Idea Group Publishing.

Kamel, S. (2005a). The Evolution of Information and Communication Technology Infrastructure. In G. Hunter & A. Wenn, (Eds.), *Egypt in Information Systems in an e-World,* (pp. 117-135). Washington DC: The Information Institute.

Kamel, S. (2005b). Assessing the Impacts of Establishing an Internet Cafe in the Context of a Developing Nation. In *Proceedings of the 16th Information Resources Management Association International Conference (IRMA) on Managing Modern Organizations with Information Technology*, San Diego, CA, May 15-18, (pp. 176-181).

Kamel, S. (2009a). The Evolution of the ICT Sector in Egypt – Partnership4Development. In *Proceedings of the 11th International Business Information Management Association (IBIMA) Conference on Innovation and Knowledge Management in Twin Track Economies: Challenges and Opportunities*, Cairo, Egypt, January 4-6, (pp. 841-851).

Kamel, S. (2009b). Evolution of Electronic Procurement in Egypt: Case of Speedsend.com. In K. Roubah, O. Khalil & A. Hassanein (Eds.), *Emerging Markets and E-Commerce in Developing Economies,* (pp. 363-386). Hershey, PA: Information Science Reference.

Kamel, S., & Abdel Ghaffar, H. (2003). B2C Model in Egypt Using Internet-based Credit Cards. In *Proceedings of the ISOneWorld Conference on Engaging Academia and Enterprise Agendas*, Las Vegas, NV, April 23-25.

Kamel, S., & Abdel Ghaffar, H. (2004). The Use of Internet-Based Credit Cards in Egypt for Business2Consumer Transactions. In M. Gordon Hunter & K. K. Dhanda (Eds.), *Information Systems: Exploring Applications in Business and Government*, (pp. 97-121). Washington DC: The Information Institute.

Kamel, S., & Fikry, A. (2007). Socioeconomic Implications of Mobile Technology on Emerging Markets. In *Proceedings of the 6th Global Mobility Roundtable (GMR) on Niche Evolution in the Mobile Business Ecosystem*, Los Angeles, CA, June 1-2. Retrieved from www.marshall.usc.edu/web/CTM.cfm.

Kamel, S., Ghoneim, S., & Ghoneim, A. (2008). The Impact of the Role of the Government of Egypt in Electronic Commerce Development and Growth. In A-V. Anttiroiko (Ed.), *Electronic Government: Concepts, Methodologies, Tools and Applications* (pp. 2376-2394). Hershey, PA: Information Science Reference.

Kamel, S. & Hussein, M. (2001). The Development of eCommerce: The Emerging Virtual Context within Egypt. *Journal of Logistics Information Management, Special Issue on Strategic Planning for eCommerce*, (pp. 119-127).

Kamel, S., & Hussein, M. (2004, October-December). King Hotel Goes Online: The Case of a Medium Enterprise in using eCommerce. *Journal of Electronic Commerce in Organizations*, *2*(4), 101–115.

Kamel, S., Rateb, D., & El-Tawil, M. (2009). The Impact of ICT Investments on Economic Development in Egypt. *Electronic Journal of Information Systems in Developing Countries*, *36*(1), 1–21.

Kamel, T. (2007). Egypt is Moving Fast in IT. *Al-Ahram Newspaper*, September 16.

Loch, K., Straub, D., & Kamel, S. (2003, February). Diffusing the Internet in the Arab World: The Role of Social Norms and Technological Culturation. *IEEE Transactions on Engineering Management*, *50*(1), 45–63. doi:10.1109/TEM.2002.808257

Lynch, D. C & Lundquist, L. (1996). *Digital Money: The New Era of Internet Commerce*. New York: John Wiley and Sons, Inc.

*Ministry of Communications and Information Technology-MCIT*. (2009). Retrieved April 14, 2009 from www.mcit.gov.eg

Pani, A. K., & Agrahari, A. (Eds.). (2007). *E-Procurement in E-Procurement in Emerging Economies Theory and Cases*. Hershey, PA: Idea Group Publishing.

Stahl, B. C., & Elbeltagi, I. (2004). Cultural Universality versus Particularity in CMC. *Journal of Global Information Technology Management*, *7*(4), 47–66.

## ADDITIONAL READING

Cohan, P. S. (1999). Net Profit, San Francisco: Jessey-Bass

Cohan, P. S. (2000) e-Profit, New York: American Management Association

Deise, M. V., Nowikow, C., King, P., & Wright, A. (2000) Executive's Guide to E-Business from Tactics to Strategy, New York: John Wiley and Sons, Inc

Earle, N., & Keen, P. (2000). From. com to. profit, San Francisco: Jossey-Bass

Hagel, J., III, & Armstrong, A. G. (1997) Net Gain, Boston: Harvard Business School Press

Hagel, J., III, & Singer, M. (1999) Net Worth, Boston: Harvard Business School Press

Hope, J., & Hope, T. (1997) Competing in the Third Wave, Boston: Harvard Business School Press

Kalakota, R., & Whinston, A. B. (1996) Electronic Commerce A Manager's Guide, Reading: Addison-Wesley

Kelly, K. (1998) New Rules for the New Economy, New York: Viking

Patel, K., & McCarthy, M. P. (2000) The Essentials of e-Business Leadership Digital Transformation, New York: McGraw Hill

Rifkin, J. (2000) The Age of Access, New Work: Jeremy P. Tarcher/Putnam

Tapscott, D. (1996). The Digital Economy, New York: MacGraw Hill

Timmers, P. (1999) Electronic Commerce Strategies and Models from Business-to-Business Trading, Chichester: John Wiley and Sons, Ltd

## KEY TERMS AND DEFINITIONS

**Electronic Commerce:** It is the delivery of goods, services, information, or payments over networks or any other electronic means, frequently considered as a subset to electronic business and sometimes both terms are used interchangeably.

**Electronic Business:** It is a dynamic set of technologies, applications and business processes that link enterprises, consumers and communities through the electronic exchange of goods, services, transactions and information (technology enabled and technology-mediated).

**Building Blocks:** The building blocks in ICT infrastructure reflects all the basic elements of the ICT industry including hardware, software, human resources, networking and information.

**Diffusion of Information and Communication Technology:** The diffusion process of ICT includes the stages of introduction, adoption, diffusion and adaptation whether that applies within an organization or a society.

**Public Private Partnership:** The collaboration of different constituencies in the marketplace including the government, the public sector, the private sector and the civil society to help realize a change and a transformation in the development process, many examples of PPP have been successful within the ICT sector especially in the developing world.

**Humanware:** The human element represents the most important building block in the ICT infrastructure and it is the determining factor in its development, growth and sustainability especially in a global, dynamic and competitive marketplace.

**Broadband:** Broadband Internet access, often known as broadband is high-speed Internet access that is contrasted with dial-up access over a modem, wireless broadband is also becoming popular around the world.

**Telecommunication Liberalization:** The reform of the telecommunications environment through reducing or eliminating the monopoly of national carriers and creating a competitive environment is often referred to as the liberalization process which is to a certain degree a degree of privatization involving transferring all or some portion of the telephone service government to private ownership.

**E-Commerce Readiness:** E-commerce readiness indicates the ability of individuals and/or the community to use ICT for online transactions including payments, buying and selling of different products and services.

**Critical Mass:** The volume of usage of different ICT tools and applications is an important determining factor in spreading awareness and in rendering such the level of ICT usage and deployment effective and efficient.

## ENDNOTE

[1] Egypt joined the International Telecommunication Union (ITU) in 1976.

# Chapter 110
# Using Assistive Technology to Ensure Access to E-Learning for Individuals with Disabilities

**Hwa Lee**
*Bradley University, USA*

## INTRODUCTION

With the advancement of technology, Electronic Learning (E-Learning) now is more of the rule than the exception. E-learning has been the synonym for online learning, web-based learning, computer-based learning, in the fields of education, business, and information technology. E-learning utilizes a wide spectrum of technologies including internet, intranets, or multimedia platforms (O'Neill, Singh, & O'Donoghue, 2004). In order for individuals with disabilities to utilize E-Learning, often cases they need Assistive Technology (AT) which functions as a technological medium for accessing computer and the internet. The extent to which individuals need AT for computer and internet access varies depending on their residual abilities. Results from numerous empirical studies indicate the effectiveness of AT for individuals with disabilities in accessing learning and daily life activities. While a large body of studies exists in E-Learning, very few focus on supporting individuals with disabilities in their access to E-Learning. Providing AT for E-Learning access is not only the intent of the federal laws but also the principles of Universal Design for Learning (UDL). The core intent of the federal law, Americans with Disabilities Act, is to narrow the disparity between individuals with and without disabilities by ensuring access to technologies needed for equal employment (CAST, 2009). Given that rehabilitation, business, education agencies attempt to fulfill the intent of the laws, the purpose of this study is to provide an overview of technology access for E-Learning for individuals with disabilities including legislations relevant to technology access for individuals with disabilities, AT service delivery models, principles of UDL, effectiveness of AT for individuals with disabilities, issues and solutions, and discussions for future directions for research.

DOI: 10.4018/978-1-61520-611-7.ch110

## BACKGROUND

### Federal Legislations for Technology Access for Individuals with Disabilities

Federal legislations such as the Americans with Disabilities Act (ADA) and the Individuals with Disabilities Education Act (IDEA) have been the major force for equal access to technology for all individuals regardless of their abilities or disabilities. According to the Technology-Related Assistance for Individuals with Disabilities Act (Tech Act, 1988), and the Public Law 105-17 the IDEA amendments of 1997, AT device is any item, piece of equipment, or product system that is used to increase, maintain, or improve the functional capabilities of a child with a disability (IDEA 1997). AT devices are typically categorized as low technology, medium technology, or high technology depending on the existence and level of sophistication in the included electronic components (Blackhurst & Lahm, 2000). The intent of these federal laws is that school and rehabilitation professionals consider AT as an option for individuals with disabilities, which presents challenges of evaluating individual needs for technology and identifying the appropriate AT items that will increase their functional capabilities in accessing E-Learning. In other words, these AT items can function as an equalizer, enhancing the independence and freedom of individuals with disabilities with their access to E-Learning.

### Universal Design for Learning

The concept of universal design was developed by a group of professionals in multiple disciplines to ensure that the design of products and environments are accessible by the widest range of individuals possible (http://www.design.ncsu.edu/cud/). The item or product with universal design is such that it can be used by individuals with or without disabilities and without any additional adpatation. Examples include curb cuts, elevators, and automatic doors to name a few. The seven principles of universal design are equitable use, flexibility, simple and intuitive, perceptible information, tolerance for error, low physical effort, and size and space for approach and use. To ensure access and participation in general education for individuals with disabilities, these principles have been applied to educational practices and yielded the Universal Design for Learning (UDL) framework by the Center for Applied Special Technology (CAST). A key characteristic of UDL curriculum is that it presents multiple options for access respecting the diverse learning styles of learners (Rose & Meyer, 2002). The UDL curriculum also recognizes the need to provide approriate challenges to all individuals by understanding state and national standards (Hitchcock, Meyer, Rose, & Jackson, 2002).

### AT Service Delivery Models

While considering a continuum of assistive technology items and services for individuals with disabilities is a mandated practice in the field of education. However, due to the vagueness of the current laws and lack of clear, consistent guidelines on how the services should be provided, service providers are faced with challenges of developing effective AT service delivery systems on their own. While funds for AT have been decreased, it is still the intent of the laws that school professionals consider AT as an option for individuals with disabilities. Once education professionals identify the need for any AT item on the Individualized Education Plan (IEP), they must provide the item at no cost to parents (IDEA 1997). As educators attempt to fulfill the intent of the laws, collaboration among all educational stakeholders including general education teachers is critical.

When educators consider AT devices for the student with a disability, evaluating the technological needs of individuals with disabilities and identifying the appropriate AT items that will increase their functional capabilities in the home, school, and/or community requires guidelines and models. Numerous models for AT service delivery have emerged based on the experiences of education practitioners (Edyburn, 2001). Given the lack of clear legal guidelines, these models can serve as the basis for AT service delivery (Bryant & Bryant, 2003). Four major models that have had significant contribution to the delivery of AT services are *The SETT (Student, Environment, Tasks, & Tools) Framework (Zabala, Bowser, & Korsten, 2004), Tech Points (Bowser,& Reed, 1995), Chamber's Model (Chamber, 1997),* and *Unifying Functional Model (*Melichar & Blackhurst, 1993). Common components of these models include evaluation, device selection and acquisition, implementation, and ongoing evaluation. While these models have had an impact on the field of AT, the extent to which these models are utilized by schools and rehabilitation agencies has not been documented (Watts, O'Brian, & Wojcik, 2004). School districts are not required to adopt one or more of these models but they can evaluate the models for the development of an effective AT service delivery system.

## EFFECTIVENESS OF AT ON LEARNING AND DAILY LIFE

A large body of literature indicates how certain types of AT devices have been effective in improving and/or maintaining learning, communication, interaction, and daily living of individuals across ages (see Alper & Raharinirina, 2006; Beck, 2002; Edyburn, 2002; 2003; 2006). Regardless of individuals' ages, types and severity of disability, ensuring equal access to technology in order for them to experience meaningful participation in their environment is the key goal of AT services.

### AT for Young Children

While the first three years in human life are considered the most critical period for brain development and language acquisition (Pinker, 1995), children ages birth to 3 are significantly undereserved with AT (Solano & Aller, 2000). When young children have disabilities that hinder their optimal development, assistive technology can play the role of prosthetics to facilitate their development. The use and benefits of certain types of AT devices for infants and toddlers have been well documented (Mistrett, 2004). Just as caregivers and educators do everything to ensure optimal development of typically developing infants and toddlers, the same effort should be given to infants and toddlers with disabilities with the use of assistive technology. The challenge is to clearly understand the nature of the disability that hinders the young child's learning and to deploy AT that will enable the child to access her environment just as a child without disabilities does. Providing access to appropriate toys and objects is one of the most important tasks for caregivers of young children with disabilities. Numerous AT items including adaptive toys are available and internet resources provide tips for adapting toys to meet young children's needs (e.g., Let's Play Project, www.beyondplay.com).

### AT for Individuals with Mild Disabilities

Mild disabilities include learning disabilities, emotional/behavioral disorders, and mild mental retardation (Edyburn, 2006). Individuals with mild disabilities tend to exhibit difficulty with (a) cognitive skills including memory, thinking, and attention; (b) academic skills such as reading, writing, math; and (c) socio-emotional characteristics (Meese, 2001). One of the misconceptions in the field of education has been that AT is only for mobility of individuals with severe physical disabilites. The new IDEA definition of AT has allowed educators to expand the concept of AT to include any item that can support the student in learning and living. Educators are expected to consider AT devices and services that will assist individuals in their learning and socio-emotional development. Increasing numbers of AT items have been developed and utilized by educators to support individuals with memory, organization, problem solving, reading, writing, and math. For example, an overwhelming number of educational software items have been utilized for individuals with and without disabilities. Numerous text-to-speech software devices have been introduced to support individuals with enhanced reading and writing. In addition, countless websites have been developed to support individuals with disabilities and their parents and teachers. Unfortunately the availability of enormous amount of resources does not necessarily correlate with utilization due to lack of guidelines and training for teachers to identify and implement the best match between student's needs and the AT device. To ease this challenge Edyburn (2000) proposed a learner productivity toolkit approach which focuses on the identification and preparation of a set of products that learners typically use in their daily learning activities. This toolkit consists of AT items for reading, writing, and math. This proactive approach allows teachers and related personnel to have devices that they are familiar with and readily available for all individuals instead of going through the lengthy referral and evaluation process. It is designed to benefit the widest range of individuals regardless of their disabilities.

## AT for Individuals with Hearing and Visual Impairments

Individuals with hearing and visual impairments pose unique learning and communication challenges to teachers and parents. Individuals with severe to profound hearing impairments tend to depend on sign language and may experience serious communication barriers as they interact with teachers and peers. Before considering any AT devices, it is critical for teachers to consider the severity, time of on-set, and type of the sensory impairments. The severity of individuals with hearing impairments varies. Depending on the level of residual hearing, some may use sign language for their learning and others may utilize an oral approach along with hearing aids. For example, a speech-to-text support service called C-Print which allows real time display of information on a computer screen or TV monitor and Communication Access Real Time Translation (CART) which provides verbatim information by the sternographer have been tested to be effective (Elliot, Foster, and Stinson, 2002). A continuum of AT devices for individuals with hearing impairments include note taking, sign language interpreters if needed, overhead projectors, closed captioning, FM systems, or other auditory devices with amplication features, animated sign language dictionary, and speech-to-text software. In addition, a number of recent communication technology such as instant messaging (IM) and mobile technology have significantly increased the level of interaction among individuals with and without sensory impairments by providing access to equal footage for communication and interaction with hearing individuals (Power & Power, 2004).

The majority of individuals with visual impairments have residual functional vision and the focus of support for them should be given to visual discrimination. AT services for individuals with low vision should focus on environmental cues including colors and contrasts, color discrimination, and illumination for individuals with low vision (Griffin, Williams, Davis, & Engleman, 2002). AT devices for individuals with various levels of visual impairment commonly have features such as text-to-speech output (e.g., JAWS, talking calculators, books on tape), tactile-based (e.g., braille, tactile map), or magnification (e.g., magnifying glasses or computer screens).

### AT for Individuals with Severe and/or Multiple Disabilities

Severe and/or multiple disabilities refer to severe to profound cognitive impairment with or without additional physical or sensory impairments. Individuals with severe and/or multiple disabilities typically require extensive support in learning and participation in the community. For the majority of these individuals the use of Augmentative Alternative Communication (AAC) devices and mobility devicices may play a critical role in ensuring the freedom and independence in their everyday life. In addition, AT devices that will help them overcome difficulties with attention and perception should be identified. Attention should be given to removing hardware barriers and providing physical access to technology. Service providers need to know how and which body parts the student can use to access the needed device. Davies, Stock, and Wehmeyer (2001) identified a number of recommended accessibility features that allow access for individuals with cognitive impairment including audio prompting, reduced screen clutter, personalization and customization, use of graphics versus text, and error minization methodoligies. AT devices in all categories including communication, learning, reading and writing, daily living, mobility and transportation, leisure, and listening can be used based on the needs of these individuals.

## ISSUES AND RECOMMENDATIONS

While the effectiveness of AT on learning and daily lives for individuals with disabilities across ages has been well documented, professionals face multiple issues in providing effective AT services, especially three major issues of compliance with federal laws, funding, and collaboration.

### Compliance with Federal Legislations

While it is mandated by IDEA (2004) that the IEP team must "consider whether the child requires AT devices and services" (Section 300.105), it does not offer directions on how to document whether AT was considered. The term "consider" can be open to multiple interpretations without specific legal guidelines. It is not clear how to document whether the IEP team does actually "consider" AT if they decide not to recommend an item for the student. The law does not use the term "provide" presumably because not every child with a disability needs to be provided with an AT device. Once it is decided that an AT item is required and therefore documented on the IEP, they must provide the item to the student at no cost. While lack of funding can not be used as an excuse for not providing the device, it is possible that the professionals may be pressured not to recommend an expensive AT item which school administrators may have concern with the cost.

### Funding

As in many education and rehabilitation programs, one of the major barriers to providing AT services is lack of funding (Judge, 2000; Kemp, Hourcade, & Parette, 2000). Whether funding gets eliminated or reduced, it is still the intent of the law (IDEA) that AT must be considered for individuals with disabilities. Funding opportunities still exist but the conditions of the federal and state grants are often too rigid and competitive for already overloaded professionals to apply. For example, the Office of Rehabilitation and Special Services (OSEP) amended the Tech Act of 1998 by authorizing funding opportunities for states with stricter conditions (Department of Education, 2005). Given the limited amount of funding from federal or state governments, professionals should seek alternative ways of acquiring AT devices for their individuals and clients.

### Collbaoration between Families and Professionals

AT services are typically provided by a number of multidisciplinary professionals including occupational therapists, physical therapists, speech therapists, teachers, and rehabilitaiton technologists. Families of individuals with disabilities have been meaningful partners in all aspects of their child's education and it should be no exception with the AT service procedures. Yet, the key elements of the existing service delivery models do not necessarily include family as an integral component of the model. Developing cultural sensitivity in the selection and use of AT device and services is critical when working with children with disabilities and their families from diverse backgrounds (Parette & McMahan, 2002). In addition, the use of AT devices may require extensive training and collaboration between the family members and the service providers. AT users and their familiy members may feel overwhelmed and reluctant to go through the training even when they clearly understand the benefits of AT device and services. To prevent the abandonment of the acquired devices, professionals need to put family needs as a priority over their own agenda when considering the selection and utilization of AT for individuals.

## FUTURE RESEARCH DIRECTIONS

Providing assistive technology is critical to ensure access to E-Learning for individuals with disabilities. Numerous empirical studies exist on E-Learning for individuals without disabilities but few studies focus on providing access technologies that will meet the learning needs of individuals with disabilities. A handful of studies address web accessibilities but none address the various challenges that are faced by individuals with disabilities. While results from empirical studies that focused on the utilization of AT do show the benefits of AT for individuals with disabilities for their learning and daily living, none address the relationship between AT for E-Learning. Future research is needed in examining the use of AT for E-Learning access for individuals with disabilities, the effectiveness of E-Learning on narrowing disparity in academic achievement and employment, application of UDL principles to E-Learning, and perceptions of professionals in education, rehabilitation, and business on equal access to E-Learning.

## CONCLUSION

The purpose of this chapter was to provide an overview of current AT as an E-Learning access medium for individuals with disabilities and to examine issues relavant to AT services. This decade has seen the exploration of AT devices in various categories and service delivery models with technological advancement and legal mandates. Empirical studies consistently show that the use of AT promotes self-confidence, freedom, independence, and meaningful participation in home, school, and community. Overwhelmingly diverse and an extensive amount of assistive technology information presents challenges and warrants a user-friendly, easily accessible information system for searching and retrieving needed information. Regardless of the issues including legal interpretation of federal laws, lack of funding, and collaboration challenges, education agencies must develop or restructure a seamless service delivery system that ensures access to AT devices and services. At the same time, educational professionals must acquire additional knowledge and skills in assistive technology regardless of their level of involvement in providing AT services (see Lahm & Nickels, 1999). Critical tasks that professionals who are involved in educating and training individuals with disabilities must carry out include increasing knowledge and skills in AT devices and services for E-Learning access, seeking funding sources and ways to acquire needed AT items, actively collaborating with professionals in business, information technology, and rehabiliation, and becoming strong advocates for individuals with disabilities in removing existing access barriers to E-Learning.

## REFERENCES


Alper, S., & Raharinirina, S. (2006). Assistive technology for individuals with disabilities: A review and synthesis of the literature. *Journal of Special Education Technology*, *21*(2), 47–64.

Beck, J. (2002). Emerging literacy through assistive technology. *Teaching Exceptional Children*, *35*(2), 44–48.

Blackhurst, A. E., & Lahm, E. A. (2000). Foundations of technology and exceptionality. In J. Lindsey (Ed.), *Technology and Exceptional Individuals* (3rd ed, pp. 3-45). Austin, TX: Pro-Ed.

Bowser, G., & Reed, P. (1995). Education TECH points for assistive technology planning. *Journal of Special Education Technology*, *12*(4), 325–338.

Bryant, D. P., & Bryant, B. R. (2003). *Assistive technology for people with disabilities.* Boston: Allyn and Bacon.

Center for Applied Special Technology. (2009). *Principles of Universal Design*. Retrieved

Chambers, A. C. (1997). *Has technology been considered? A guide for IEP teams.* Reston, VA: CASE/TAM.

Davies, D. K., Stock, S. E., & Wehmeyer, M. L. (2001). Enhancing Independent Internet Access for Individuals with Mental Retardation through Use of a Specialized Web Browser: A Pilot Study. *Education and Training in Mental Retardation and Developmental Disabilities*, *36*(1), 107–113.

Department of Education. Office of Special Education and Rehabilitative Services (2005). *Overview of Information; Assistive Technology Act of 1998, as Amended--Assistive Technology Alternative Financing Program, Federal Register, 70*(125), 37794-37798. Retrieved June 1, 2007 from http://www.section508.gov/docs/AT1998.html

Edyburn, D. L. (2000). Assistive Technology and Students with Mild Disabilities. *Focus on Exceptional Children*, *32*(9), 1–24.

Edyburn, D. L. (2001). Models, theories, and frameworks:Contributions to understanding special education technology. *Special Education Technology Practice*, *3*(2), 16–24.

Edyburn, D. L. (2006). Assistive Technology and Students with Mild disabilities. *Special Education Technology Practice*, *8*(4), 18–28.

Elliot, L., Foster, S., & Stinson, M. (2002). Student Study Habits Using Notes from a Speech-to-Text Support Service. *Exceptional Children*, *69*(1), 25–40.

Griffin, H. C., Williams, S. C., Davis, M. L., & Engleman, M. (2002). Using Technology to Enhance Cues for Children With Low Vision. *Teaching Exceptional Children*, *35*(2), 36–42.

Hitchcock, C., Meyer, A., Rose, D., & Jackson, R. (2002). Providing New Access to the General Curriculum; Universal Design for Learning. *Teaching Exceptional Children*, *35*(2), 8–17.

Individuals with Disabilities Education Act (IDEA) Amendments of 1997.(1997). United States Department of Education, Office of Special Education and Rehabilitation Programs. *IDEA '97 Amendments, Final Regulation.* Retrieved June 1, 2007 from http://www.ed.gov/offices/OSERS/Policy/IDEA/index.html.

Individuals with Disabilities Improvement Act of 2004. United States Department of Education. *Public Law 108-446*. Retrieved June 1, 2007 from http://idea.ed.gov/download/statue.html.

Judge, S. L. (2000). Accessing and Funding Assistive Technology for Young Children with Disabilities. *Early Childhood Special Education*, *28*(2), 125–131. doi:10.1023/A:1009507722653

Kemp, C. E., Hourcade, J. J., & Parette, H. P. (2000). Building an Initial Information Base: Assistive Technology Funding Resources for School-Aged Students with Disabilities. *Journal of Special Education Technology*, *15*(4), 15–24.

Lahm, E. A., & Nickels, B. L. (1999). Assistive Technology Competencies for Special Educators. *Teaching Exceptional Children*, *32*(1), 56–63.

May 29, 2009 from http://www.cast.org/

Meese, R. L. (2001). *Teaching learners with mild disabilities: Integrating research and practice.* Belmont, CA: Wadsworth/Thomson Learning.

Melichar, J. F., & Blackhurst, A. E. (1993). *Introduction to a functional approach to assistive technology,* [Training Module]. Department of Special Education and Rehabilitation Counseling, University of Kentucky, Lexington.

Mistrett, S. (2004). Assistive technology helps young children with disabilities participate in daily activities. *Technology in Action*, *1*(4), 1–8.

O'Neill, K., Singh, G., & O'Donoghue, J. (2004). Implementing elearning programmes for higher education: A review of the literature. *Journal of Information Technology Education*, *3*, 313–323.

Parette, P., & McMahan, G. A. (2002). What Should We Expect of Assistive Technology? Being Sensitive to Family Goals. *Teaching Exceptional Children*, *35*(1), 56–61.

Pinker, S. (1995). *The language instinct*. New York: Harper Collins.

Power, M. R., & Power, D. (2004). Everyone here speaks TXT: Deaf people using SMS in Australia and the rest of the world. *Journal of Deaf Studies and Deaf Education*, *9*(3), 333–343. doi:10.1093/deafed/enh042

Rose, D. H., & Meyer, A. (2002). *Teaching every student in the digital age: Universal design for learning*. Alexandria, VA:ASCD.

Solano, T., & Aller, S. K. (2000). Tech for tots: Assistive technology for infants and Young children. *Exceptional Parent*, 44–47.

Technology-Related Assistance for Individuals with Disabilities Act (Tech Act), P.L., 100-407 *(1988).*

Watts, E. H., Obrian, M., & Wojcik, B. (2004). Four models of assistive technology consideration. *Journal of Special Education Technology*, *19*(1), 43–56.

Zabala, J., Bowser, g. & Korsten, J. (2004). SETT and ReSETT: Concepts for AT Implementation. *Closing the Gap, 23*(5), 1, 10-11.

## KEY TERMS AND DEFINITIONS

**Americans with Disabilities Act (ADA):** A comprehensive federal civil-rights statute protecting the rights of people with disabilities. This law affects access to employment; public programs and services; access to places of public accommodation including businesses, transportation, and non-profit service providers; and telecommunications (www.adata.org).

**Assistive Technology:** Any device or product system that is used to increase, maintain, or improve functioning of individuals with disabilities.

**Augmentative Alternative Communication (AAC):** Any system that assists communication of individuals with communication impairments.

**C-Print:** A speech-to-text system developed for individuals who are hard of hearing or deaf in the educational environments.

**Closed Captioning:** A number of systems developed to display auditory information as text on television or projector screen.

**Communication Access Real Time Translation (CART):** A technology that provides the instant translation of the spoken word into English text using a stenotype machine, notebook computer and realtime software for individuals who are hard of hearing or deaf. The text appears on a computer monitor or other display. CART is also often referred to as realtime captioning (http://www.cartinfo.org/)

**E-Learning:** Learning system that utilizes materials that are largely made available electronically.

**Individuals with Disabilities Education Act (IDEA):** This federal law requires public schools to make available to all eligible children with disabilities a free appropriate public education in the least restrictive environment appropriate to their individual needs.

**Individualized Education Plan (IEP):** A legal document that contains the student's present levels.

**Universal Design for Learning (UDL):** An educational framework based on the principles of Universal Design (www.cast.org). UDL guides the development of flexible learning environments that can accommodate individual learning differences.

# Chapter 111
# A Holistic View of the Challenges and Social Implications of Online Distribution:
## The Case of Pensions

**Tina Harrison**
*The University of Edinburgh, UK*

**Kathryn Waite**
*Heriot Watt University, UK*

## ABSTRACT

*Recent policies, aimed at reducing pension costs and improving consumer awareness, have contributed to the development of the Internet as a distribution channel within the pensions sector. This article critically evaluates the extent to which use of the Internet has facilitated and promoted pension distribution in the UK, as well as identifying the forces that are constraining or facilitating further change. Drawing on data gathered from pension providers, intermediaries and consumers the paper discusses the threat and implication of disintermediation, the capability of the Internet to empower those who use it, the resource implications of channel conflicts and the outcomes of shifts in responsibility for process enactment. The article reveals that the Internet has had some impact on the structure, geography and processes of pension distribution within the UK.*

## INTRODUCTION

The market for individual and company pensions has been identified as uncompetitive and inefficient resulting in consumer confusion and apathy (Sandler, 2002; Pickering, 2002). Recommended solutions are large-scale product rationalisation and process simplification. Sandler (2002) suggests end-to-end electronic processing as a key means to achieving improvement whilst noting that "success will necessitate very broad take-up" (p. 217) requiring collective action and co-ordination. In response pension providers are seeking to develop the Internet as a low cost distribution and communication channel.

DOI: 10.4018/978-1-61520-611-7.ch111

There are opportunities for providers to develop direct online sales, for advisors to develop online financial advice services and for consumers to utilise the Internet to inform decision making.

This chapter critically evaluates the extent to which use of the Internet can facilitate and promote pension distribution as well as identifying the forces that are constraining or facilitating change. The paper investigates the beliefs, attitudes and behaviours of key constituents of the pensions distribution network, notably: pension providers, independent financial advisers (IFAs), corporate pension customers and the individual consumer.

The chapter informs several broad areas of debate including: the threat and implication of disintermediation; the capability of the Internet to empower those who use it; the resource implications of channel conflicts and the outcomes of shifts in responsibility for process enactment. From a strategic marketing perspective this study contributes to the debate into how service organisations can develop more efficient distribution strategies and the management issues surrounding alternative channels of access to consumers.

## BACKGROUND

E-commerce technology is now viewed as an integral part of marketing channels and distribution systems (Rosenbloom, 2004). An e-enabled supply chain is perceived as having many advantages, for example increased business efficiency, enhanced information flows, improved transaction speed, wider geographical spread, increased temporal reach, cost reduction and competitive differentiation for e-enabled constituents (Hoffman et al, 1998; Zank and Vokurka, 2003).

In addition, "the Internet offers *direct* links with customers, suppliers and distributors…[enabling] companies to *bypass* others in the value chain,… to *dominate* the "electronic channel" and thereby control access to customers and set terms of trade" (Walters and Lancaster, 1999, p.800, original italics). Hence, e-commerce technology has the potential not only to enhance supply chain performance but also to change its structure and may even pose a threat to certain supply chain members, particularly the intermediary. However, intermediaries perform a number of functions including specialised information, professional advice, customisation to consumers' needs, and reduction of uncertainty (Kimiloglu, 2004). Thus a company bypassing a distribution network to pursue commerce in cyberspace can be exposed to considerable risk (Ghosh, 1998).

In the context of pensions it is debatable to what extent the Internet is able to satisfy consumer requirements for advice and information due to the complexity, intangibility and deferred end benefit of the product (Ennew et al. 1995). The financial intermediary provides the consumer with the necessary "financial know-how" in order to make the optimum investment decision (Harrison 2000).

On the other hand, various claims exist of the Internet as a tool to empower consumers (Bush, 2004; Wind and Mahajan, 2001; Rha et al, 2002). The Internet offers consumers unparalleled access to a massive body of knowledge and information with comparatively lower search costs relative to established sources of information. This has the potential to increase the bargaining power of consumers (Bakos, 1991; 1997; Veradarajan and Yadav, 2002; Porter, 2001) and redress power imbalances due to information asymmetry by providing access to information formerly only available to professionals. This facilitates choice and risk reduction that in turn enables consumers to exercise increasing control over their consumption activities. Consequently, it is believed that consumers are abandoning their former passive roles. Indeed, there is emerging empirical evidence that decision-making is improved through the use of computer technology (Ariely, 2000).

In an increasingly competitive business environment, financial institutions face resource decisions of whether to develop direct consumer facing distribution channels or to invest in infrastructure to support intermediaries. Zank and Vokurka (2003), in a survey of manufacturing distribution channel constituents, found that most companies perceive that the Internet had positive supplementary impact on distribution channel relationships.

One outcome of increased use of the e-technologies has been to shift responsibility for information processing and pension transactions downline from the provider to the intermediary or to the customer (see for example, Berwick, 2002; Bolger, 2001; Croft, 2001). Although there are benefits of increased control, transparency of process and improved information flow there are also potential barriers including fear of error and the skill and expense needed for implementation of these new processes. This is equally true for the IFA as for the customer and may result in the exclusion of particularly vulnerable groups such as small businesses (for example 86% of IFA's are small businesses) and the lower income groups. Hence, research is needed to understand the extent to which the pensions industry can benefit both economically and socially from the use of the Internet to distribute pensions.

## OBJECTIVES AND RESEARCH METHODS

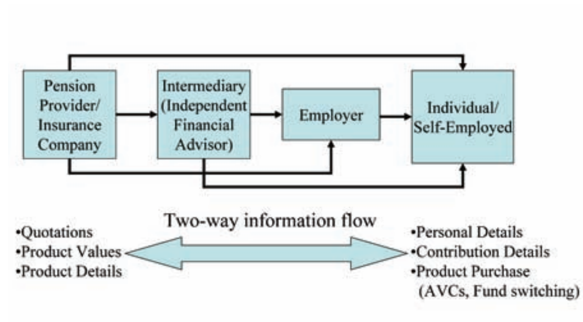
The principal aim of the research is to explore the extent to which the Internet has transformed the structure, geography and processes of pension provision and the likelihood and extent of further change. Specific research questions included:

- What is the likelihood and implication of disintermediation?
- To what extent can the Internet empower those who use it?
- What are the resource implications of channel conflict?
- What are the outcomes of shifts in responsibility for process enactment?

The distribution system chosen was that of the UK pension distribution channel (see Figure 1). There are typically two to four constituents in this distribution channel. At its simplest level individuals can purchase directly from pension providers/insurance companies, though this is not common. More often, purchase is made via an intermediary (the Independent Financial Advisor, IFA) and/or the workplace. Hence, the employer can act as an intermediary. According to Sandler (2002), over half of life and pensions business is sold via IFAs with only 5% on an execution-only basis (i.e. using a direct route that bypasses the financial advisor through a traditional sales person or via the Internet).

A pension describes a plan or arrangement used to provide people with an income when they are no longer earning a regular income from employment. In the UK pensions are provided by both the state and private sector. This research focuses only on pensions provided via the private sector. Occupational pensions are provided via the workplace and involve contributions from the employee and possibly also the employer. Personal pensions are arranged individually either via an IFA or directly with a pension provider. Pensions may be classified as defined benefit (DB) or defined contribution (DC) depending on how the benefits are determined. Occupational pensions can be either DB or DC whereas personal pensions are typically DC. A DB pension guarantees a certain payout at retirement, according to a fixed formula which usually depends on the employee's final or average salary and length of tenure in the scheme. By contrast, a DC pension is dependent on the amount invested in the scheme and the performance of the investment options used. The accumulated investment can be used to provide a retirement income either directly or by purchasing an annuity (Byrne, 2007).

*Figure 1. The UK pension supply chain*




Data was gathered from four key groups in the pension supply chain: pension providers, Independent Financial Advisers (IFAs), corporate customers (employers) and consumers. A combination of observation research, interviews, focus groups and surveys was used to gather the data (see Figure 2 for an overview). The research took place between 2003 and 2006.

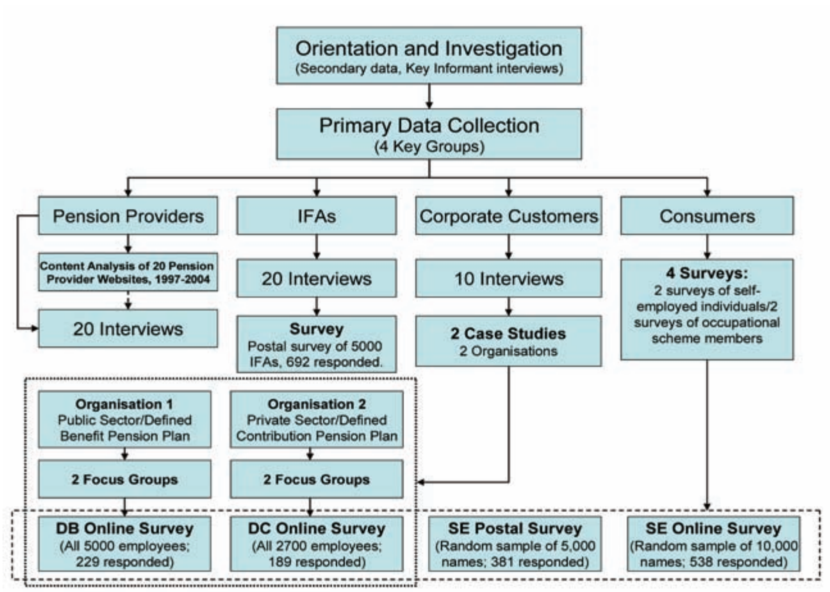
## FINDINGS

### Threat and Implication of Disintermediation

The research finds that the immediate threat of disintermediation is limited, although it seems likely to increase in future. Currently, providers and consumers do not perceive huge benefits to be gained by using the Internet to remove the intermediary completely from the distribution network. Providers recognise that pensions are "sold and not bought" and therefore rely on the IFA to stimulate demand (on average 70% of pensions are sold via IFAs). Consumers generally are using the Internet to supplement but not replace the reassurance and advice provided by the IFA. While qualitative data reveals a limited likelihood of using the Internet as a direct pension channel, quantitative data finds an increased capacity to self-advise among some consumers as a result of using the Internet for pensions possibly leading to increased use of the Internet as a direct channel for some consumers in future. For example, between 15% to two-thirds of consumers surveyed agree that they feel less of a need to rely on the advice of financial experts/advisors as a result of using the Internet. Self-employed individuals are more predisposed to reduce their reliance on IFA advice than employees. Analysis of the self-employed data shows that access to information sources has been facilitated through pension website use. For example, disproportionately more self-employed individuals (one third or more) compared to employees (on average 9%) have used their pension website to access links to other information and relevant websites.

Results from the IFA survey confirm the limited impact to date of disintermediation by the Internet. Moreover, IFAs believe there is only a minimal threat of disintermediation in the future. For example, only 10-15% of IFAs has experienced any reduction in their business as a result of clients dealing direct with providers or has experienced any weakening of their position in the supply network. IFAs who have developed their

*Figure 2. Overview of methodology*




own websites report a reduced impact and early adopters and advanced users report even greater reductions (Harrison and Waite, 2005, 2006). These findings indicate that IFAs who become more involved in the technology are strengthening their position in the supply network, are becoming more embedded and thus are reducing the risk of disintermediation.

## Capability of the Internet to Empower Those Who Use It

Survey data reveals the extent of empowerment experienced by consumers through Internet use (see Table 1). Results show that the Internet is increasing access to pension information. Over half to almost two-thirds of all pension consumers who have used their pension website report experiencing increased access to information and between one-fifth to one half of consumers feel they are better informed about pensions.

Consumers also report an increased capacity to understand their pension, although the experiences vary across the samples surveyed. Consumers report that website use has created the conditions for autonomous decision making. For example, around a third of consumers are experiencing greater confidence in making pension enquiries and decisions as a result of using their pension website. The IFA survey supports this finding: 32% of IFAs reported experiencing improved levels of pension knowledge amongst clients who had used the Internet.

However, behavioural change is limited. While almost two-thirds of DC consumers report taking more of an interest in their pension as a result of using their pension website, less than a third have either saved more or feel better equipped for retirement. The behavioural impact is greater for the self-employed than for occupational scheme members. This is a positive finding, since self-employed individuals tend to be under-pensioned.

Furthermore, greater familiarity with and use of the Internet for pensions is also likely to yield positive impacts. The surveys reveal that larger numbers of frequent users of pension websites report experiencing positive outcomes than those who have made only moderate use of the

*Table 1. Empowerment outcomes experienced from using pension websites*

| As a result of using my pension website .. | DB Survey | DC Survey | Self-employed (online) | Self-employed (postal) |
|---|---|---|---|---|
| I have a better understanding of my pension | 55 | 34 | 69 | 31 |
| I know how much my pension is worth | 47 | 70 | 58 | 82 |
| I feel more confident about making my own pension decisions | 35 | 28 | 39 | 38 |
| I feel less of a need to rely on the advice of financial advisers/experts | 17 | 14 | 27 | 38 |
| I am taking more of an interest in my own pension | 46 | 62 | 52 | 38 |
| I have saved more towards my retirement | 11 | 16 | 31 | 25 |

website. For example, among the DC members 84% of individuals using their website 4-6 times in 12 months agree that they have access to more information on their pension, compared with 44% of individuals using the website 1-3 times in 12 months.

## Resource Implications of Channel Conflict and Competitive Advantage

The decision of providers, intermediaries and employers to offer pensions via the Internet is influenced by the match between business objectives and perceived benefits. Two key benefits outlined in interviews were cost reduction and improved communication. In terms of cost reduction, providers report that development has focused on automating high-volume processes, which have the greatest impact on margins. Employers report cost considerations driving Internet development and explained how the pensions department had to compete internally with other departments for "finite resources" for IT.

Some providers and employers report supporting both online and offline channels, resulting in increased expenditure rather than cost savings. In contrast, those organisations that had moved to a single web-based channel reported a reduction in costs and staffing.

Dual channels are operated in order to increase pension penetration for employers and large IFAs and maintain market share for providers and smaller IFAs. For example, employers operating DB pensions talked about the need to increase the membership base in order to maintain the viability of the scheme.

## The Outcomes of Shifts in Responsibility for Process Enactment

Findings show that Internet use is resulting in shifts in roles and responsibilities. There is a general downward shift in processing responsibility: to consumers from providers, employers and IFAs and from providers to IFAs. For example, IFAs (42%) have experienced an increase in administration and processing as result of provider Internet development, and this is more so for those IFAs who have developed their own websites (50%). Also identified is an upward shift in the locus of pension expertise from employers to providers and an upward shift of technology development from IFA and employer to provider. For example, several providers were developing software for IFA websites. Hence, there is evidence that certain channel members are performing tasks that previously were performed by other channel members on their behalf.

Employer interviews show that structural change in concert with patterns of Internet use is transforming occupational pension activity. Interview data reveals that employers adopt very different positions and there is a clear association with the type of pension scheme in operation (whether DB or DC). Employers perceive that their roles are defined not only by the scheme but also enhanced and shaped by Internet capabilities. Roles identified vary from the caretaker role, the facilitator and shop-keeper along a continuum from being very hands-on to very hands-off. Organisations operating DB schemes tend to take more of a hands-on approach, whereas those operating a DC scheme tend to be more hands-off.

## FUTURE RESEARCH DIRECTIONS

- Future research needs to track the impact of online empowerment on pension activity and identify how empowerment can be harnessed to the benefit of both consumers and industry. There are issues concerning the level of empowerment desirable and the consequences of unwanted empowerment.
- Investigate the impact of changes in workplace provision of pensions. The project has shown that the Internet is used as a replacement channel for traditional face-to-face methods in concert with shifts from DB to DC provision. Further research is needed to map the implications of these changes for the individual and the organisation.
- Assess the capacity of online information provision to reach and inform disenfranchised consumers. Detailed investigation of sub-groups within under-pensioned groups should be undertaken to increase understanding of what might be done to increase the benefits from the networks created through electronic connection.
- Assess the impact of more recent developments in social media (including Web 2.0 and peer generated information) on informational flows and consumer empowerment in this context. The importance of word-of-mouth in financial services has been recognised in the literature. Research could usefully explore how such information is communicated and used within social network contexts.

## CONCLUSION

- *Structural impacts*: The research identifies the potential for structural change. Although disintermediation currently is limited, evidence suggests that some form of disintermediation could occur in future. An emerging segment is the self-employed, particularly those favorably disposed towards the Internet.
- *Geographical impacts:* The project identifies changes in the geography of information provision including an increase in information access to previously disenfranchised groups (i.e. the self-employed) resulting in social inclusion. Increased access to information has improved IFA client service and individual consumer understanding of pensions. However, the Internet appears to be increasing the distance between the employee and the employer for DC scheme members. This is a valuable finding relating to the current economic trend away from final salary provision. The use of technology to support shifts in pension expertise away from the workplace is a matter of concern that needs further investigation.
- *Process impacts*: The research identifies downwards and upwards shifts in roles and responsibilities for processing, administration and technology development. Providers state that they are developing technological solutions on behalf of IFAs and employers. IFAs perceive greater responsibility for processing. Employers identify shifts in processing to employees

and shifts in pension expertise to providers. The research captures the broad outcomes of these shifts. Providers report cost savings and increased processing speed. IFAs have reinforced their position in the supply network. On one hand employers report spending more time promoting pensions and serving employees, while other employers are becoming distanced from their scheme members. Employees feel that they have been empowered.

## ACKNOWLEDGMENT

The research was funded by the Economic and Social Research Council (RES- 335250031) as part of the E-Society Programme.

## REFERENCES

Ariely, D. (2000). Controlling The Information Flow: Effects On Consumers' Decision Making And Preferences. *The Journal of Consumer Research*, *27*(September), 233–248. doi:10.1086/314322

Bakos, J. Y. (1991). A Strategic Analysis of Electronic Marketplaces. *MIS Quarterly*, *13*(3), 295–310. doi:10.2307/249641

Bakos, J. Y. (1997). Reducing Buyer Search Costs: Implications for Electronic Marketplaces. *Management Science*, *43*(12), 1676–1692. doi:10.1287/mnsc.43.12.1676

Berwick, I. (2002). Slow Start Has Brought Benefits To All. *Financial Times (North American Edition)*, *6-7*(04).

Bolger, J. R. (2001). L&G Lines Up £30M Spending On Internet. *Financial Times (North American Edition)*, *03*(03).

Bush, J. (2004). *Consumer Empowerment and Competitiveness*, (October). London: National Consumer Council.

Byrne, A. (2007). Employee Saving and Investment Decisions in Defined Contribution Pension Plans: Survey Evidence from the UK. *Financial Services Review*, *16*, 19–40.

Croft, J. (2001). Online Insurance Sales To Replace Man From The Pru. *Financial Times (North American Edition)*, *14*(2).

Ennew, C., Watkins, T., & Wright, M. (1995). *Marketing Financial Services*, (2nd Ed.). Oxford, UK: Butterworth-Heinemann Ltd.

Ghosh, S. (1998). Making Business Sense of the Internet. *Harvard Business Review*, *76*(2), 126–136.

Harrison, T. (2000). *Financial Services Marketing.* Harlow, UK: Pearson Education Ltd.

Harrison, T., & Waite, K. (2005). Critical Factors Affecting Intermediary Website Adoption: Understanding How to Extend E-participation. *Journal of Business and Industrial Marketing*, *20*(4/5), 187–199. doi:10.1108/08858620510603864

Harrison, T., & Waite, K. (2006). A Time-based Assessment of the Influences, Uses and Benefits of Intermediary Website Adoption. *Information & Management*, *43*(8), 1002–1013. doi:10.1016/j.im.2006.09.004

Harrison, T., Waite, K., & Hunter, G. L. (2006). The Internet, Information and Empowerment. *European Journal of Marketing*, *40*(9/10), 972–993. doi:10.1108/03090560610680961

Hoffman, D. L. Novak. T. & Chatterjee, P. (1993), Commercial Scenarios for the Web: Opportunities and Challenges. *Journal of Computer Mediated Communication, 1*(3). Retrieved 31 March, 2009, from http://jcmc.indiana.edu/vol1/issue3/hoffman.html

Kimiloglu, H. (2004). The "E-Literature": A Framework for Understanding the Accumulated Knowledge about Internet Marketing. *Academy of Marketing Science Review, 6*. Retrieved March 31, from http://www.amsreview.org/articles/kimiloglu06-2004.pdf

McPhee, N. (1997). Technology - Detailed Findings. *IFA Insight at PIMS*. London: MSS Marketing Research Ltd.

Oliver, Wyman & Company (2001). *The Future Regulation Of UK Savings And Investment. Targeting the Savings Gap.* London: Association of British Insurers.

Pickering, A. (2002). *A Simpler Way to Better Pensions.* London: Department of Work and Pensions.

Porter, M. E. (2001). Strategy and the Internet. *Harvard Business Review*, *79*(3), 62–78.

Rha, J.-Y., Widdows, R., Hooker, N. H., & Montalto, C. P. (2002). E-consumerism as a tool for empowerment. *Journal of Consumer Education*, *19*(20), 61–69.

Rosenbloom, B. (2004). *Marketing Channels,* (7th Ed.). Mason, OH: Thomson South-Western.

Sandler, R. (2002), *Medium and Long Term Retail Savings in the UK – A Review,* London: HM Treasury.

Varadarajan, R., & Yadav, M. (2002). Marketing Strategy and the Internet: An Organizing Framework. *Journal of the Academy of Marketing Science*, *30*(4), 296–312. doi:10.1177/009207002236907

Walters, D., & Lancaster, G. (1999). Using the Internet as a Channel for Commerce. *Management Decision*, *37*(10), 800–816. doi:10.1108/00251749910302908

Wind, J., & Mahajan, V. (2001). The Challenge of Digital Marketing. In J. Wind & V. Mahajan, (Eds), *Digital Marketing: Global Strategies from the world's leading experts,* (pp. 3-25). New York: John Wiley & Sons.

Zank, G. M., & Vokurka, R. J. (2003). The Internet: Motivations, Deterrents, and Impact on Supply Chain Relationships. *SAM Advanced Management Journal*, *68*(2), 33–40.

## ADDITIONAL READING

Basch, M. (2000). Harness the power of the Internet: A New Model for the 21st Century . *Information Executive*, *4*(10), 8–9.

Beatty, R. C., Shim, J. P., & Jones, M. C. (2001). Factors Influencing Corporate Website Adoption: A Time Based Assessment . *Information & Management*, *38*(6), 337–354. doi:10.1016/S0378-7206(00)00064-1

Blili, S., & Raymond, L. (1993). Information Technology: Threats and Opportunities for Small and Medium Sized Enterprises . *International Journal of Information Management*, *13*(6), 439–448. doi:10.1016/0268-4012(93)90060-H

Davenport, T. H. (1993). *Process Innovation*, Boston, MA: Harvard Business School Press.

Evans, P., & Wurster, T. S. (2000), *Blown to Bits: How the New Economics of Information Transforms Strategy,* Boston, MA: Harvard Business School Press.

Gallaugher, J. (1999). Challenging the New Conventional Wisdom of Net Commerce Strategies . *Communications of the ACM*, *42*(7), 27–29. doi:10.1145/306549.306558

Greenhalgh, T., Robert, G., Macfarlane, F., Bate, P., & Kyriakidou, O. (2004). Diffusion of Innovation in Service Organisations: Systematic Review and Recommendations . *The Milbank Quarterly*, *82*(4), 581–629. doi:10.1111/j.0887-378X.2004.00325.x

Larsen, T., & McGuire, E. (Eds.). (1998), *Innovation Systems Innovation and Diffusion: Issues and Directions,* Hershey, PA: Idea Publishing Group.

Rogers, E. M. (1995) *Diffusion of Innovations*, 4th Edition, New York: The Free Press.

Stockdale, R., & Standing, C. (2004). Benefits and Barriers of Electronic Marketplace Participation: an SME Perspective . *The Journal of Enterprise Information Management*, *17*(4), 301–311. doi:10.1108/17410390410548715

Thong, J. Y. L. (1999). An Integrated Model of Information Systems Adoption in Small Business . *Journal of Management Information Systems*, *15*(4), 187–214.

## KEY TERMS AND DEFINITIONS

**Disintermediation:** The removal of a middleman or intermediary in a distribution channel so as to create a direct link between the producer/manufacturer and the final consumer of the product.

**E-Commerce:** Electronic commerce is any business transaction with customers, suppliers or external partners conducted via electronic systems such as the Internet, intranet or extranet or via proprietary systems.

**E-Society:** Electronic or information society. The study of the impact of digital technologies on the behaviours and processes of individuals and organisations.

**Empowerment:** Empowerment results from a combination of external assignation (the empowering environment) and internal realization of power (consumer perceptions). Hence, conditions must exist in the external environment that allows the transference or increase of power from one party to another. At the same time, the recipient must realise the increase in power and be in a position to benefit from this realisation.

**Supply Chain:** A network of multiple companies (typically manufacturers/suppliers, distributors, transporters, storage facilities and retailers) that participate in the manufacture, delivery and sale of a product to the final consumer.

**Distribution Channel:** A distribution channel or chain is a set of companies involved in making products/services available for sale to the final consumer. A distribution channel can be direct (from manufacturer to final consumer) or indirect (involving a number of intermediaries or middlemen).

# Chapter 112
# The Global Telecommunications Industry Facing the IP Revolution:
## Technological and Regulatory Challenges

**Harald Gruber**
*European Investment Bank, Luxembourg*

## 1 INTRODUCTION

Technological innovation in the telecommunications sector is a key contributor to the rapid diffusion of e-business. The steady drive towards semiconductor miniaturisation leads to a continuous decline in the price of telecommunications equipment and increase in performance. Technological change therefore continues to transform the way telecommunications services are provided and used. Telecommunication networks are subject to a technological switch from so called circuit switched technology to packet switched technology. In fact, digitalisation of audio and video signals has led to the convergence of telecommunications, data processing and broadcasting technologies into a single service platform based on Internet Protocol (IP). This has strong implications on legacy networks of existing operators, because they need to support during a transition period both technologies in the network, but this duplication is inefficient. This is more so as the incumbent telecommunications operators are subject to sector specific regulation. This regulation was motivated by the externalities that telecommunications generate and the concern that operators would exploit market power to the detriment of users. This appears to be less the case when there is a multiplicity of telecommunications networks.

In Next Generation Networks (NGN) all communication services (voice, data, Internet and TV/video) will be migrated to IP, will share a single

DOI: 10.4018/978-1-61520-611-7.ch112

aggregation and backbone infrastructure and there will be a unique service management platform and integrated provision of applications, including e-business. The migration of services from the switched network to NGN will be progressive. Data is the first to migrate and voice (VOIP) is normally the last because of the technical constraints, volume and investment required. Even larger investment would be necessary for access networks with sufficient transmission capacity, which may need to increase as type of e-business applications become more demanding in terms of network performance.

Telecommunications companies are thus facing the need for significant investment volumes on NGN for both the core network and the access network. They expect from this operating savings in the future as a result of having unified IP networks and also by the increased revenues as a result of a being able to offer a broader product range. However, there is the risk that if the demand for the new services and applications does not materialise on the fixed and/or mobile networks, a part of the forecast savings are overestimated and NGN investments will not yield expected financial returns. This risk induces several operators to adopt a cautionary approach to investment, also because they do not take into account the externalities they cannot appropriate. In particular they fear that they will not have any share in the increasing value of the information, to a large extent created through e-business, which will transit over their networks. This market failure represents a reason for public support to investment into access infrastructure.

To put the role of telecommunications for e-business into perspective, this study unravels the interplay between the evolution of technology, market performance of the telecommunications sector and regulation. It is arranged as follows. Section 2 provides an overview of the main market trends on a global level. It illustrates which regions show a particular strong market performance. Section 3 links the technological evolution to the market strategies that telecommunications operators currently are faced with. It shows that rapid technological change challenges the positions of established operators across a broad range of markets. A critical step is the setting up of broadband access networks close to the end-customer. They are key for satisfying demand of high bit rates such as High Definition IPTV. Section 4 illustrates the regulatory challenges, as regulation has profound implications for investment. The debate is still going on and is far from being concluded, while international comparisons suggest that different access provisions do lead to different results. Section 5 concludes.

## 2 MARKET OVERVIEW

The market dynamics in telecommunications are characterised by rapid technological change and the introduction of new services. This leads to a rapid and increasing penetration of telecommunications infrastructure, in particular for mobile and broadband services. Telecommunications infrastructure is an important input for sustained economic growth (Röller and Waverman, 2001) and thus there is a strong public interest in good performance of this sector.

The market is typically divided into the following segments: fixed voice services, mobile voice services and data/broadband services. These segments have fairly different growth profiles. Growth in the mobile telecommunications sector has remained sustained since the adoption of digital (mostly GSM) technology and competitive supply of services by two or more companies in each country (Gruber, 2005). The worldwide mobile subscriber base has reached 2.6 billion in 2006, which corresponds to 40 subscribers per 100 inhabitants[1]. As a comparison, in 2000 there were 12 subscribers per 100 inhabitants. What is even more striking is that two thirds of mobile subscribers are in developing countries, which are also contributing to most of the growth in the subscriber base. A continuation of subscriber growth is expected, possibly leading to 54 subscribers per 100 inhabitants by 2010 (IDATE, 2007). On the other hand the fixed line telecommunications subscriber base is shrinking in many countries, in particular in industrialised countries. This reduction is mostly compensated by the fixed line growth in China. In 2006, there were 19 fixed lines per 100 inhabitants at worldwide level, but with great disparities across countries. While the fixed line penetration level is stagnating, the number of mobile subscribers now more than twice outnumbers fixed line subscribers, with the ratio still increasing. The greatest impact from mobiles comes from the fact that they are not just a different or complementary way of communication but have opened up entirely new communication means in many parts of the developing world. Mobile telecommunications has become an important tool for economic development and fighting poverty (ITU, 2006). It has not just created new jobs and revenues but also contributed to economic growth by widening markets, creating better information flow, lowering transaction costs, and substituting for costly physical transport.

Data traffic is increasing its share of overall telecommunications revenues, even for mobile telecommunications. While voice revenues are still the predominant part of mobile service revenues, for a mobile operator like Vodafone, non-voice revenues such as SMS and Internet data transmission account already for 17% of its total mobile telecommunications revenues (OECD, 2007). However, the fixed line network is bound to remain the preferred platform for data traffic and broadband access, at least in developed countries. Broadband is also the way fixed line companies are able to stem the decline from traditional voice revenues due to fixed mobile substitution for both subscribers and traffic. Broadband services are playing a key role in keeping up the subscriber numbers and the revenue base for fixed line telecommunications. The number of broadband lines is increasing steadily with 280 million lines installed worldwide in 2006, corresponding to 4 lines per 100 inhabitants. The vast majority of broadband users are in the developed world: more than 95 percent are located in Asia-Pacific, Europe and North America, in particular countries with a well developed fixed line infrastructure.

Strong disparities exist across countries in the penetration of fixed lines. There is an average of 12 fixed lines per 100 inhabitants in developing countries, compared to 46 lines per 100 inhabitants in developed countries. This makes the supply of fixed line broadband access more difficult in a developing country context. Hence wireless access should represent an interesting technological alternative for future broadband development. Likewise there is a substantial gap in broadband availability within countries, with rural areas having much lower penetration rates than urban areas.

Balanced competition as a result of increased numbers of suppliers and service platforms leads to declining prices for telecommunications services. This downward pressure is enhanced by the shift of voice traffic toward data traffic by means of voice over internet protocol (VOIP). This implies that telecommunications traffic revenues is bound to move away from time and distance sensitive charging towards a flat fee pricing structure for network access based on capacity. Subscriber access should therefore become the key variable for revenue generation in the telecommunications business. This is happening already to a noticeable extent in the fixed line sector, with dramatic implications for the revenue structures of telecommunications companies. The mobile sector has been unaffected by the shift to VOIP up to now. It is however likely that with the diffusion of mobile broadband access the revenue structure will be affected in a similar way as in the fixed line sector.

## 3 IMPACT OF DIGITALISATION ON SUPPLY SIDE

### 3.1 Technological Progress in Access Technologies

Technological innovation in semiconductors transforms the way telecommunications services are provided and used. In fact, the performance increase of semiconductors has allowed for transformation of analogue text, audio and video signals in to a common format of zeros and ones, i.e. digitalisation. Digital signals can be sent over any transmission infrastructure. In other words, infrastructures previously dedicated to single services such as voice telecommunications, data processing or broadcasting now are able to transmit any type of information content based on Internet Protocol (IP). Let us look at this transformation more in detail with respect to the customer access infrastructure for communications services.

The access to communication services was traditionally dedicated to the type of the service to be supplied. This is illustrated by the "silo" paradigm, where there is a dedicated access infrastructure for each service. Mobile operators use cellular wireless access technologies to provide mobile voice telecommunications services, while fixed line operators like the incumbents or alternative operators rely on copper cables in the ground to provide access to voice services and later predominantly broadband data access. The cable TV operators used a coaxial cable access network for the distribution of the TV services only.

Helped by digitalisation, all three access types have gradually started to expand their offers. More in general, the single service business model has moved towards a "triple play" offering consisting in voice, broadband data and TV services. For instance, for fixed line operators the supply of broadband services has become a key factor in fighting the loss of voice service subscribers and traffic to the mobile networks and fixed line operators are also providing TV services.

### 3.2 Next Generation Access Infrastructure

Legacy fixed line access networks, mainly based on copper infrastructure, are not capable to handle future data transmission rates. Along with the strongly increasing traffic flow there will also be the need for increasing the transmission capacity of the telecommunications infrastructure. This can be achieved by using optical fibre instead of copper cables. While optical fibre has been already in use since long time in backbone infrastructure, the need for increasing the transmission capacity for individual customer the optical fibre cable has to be put closer to the customer. Currently the typical broadband subscriber has a digital subscriber line (DSL) where the transmission capacity is inversely related to the length of the copper local loop, i.e. the line between the user and the local telecommunications exchange. It typically has a minimum data transmission capacity of 1Mbps. A critical step of the NGN in terms of investment requirements and impact on services will be the installation of optical fibre on the customer access network. Several architectures of Fibre-To-The-Loop are possible, ranging from Fibre to the Curb combined e.g. with Very high speed DSL (VDSL), to Fibre to the Home (FTTH). The choice will depend on the commercial objective, the competitive situation, the financial resources of the companies and investment horizon.

Fibre close to the end-customer allow for transmission bit rates of around 100 Mbps each way possible, which is considered the reference bit rate for the near future. Fibre combined with copper (VDSL) should deliver up to 50 Mbps. One key factor for demand of high bit rates is High Definition Internet Protocol Television (HD-IPTV) that becomes essential for viewing quality with the larger TV screens. The 100 Mbps each way can be used e.g. for near 100 Mbps symmetric Internet or for 50 Mbps symmetric Internet plus 4 to 5 simultaneous HD-IPTV channels (using a 10 Mbps bit rate average), in addition to VOIP service. It is not foreseen that DSL alone will enable such bit rates for the average distances from the final users to the local exchanges.

## 4 THE POLICY CONTEXT AND REGULATORY ISSUES

Regulation strongly affects firm behaviour, especially when it involves large investments in access infrastructure with relatively long and uncertain payback periods. After the steep decline in investment activity, as a consequence of the bursting of the financial bubble in 2000-2001, investment in telecommunications has remained flat. In real terms it is below the investment level prior to the speculative bubble (OECD, 2007). Investment performance in the EU remains also poor compared to the US and Asia. At a per capita level, investment in telecommunications in 2005 was more than 50% higher in the US and Japan (USD 193 and USD 191 respectively) than in Europe (USD 124). As will be seen shortly, investment incentives are also to a large degree shaped by the regulatory framework.

Telecommunications is a regulated network industry and regulatory provisions have a bearing on the investment incentives and the overall economic performance of the industry. Access regulation has an important role to play in this respect. Not surprisingly, the economic literature has contemplated the case that inappropriate access regulation has negative effects on infrastructure investment (Guthrie, 2006). Regulatory conditions are country specific and a comparative analysis gives useful insights on the performance of regulatory measures. For instance, much attention is given towards incumbents giving open access at cost based prices. More in general, access regulation is permeated by the idea that new entrants should be assisted to enter in a way that foresees initially limited investment, but then it should increase. In other words, entry should first be service based and then increasingly switched to own facilities. In the longer term regulation could then become unnecessary because of the existence of competing platforms. This has been associated with the "ladder of investment" theory (Cave 2006), which postulates that initially new entrants use the facilities of the incumbent for service based competition and later invest in own infrastructure, i.e. assets with increasing difficulty to replicate.

The economic literature has contemplated the case that inappropriate access regulation has negative effects on infrastructure investment. This is in particular the risk when regulators cannot **ex ante** committo specific **ex post** prices. Gans and King (2004) show how investment incentives can be improved through 'access holidays', i.e. a limited period without access regulation. Such a perspective however is likely to create substantial dispute, as there are strongly conflicting interests involved. Although the way access products are priced have an influence on the investment incentives, the regulatory frameworks are silent on the investment incentives for either the incumbent or the new entrant. For instance, the EU regulatory framework is expected to stay firmly based on the notion of access price regulation and of mandatory unbundling of bottleneck infrastructure such a local loops.

This regulatory evolution in the European Union may be compared with the regulatory trends in the United States. The evolution of the telecommunications market is oriented by the Telecommunications Act of 1996. As in the European Union, there is a policy objective of overturning the regulated monopoly regime by injecting competition in the market, and these forces should make regulation unnecessary in the long run. Incumbent operators were mandated to unbundle network elements, such as local loop access to customers. But the unbundling obligation was successfully challenged in court in 2004. The regulator FCC did not appeal to the court's decision, and this was widely interpreted as a strategy switch away from service competition based on a single infrastructure (intra-platform competition) towards inter-platform competition[2]. In the aftermath the incumbent Verizon has made substantial investment for FTTH infrastructure.

A consensus is emerging on the proposition that inter-platform competition would help to create the premises for rolling back regulation in the sector. This has been achieved in the US, but in Europe there is a trend towards a single platform: the share of DSL technology in total broadband access technologies is steadily increasing. By 2008 DSL accounted for 82 per cent of the broadband access lines. The focus on a single access technology may have two important drawbacks for the diffusion of broadband access. First, the investment level is crucially affected by the incentive for the incumbent fixed line operator. Second, the benefits of inter-platform competition are foregone. Cable modem, which used to be the most important alternative broadband platform is losing share. The only technology that appears to become increasingly important, albeit starting at a very low basis is wireless in the local loop.

## 5 CONCLUSION

Telecommunications is a key enabler of the diffusion of e-business services and has very strong bearings on the productivity growth performance of advanced countries. IP has shaken up the delivery mode of services by allowing for the convergence of different types of service provisions on a single platform and lowering the cost of transmission. Moreover, it has increased the competition by allowing for the entry of new actors on the scene. The new sector challenge is investment in NGN to cope with the traffic growth induced by IP technology. While investment in NGN core networks aimed at integrating different service platform into an all-IP network is well under way, investment in NGN access network is only at the beginning. The latter constitute a much larger challenge because for the sheer size of the investment requirements, the uncertain nature of financial benefits and the exposure to regulatory discretion.

Regulation has profound implications for investment and regulatory environments are shaped at national or regional level. It is these regulatory frameworks that provide one of the greatest differentiating factors in the industry and determine its performance. For instance, cost based access pricing regimes were put in place in Europe to favour competitive entry, at least for intra-platform competition. In this sense the ladder of investment concept worked to illustrate the entry mode with increasing own facilities over time. However, it failed to deliver significant investment for inter-platform competition. Entry through unbundled local loops does not seem to lead to inter-platform competition, which seems to be the only self-sustaining form of competition to allow a rolling back of sector regulation in favour of competition law. The US on the other hand has rolled back regulation in broadband access and this has induced strong investment in fibre to the home infrastructure. The solution of the problem of investment incentives will be a key determinant for the diffusion of technological innovations and the benefits induced by the IP revolution.

## DISCLAIMER

The views expressed are of the author and need not necessarily reflect those of the EIB.

## REFERENCES

Cave, M. (2006). Encouraging Infrastructure Competition Via the Ladder of Investment. *Telecommunications Policy*, *30*, 223–237. doi:10.1016/j.telpol.2005.09.001

Denni, M., & Gruber, H. (2007). The diffusion of broadband telecommunications in the US: the role of different forms of competition. *Communications and Strategies*, *4*, 139–157.

EC (2003). Electronic Communications: The Road to the Knowledge Economy. European Commission COM, 65 final.

Gans, J., & King, S. (2004, March). Access Holidays and the Timing of Investment. *The Economic Record*, *80*, 89–100. doi:10.1111/j.1475-4932.2004.00127.x

Gruber, H. (2005). *The Economics of Mobile Communications*. Cambridge, UK: Cambridge University Press.

Guthrie, G. (2006). Regulating infrastructure: The impact on risk and investment. *Journal of Economic Literature*, *44*(4), 925–972. doi:10.1257/jel.44.4.925

IDATE. (2007). *Digiworld 2007*. Montpellier, France: Idate.

ITU. (2003). *Broadband Korea: Internet Case Study*. Geneva: International Telecommunications Union.

ITU. (2006. World Telecommunication/ICT Development Report 2006: Measuring ICT for social and economic development. Geneva: International Telecommunications Union. OECD (2007). *Communications Outlook*. Paris: OECD.

Prieger, J. E., & Heil, D. (2009). Is Regulation a Roadblock on the Information Highway? In I. Lee (Ed.), *Handbook of Research on Telecommunications Planning and Management for Business*. Hershey, PA: IGI Global.

Röller, L.-H., & Waverman, L. (2001). Telecommunications Infrastructure and Economic Development: A Simultaneous Approach. *The American Economic Review*, *91*(4), 909–923.

## KEY TERMS AND DEFINITIONS

**Digital Subscriber Line (DSL):** A family of technologies that provides digital data transmission over the wires of a local telephone network and allows "always on" connection to the Internet. Typically, the download speed of consumer DSL services ranges from 256 kilobits per second (kbit/s) upwards.

**Fiber To The Home (FTTH):** A network architecture that uses optical fiber to replace the usual copper local loop used for telecommunications.

**Internet Protocol (IP):** A key protocol on which the Internet is based. It is a standard that describes software that keeps track of the Internet's addresses for nodes, routes outgoing messages and recognizes incoming messages.

**Internet Protocol Television (IPTV):** A mode of transmitting system television service using Internet Protocol over any broadband communications infrastructure, instead of being delivered through traditional broadcast and cable formats.

**Ladder of Investment:** Regulatory concept according to which mandated access to network infrastructure components should lead to increasing investment in competing networks.

**Next Generation Network (NGN):** A broad term to describe some key architectural evolutions in telecommunication networks (both for core and access) that will be deployed during the next decade. NGNs are commonly built around the Internet Protocol, and therefore the term "all-IP" is also sometimes used to describe the transformation towards NGN.

**Voice Over Internet Protocol (VoIP):** A general term for delivery of voice communications over the Internet. This implies that traditional geographical numbering systems as well as traditional charging rules (e.g. time, distance) may not apply.

## ENDNOTES

1. Figures are from WDI data base of the World Bank.
2. There is empirical evidence (Denni and Gruber, 2007) for the US that inter-platform competition has significant positive effects on the diffusion of broadband access. Intra-platform competition, based on the same platform, instead has ambiguous effects. See also Prieger and Heil (2009).

# Chapter 113
# Evolving e-Business Systems:
## Transgenic Forces in International Realpolitik Space in 2050

**Denis Caro**
*École de Gestion Telfer University of Ottawa, Canada*

## ABSTRACT

*This chapter posits that transgenic governance forces are evolving and will engage future international e-business professionals in a multi-polar world of 2050. Social governance will be a cogent and compelling force in a tomorrow's internationalized world community. This is a call to e-business professionals and academicians to understand and engage themselves in the underlying different perceptions and paradigms, or Weltanschauung, of diverse sectors in a world of rising new cultures. They must become "transgenic" in their perspective and seize every opportunity to develop and sensitize themselves to the socio-political dynamics that influence future growth and development of international e-business systems. An understanding of strategic socio-political forces serves as an inter-organizational learning paradigm that fosters innovation and social responsibility for the betterment of humankind internationally.*

## INTRODUCTION

The 21st century continues to witness the transformation of organizational systems globally through e-business systems, which drive and evolve systemic goals. The implementation of business intelligence systems, client-relationship management systems, data mining and warehousing, knowledge management, security systems, supply chain management and systems integration continue to compel different sectors to engage in forging inter-organizational relationships internationally. With the cogent and ubiquitous developments in nomadic information systems and wireless and wearable technologies, the emerging future continues to witness the convergence of artificial intelligence, biotechnology and nano-technology (Pearson, 2001). This promises to further accelerate inter-organizational and inter-sectorial interactions. The literature underscores the critical role of strategic inter-sectorial partnerships in fostering efficiencies, sectorial growth and social actualization through innovation and mutual

DOI: 10.4018/978-1-61520-611-7.ch113

organizational learning (Burgelman and Doz, 2001; Das and Teng, 2001). These linkages have the potential to liberate thinking beyond closed organizational paradigms and embrace complex changes and uncertainty extra-organizationally and proactively. This paper posits that international e-business systems are mutually advantageous inter-organizational systems between knowledge cultures differing in values, missions, perceptions and evolution. Moreover, e-business systems incubate and thrive in socio-cultural polities, which are articulated through the governance systems. This paper examines the transgenic forces that underscore Zhu's WRS-Li stage model, in light of tomorrow's rising and more complex socio-political space in which international e-business systems form, evolve and derive their substance.

## BACKGROUND

E-business systems thrive through knowledge exchanges, relational and transactional capital transfers and are sustained through transactional processes. Tight coupling of international e-business systems require transactional and transformational leadership skill sets. The extant literature on critical success factors in international e- business systems, including B2B, B2C and collaborative interorganizational networks, stresses the importance of leadership, governance support, organizational learning, and knowledge management infrastructures. (Connelly, 2007; Ghosh, S. & M. Bertisen, 2007; Lee, C-P., G-G Lee & H-F Lin, 2007;Awazu, 2006; Jeon B.N., K.S.Han & M.J. Lee, 2006; Kumar, N. & Q.Peng, 2006). Moreover, the underlying theme of this literature stresses the importance of mutual international respect, understanding and shared visions as the fundamental basis for trust-the fundamental pillar of effective international e-business systems (Patel, T, 2007; Lu, X-H., L.-H. Huang & M.S.H. Heng, 2006; Mandal, P., 2006; Dubelaar, C., A. Sohal & V. Savic, 2005; Holsapple, C. W. & S. Sasidharan, 2005; Mandal P., 2004). Indeed the bridging of international digital divides, the deployment of responsible e-commerce systems, the productive development growth of future maquiladoras will depend on the fostering of these trust relationships (Rao, M.R. & Pomander, 2007; Ferguson, C. W. & D.C.Yen, 2006; Mandal, 2006).

Moreover, it requires an understanding of dynamic socio-political elements that influence e-business systems behaviour and foster trust within complex economic, socio-cultural and strategic dimensions (Murray, P.J. & Z. Zhu, 2003). In-depth knowledge of the technological and socio-political dynamics is tantamount to an understanding "of-the-becoming" (de Rond & Bouchikhi, 2004). Structural bonding (economic and functional factors that involve explicit benefits) and social bonding (emotional and affective resources) are the prerequisites to relationship cohesion in e-business (Rodriquez, 2002). Perception, mutuality, trust and understanding are the implicit drivers of e-business system behaviour. Mutual trust and understanding, or relational capital, fosters climates of good faith and open collaboration, which in turn forge efficient and effective international e-business systems (Roussin-Isett. K., 2005; Ibbott, C. J. & R.M. O'Keefe, 2004; Simsarian-Webber, S. & Kimoski, R. J., 2004; Gebrekidan, D.A. & G.B. Awuah, 2002).

E-business professionals must invest the time, energy and effort in understanding multiple Weltanschauung (views of the world), or paradigms (Shi & Wright, 2001). Active engagement, financial and political support of governance organizations is of paramount importance to the evolution to effective e-business systems. Governance laws, policy and regulation in market and competitive processes, financing, technological standards, knowledge management, privacy and security, all have a paramount impact on the transformational directions of international e-business systems. These governance forces reverberate and impact on a wide gamut of international sectors and industries, be they in aerospace, agriculture, aquaculture,

*Table 1. e-business dimensions in an international context*

| E-business Dimensions | Zhu's WSR-Li Model Equivalence* | Characteristics | E-Business Systems Articulation |
|---|---|---|---|
| 1. Transactional | Wu-Li | Knowing<br>Resources<br>Conditions | Resourcing e-business systems |
| 2. Relational | Shi-Li | Sensing<br>Perspectives<br>Psycho-cognitive<br>Weltanschaungen | Mutual intersectorial understanding |
| 3. Transgenic | Ren-Li | External<br>Socio-political<br>Sociocultural | Governance forces<br>Supra-cultural<br>interaction and understanding |

*Adapted from Zhu's WSR-Li stage model (Zhu, 2002)

biotechnology, defence, education, emergency preparedness, energy, environmental services, financial services and banking, governance, health care, human capital services, humanitarian services, insurance services, information and communication technology, marketing, mining, ocean technology, pharmaceutical, retailing, space technology and transportation.

Effective e-business systems are inter-organizational learning paradigms that foster innovation, growth and social responsibility. Governance systems are of paramount importance in an internationalizing planet with converging transnational values and imperatives. An understanding of the international perceptions, assumptions and values are crucial in creating and sustaining effective e-business systems. It is posited that the most effective and stable e-business systems are those where professionals understand closely collaborate with governance systems. It is axiomatic that where the ultimate transactional power lies, there rests the ultimate transformational base (Caro, 2007). Governance organizations in effect hold the transgenic power to leverage the growth, stabilize, sustain and transmute e-business systems. Symbiotic networks are the lodestar of future e-business systems (Caro, 2009). Symbiotic dyadic e-health networks require relational capital (trust), transactional and transformational competencies sustained through transgenic powers of governance organizations.

This points to the need to understand the intersectorial cultural and organizational climates. Zhu's "Wu-Shi-Ren (WSR)-Li" stage model provides a relevant framework to understand these dynamics in the Realpolitik of e-business systems globally. The model underscores the perspectives, sensing and the psycho-cognitive elements ("Shi-Li") with socio-political elements and power structures ("Ren-Li") to leverage technological resources ("Wu-Li") (Zhu, 2001). In essence, the "sensing and caring" transform the "knowing", which facilitates the growth of e-business systems (Zhu, 2002). Building on Zhu's framework, it is possible to discern yet another critical and additional *external* dimension, or "Ren-Li" force, which becomes manifest in culturally influenced socio-political dynamics (Caro, 2007). These transgenic forces are constituted from the public governance organizations and values of the socio-political environments in which e-businesses take form, evolve and coalesce. Transgenic forces are particularly potent "Ren-Li" elements that reflect the importance of the socio-cultural context (Caro, 2008).

Public governance systems and values, an extension of Zhu's Ren-Li's dimension in socio-political environments constitute an important and added dimension to Zhu's WRS –Li model: a transgenic one. This is particularly the case in those nations, where social governance values are integral and germane to socio-political domains. International governance organizations will have critical responsibilities in facilitating dialogue and collaboration of the e-business professionals in diverse sectors. The strength and quality of governance leadership and organization is the Realpolitik basis, which unleashes the transformational resources and "transgenic" energy to develop synergistic e-business systems. This supra level of social governance holds the key, or "transgenic", power to leverage the growth, sustain and transmute symbiotic e-business systems into a public value. These governance structures promote collaborative action and internal cohesion and collaboration in the pursuit of socio-political goals and objectives (Scott, 2008). These higher transgenic powers are critical facilitators through which international e-business systems are substantiated and take form.

## 2050 Transgenic Model

It is posited that international transgenic forces are a function of two key dimensions: eco-space power (measured by millions of kms$^2$) multiplied by the human capital power (demographic size measured by population projections in the year 2050). Using this generic model, in isolating critical polities, nation-states had to meet one of two criteria to discern the structural manifestations of transgenic forces:

1. only polities that were 10% and over in geographical size of the Russian Federation (at 17, 075,200 km$^2$) or;
2. only polities with over 10% and over in projected population size of the Republic of India (at 1, 807,000, 000) in the year 2050 (United States Census Bureau, 2008).

This resulted in a preliminary composite a constellation of 26 key polities. From this, the list was then reduced to include only those whose result was 1% of the strategic power of the People's Republic of China with a total of score of 13,672, which is the world's highest transgenic score. This resulted in 17 key political entities, which will likely become the e-business strategic focal points of the world of 2050. These nations, included in Table 2, will facilitate and strongly influence international e-business growth and development for the betterment of humankind.

Furthermore, based on Table 2, one can decipher three key class orders of transgenic polities:

1. Class order A, which will constitute over 90% of the total e-business significant transgenic forces. These will be the principal global world drivers and leader-nations of 2050, which will globally transcend geopolitical, socio-cultural and temporal boundaries;
2. Class order B, those with less than 10% of the total e-business composite power, but over 10% of that of the People's Republic of China; and
3. Class order C, those nations with less than 10% of the total e-business composite power.

Both class order B and C polities will be pivotal entities but likely more on a regional level and probably subordinate to the class order A ones.

Interestingly, the list does not include Japan, which from its declining population and relative small size has not made the composite list. Although not of international transgenic power, it may well exert great regional influence in 2050. Another hypothesis is that Japan may form a common market with the People's Republic of China, as may the Socialist Republic of Vietnam and/or the Republic of the Philippines, both of which will also exert great regional impact. The same may be

*Table 2. Constellation of potential strategic e-business transgenic forces of 2050*

| | Eco-Space km² (000,000)* | Projected 2050 Demographics (ooo,ooo)* | Potential Transgenic Score (Rounded) |
|---|---|---|---|
| 1. Argentine Republic | 2.8 | 53.5 | 150 |
| 2. Canada | 10.0 | 41.1 | 411 |
| 3. Commonwealth of Australia | 7.7 | 29.0 | 223 |
| 4. Democratic Republic of Congo | 2.4 | 189.3 | 454 |
| 5. European Union | 4.0 | 472.0** | 1888 |
| 6. Federal Republic of Nigeria | .9 | 264.3 | 238 |
| 7. Federative Republic of Brazil | 8.5 | 260.7 | 2216 |
| 8. Federative Republic of Ethiopia | 1.1 | 278.3 | 306 |
| 9. Islamic Republic of Pakistan | .8 | 295.2 | 236 |
| 10. Islamic Republic of Iran | 1.7 | 81.5 | 139 |
| 11. People's Republic of China | 9.6 | 1424.2 | 13672 |
| 12. Republic of India | 3.3 | 1807.9 | 5966 |
| 13. Republic of Indonesia | 1.9 | 313.0 | 595 |
| 14. Republic of Sudan | 2.5 | 88.2 | 221 |
| 15. Russian Federation | 17.1 | 109.2 | 1867 |
| 16. United Mexican States | 2.0 | 147.9 | 296 |
| 17. United States of America | 9.8 | 439.0 | 4302 |
| Total | 86.2 | 6294.3 | 33180 |

*United States Census Bureau, 2008
**Mcdougall, R., 2008

said of many nations of the Arab world that are currently politically and economically fragmented. Common markets and political unions may well set the stage for strong transgenic forces emanating from the Arab part of the world. Clearly, many of the traditional European states such of the Republic of France, The Federal Republic of Germany, the Italian Republic, the Kingdom of Spain, and the United Kingdom of Great Britain and Northern Ireland stand little chance as individual and separate polities to impact global e-business directions in the face of the colossal transgenic changes that will sweep the world by 2050. Only the European Union as a unified polity will assure a place as an e-business focal center in the middle of the 21st century. Moreover, it is clear that a Euro-centric world stands no chance in a 2050 world, which will be dominated by the transgenic power of the People's Republic of China and the Republic of India. The emerging 2050 picture points to a multi-polar world with six clear polities, which will likely together have a very significant impact on all facets of international e-business in every conceivable sector of humankind activity.

## FUTURE RESEARCH DIRECTIONS

The proposed transgenic model has a number of constraints. Given the current turbulence of the economic environments, it does not include projected Gross National Product (GNP) of key nations, which might drive the form of future international e-business systems. Moreover, the model does not account for the internal divergent ethnical compositions within each political entity,

*Table 3. Class orders of critical transgenic forces in 2050*

| Class Order | Transgenic Scores | Rank Ordered Key 2050 Polities | Percentage of Composite Total |
|---|---|---|---|
| Class Order A | *>1367* | *1. Peoples Republic of China*<br>*2. Republic of India*<br>*3. United States of America*<br>*4. Federative Republic of Brazil*<br>*5. European Union*<br>*6. Russian Federation*<br>*Federative Republic of Brazil*<br>*Peoples Republic of China*<br>*Republic of India*<br>*Russian Federation*<br>*United States of America* | 90% |
| Class Order B | *333-1367* | *7. Republic of Indonesia*<br>*8. Democratic Republic of Congo*<br>*9. Canada* | 5.5% |
| Class Order C | *136-332* | *10. Federal Democratic Republic of Ethiopia*<br>*11. United Mexican States*<br>*12. Islamic Republic of Pakistan*<br>*13. Federal Republic of Nigeria*<br>*14. Commonwealth of Australia*<br>*15. Republic of Sudan*<br>*16. Argentine Republic*<br>*17. Islamic Republic of Iran* | 4.5% |

which in some cases could destabilize and fragment the political integrity of these polities. Nor does the model include the scenario of possible political unions, or the formation of new common markets, which might result from the global socio-economic turbulence. The proposed model assumes that there will not be catastrophic events that would substantially alter the current political integrity, nor the demographic patterns of these nations. Yet there are many unsettling forces in our current world, such as pandemics, over-militarism, severe overpopulation and chronic underdevelopment. These multivariate possibilities form the backdrop for further investigation.

The implications for international e-business research are manifold. Research must take into account an in-depth understanding of the larger socio-cultural environment in which e-business systems are developed and evolve. This requires more research into the transgenic dimensions of what propels these critical international e-business milieus. For example, how does the internal socio-cultural development of the People's Republic of China affect the systemic patterns of e-business not only within its national borders, but internationally? What are the implications of transgenic forces on the interchange of e-business products and services between the European Union and the Federative Republic of Brazil, for example?

The patterns and development of e-business systems has the potential to either promote or hinder world development and peace. Understanding the backdrop of the transgenic forces with its governance and socio-political dimensions is the key to the evolution of e-business systems thinking and evolution. By virtue of their eco-space and projected demographic dimensions size, the class order A polities, including the Peoples Republic of China, the Republic of India, the United States of America, the Federative Republic of Brazil, the European Union, and the Russian Federation will likely be the superpowers of the mid-21$^{st}$ century. An understanding of the governance dimensions within and between these critical nations will drive the future of international e-business growth and regulations in the world of 2050. To the extent that these nations stabilize and become fully developed and interact synergistically, the global socio-political climate and environment for e-business systems of the year 2050 will be a positive one.

An understanding of strategic geopolitical forces serves as an inter-organizational learning paradigm that foster innovation and social responsibility for the betterment of humankind internationally.

This transgenic prototype model is based on a number of systemic assumptions:

1. that these nations will grow socio-cultural stable ones. This is far from certain given the turbulent socio-economic environment that the world is currently facing.
2. that the world will grow into a more inspiring and peaceful milieu with national and international governance policies will promote peace and equitable development. An understanding of the dynamics within and between these 17 transgenic nations will become the key to e-business efficiency and effectiveness in all sectors and industries. An understanding of the socio-cultural dynamics and environments of these polities will become instrumental in e-business initiatives, growth and evolution. The world's economic health, world stability and humankind development will depend largely in the understanding of the transgenic forces in these critical nations.

## CONCLUSION

This chapter posits that the transgenic governance forces that are evolving will engage future e-business professionals and educators in a multi-polar world of 2050, where social governance will become cogent and compelling in tomorrow's integrated world community. This is a call to future e-business professionals to understand and engage themselves in the underlying different perceptions and paradigms, or Weltanschauung, of diverse sectors in a world of rising new cultures. They must become "transgenic" in their perspective and seize every opportunity to develop and sensitize themselves to the socio-political dynamics that influence future growth and development of international e-business systems.

The G7, also known as the Haley Group, is the forum of the finance ministers from seven industrialized nations, including Canada, France, Germany, Italy, Japan, United Kingdom and the United States. With the inclusion of Russia, the G7 became the G8. This G8 ultimately set the tone for economic, monetary and fiscal policy coordination globally, which are critical to the growth and direction of e-business systems globally. Concomitantly, 2009 saw the rise of G20 expanding the forum to include the finance ministers and central bank governors of Argentina, Australia, Brazil, China, India, Indonesia, Mexico, Saudi Arabia, South Africa, South Korea and Turkey, in addition to the G8 nations. In the future, it is posited that there will likely be new global forums that will include the new rising transgenic powers of the Congo, Ethiopia, Iran, Nigeria and the Sudan. It would appear that the world of 2050 would be far more Afro-centric than is currently the case. Future effective e-business partnerships and networks will depend on in-depth understanding of the socio-political dynamics of these 17 transgenic powers and a relearning and reengineering of current constellations of e-commerce patterns (Aguilera, R., 2007; Chi, L., Holsapple C. W. & Srinivasan, C., 2007;Hwang, Y. -S. & Park, S. H., 2007; Kauser, S., 2007; Hsu, P.F., K. L, Kraemer, K.L. & Dunkle, D.; Rosenkranz, S., 2007; Littler, D., 2006). It is posited that effective e-business executives should proactively prepare for new emerging patterns of e-business systems will be shaped by the interaction of these transgenic powers on the horizon.

A cautionary note is warranted: over-militarism, overpopulation and declining economic possibilities for humankind well-being form an ominous brew that may set the stage for world catastrophes. The positive development, stability and international cooperation between these 17 transgenic forces will set the stage for peace and harmony. The failure to do so will increase the chances of regional if not world conflagrations. It behoves e-business educators and professionals in 2010 to prepare to comprehend the new emerging Realpolitik being forged internationally. That these transgenic forces be understood and reckoned with the emerging Weltanschauung of international e-business is a sine qua non. This understanding will be one of the keys to world peace and harmony, in which e-business systems will thrive and have their substance. Transgenic forces are the public governance agents and values of the socio-political environments that provide the international context in which e-business systems take form, develop and have their substance. This model suggests that the e-business world faced with transgenic forces and changes internationally may have to engage in a process of unlearning and reengagement in a process of second-order learning. The future of effective e-business systems will depend on the reorientation and understanding of the world dynamics, as we know it. It will require the unlearning of current Weltanschauung, or world-views (Gharajedaghi, J. 2007). Ironically, the temporal path between 2010 and 2050 is fraught with global threats and vulnerabilities and yet at the same time untapped opportunities and possibilities. It is safe to say, however, that the world of 2050 will be substantially different that the one of 2010. It is incumbent of e-business professionals and the academicians who are developing them to take careful heed of the global seismic changes that will soon become apparent to all.

## REFERENCES


Aguilera, R. (2007). Translating theoretical logics across borders: Organizational characteristics, structural mechanisms and contextual factors in international alliances. *Journal of International Business Studies*, *38*(1), 38–46. doi:10.1057/palgrave.jibs.8400254

Awazu, Y. (2006). Managing technology alliances: The case for knowledge management. *International Journal of Information Management, 26*(6), 484. Retrieved June 12, 2009, from Proquest database, Document ID: 1174326251.

Burgelman, R. A., & Doz, Y. L. (2001). The power of strategic integration. *MIT Sloan Management Review*, *42*(3), 28–39.

Caro, D. (2007). Evolving e-health symbiosis: Theoretical constructs in international Realpolitik space. *The International Journal of e-Business Research (IJEBR), 3*(4), 67-78.

Caro, D. (2008). Deconstructing symbiotic dyadic e-health networks: Transnational and transgenic perspectives. *International Journal of Information Management*, *28*, 94–101. doi:10.1016/j.ijinfomgt.2007.12.002

Caro, D. (2009). Evolving e-health systems: Symbiotic constructs between corporate and e- health care worlds in international space. In I. Lee, (Ed.), *Emergent Strategies for E-Business Processes, Services and Implications: Advancing Corporate Framework - Advances in E-Business Research Series,* (Vol. 3, pp. 175-188).

Chi, L., Holsapple C. W., & Srinivasan, C. (2007). The linkage between IOS use and competitive action: a competitive dynamics perspective. *Information Systems and eBusiness Management, 5*(4), 319-357.

Connelly, D. R. (2007). Leadership in the collaborative interorganizational domain. *International Journal of Public Administration*, *30*(11), 1231–1262. doi:10.1080/01900690701230150

Das, T. K., & Teng, B. S. (2001). Trust, control and risk in strategic alliances: Integrated framework. *Organization Studies*, *22*(2), 251–284. doi:10.1177/0170840601222004

De Rond, M., & Bouchikhi, H. (2004). On the dialectics of strategic alliances. *Organization Science*, *15*(1), 56–70. doi:10.1287/orsc.1030.0037

Dubelaar, C., Sohal, A., & Savic, V. (2005). Benefits, impediments and critical success factors in B2C adoption. *Technovation*, *25*(11), 1251–1262. doi:10.1016/j.technovation.2004.08.004

Ferguson, C. W., & Yen, D. C. (2006). A regional approach to e-commerce global expansion. *International Journal of Electronic Business*, *4*(1), 99–114.

Gebrekidan, D. A., & Awuah, G. B. (2002). Interorganizational cooperation: A new view strategic alliances –The case of Swedish firms in the international market. *Industrial Marketing Management*, *31*(8), 679–693. doi:10.1016/S0019-8501(01)00179-1

Gharajedaghi, J. (2007). Systems thinking: A case for second-order learning. *The Learning Organization*, *14*(6), 473–479. doi:10.1108/09696470710825088

Ghosh, S., & Bertisen, M. (2007). The phenomenon of e-business networking: a critical review. *International Journal of Information Technology and Management*, *6*(2-4), 250–270. doi:10.1504/IJITM.2007.014003

Holsapple, C. W., & S. Sasidharan. (2005). The dynamics of trust in B2C e-commerce: a research model and agenda. *Information Systems and eBusiness Management, 3*(4), 377-403.

Hsu, P.F., K. L, Kraemer, K.L., & Dunkle, D. (2006). Determinants of e-business use in U.S. firms. *International Journal of Electronic Commerce, 10*(4), 9. Retrieved June 12, 2009, from Proquest database, Document ID: 1152024071.

Hwang, Y.-S., & Park, S. H. (2007). The organizational life cycle as a determinant of strategic alliance tactics: research propositions. *International Journal of Management*, *24*(3), 427–437.

Ibbott, C. J., & O'Keefe, R. M. (2004). Trust, planning and benefits in a global interorganizational system. *Information Systems Journal*, *14*(4), 131–152. doi:10.1111/j.1365-2575.2004.00167.x

Jeon B.N., K.S.Han & M.J. Lee. (2006). Determining factors for the adoption of e-business: the case of SMEs in Korea. *Applied Economics, 38*(16), 1905. Retrieved June 10, 2009, from Proquest database. (Document ID: 1158368321).

Kauser, S. (2007). Alliance relationship dynamics: conflict, structure and control. *Journal of Euro – Marketing, 16*(3), 5. Retrieved June 18, 2009, from ABI/INFORM Global database, Document ID: 1293486251.

Kumar, N., & Peng, Q. (2006). Strategic alliances in e-government procurement. *International Journal of Electronic Business*, *4*(2), 136–145.

Lee, C.-P., Lee, G.-G., & Lin, H.-F. (2007). The role of organizational capabilities in successful e-business implementation. *Business Process Management Journal*, *13*(5), 677–693. doi:10.1108/14637150710823156

Littler, D. (2006). Alliance enigmas. *International Journal of Technology Management, 33*(2,3), 115-129. Retrieved June 18, 2009, from ABI/INFORM Global database, Document ID: 97558760133.

Lu, X.-H., Huang, L.-H., & Heng, M. S. H. (2006). Critical success factors of inter-organizational information systems-A case study of Cisco and Xiao Ting in China. *Information & Management*, *43*(3), 395–408. doi:10.1016/j.im.2005.06.007

Mandal, P. (2004). Inter-country analysis of e-business. *Journal of Global Information Technology Management*, *7*(20), 1–5.

Mandal, P. (2006). Behavioral factors and formation technology infrastructure considerations in strategic alliance development. *International Journal of Enterprise Information Systems*, *2*(4), 77–88.

Mcdougall, R. (2008). *Too Many People Europe's Population Problem,* (pp.1-6). Optimum Population Trust. Retrieved April 25, 2008, from www.optimumpopulation.org/opt.europe.html

Murray, P. J., & Zhu, Z. (2003). Systems thinking: Managing complexity and change. *Systems Research and Behavioral Science*, *20*(5), 385–386. doi:10.1002/sres.573

Patel, T. (2007). The role of dynamic cultural theories in explaining the viability of international strategic alliances,A focus on Indo-French alliances. *Management Decision*, *45*(10), 1532–1559. doi:10.1108/00251740710837951

Pearson, I. D. (2001). What' s next? *BT Technology Journal*, *19*(4), 98–106. doi:10.1023/A:1013786714912

Rao, M. P., & Mandal, P. (2007). Information technology in maquiladoras: an exploratory study of usage and Perceptions. *International Journal of Enterprise Information Systems*, *3*(4), 51–68.

Raven, P. J., Huang, X., & Kim, B. B. (2007). E-business in developing countries: a comparison of China and India. *International Journal of E-Business Research*, *3*(1), 91–109.

Rodriquez, C. M. (2002). Relationship bonding and trust as a foundation for commitment in US –Mexican strategic alliances: A structural equation modeling approach. *Journal of International Marketing*, *10*(4), 53–77. doi:10.1509/jimk.10.4.53.19553

Rosenkranz, S. (2007). Strategic positioning of alliances. *International Journal of the Economics of Business, 14*(1), 135. Retrieved June 18, 2009, from ABI/INFORM Global database, Document ID: 1245500261.

Roussin-Isett, K. (2005). The evolution of dyadic inter-organizational relationships in a network of publicly funded nonprofit agencies. *Journal of Public Administration and Theory*, *15*(1), 149–165. doi:10.1093/jopart/mui008

Scott, R. E. (2004). Investigating e-health policy –tools for the trade. *Journal of Telemedicine and Telecare*, *10*, 246–248. doi:10.1258/1357633041424377

Shi, X. P., & Wright, P. C. (2001). Developing and validating an international business negotiator's profile: The China context. *Journal of Managerial Psychology*, *16*(5/6), 364–390. doi:10.1108/EUM0000000005523

Simsarian-Webber, S., & Kimoski, R. J. (2004). Client-project manager engagements trust and loyalty. *Journal of Organizational Behavior*, *25*(8), 997–1014. doi:10.1002/job.294

United States Census Bureau. (2008, December 15). *International Data Base.* Retrieved April 24, 2009 from www.census.gov/cgi-bin/ipc/idbrank.pl

Zhu, Z. (2001). Towards an integrating programme for information systems design: An oriental case. *International Journal of Information Management*, *21*(1), 69–90. doi:10.1016/S0268-4012(00)00051-7

Zhu, Z. (2002). Evaluating contingency approaches to information systems design. *International Journal of Information Management*, *22*(5), 343–356. doi:10.1016/S0268-4012(02)00014-2

## ADDITIONAL READING

Adewale, O. S. (2004). An internet-based telemedicine system in Nigeria. *International Journal of Information Management*, *24*(3), 221–234. doi:10.1016/j.ijinfomgt.2003.12.014

Amaravadi, C. S., & Lee, I. (2005). The dimensions of process knowledge. *Knowledge and Process Management*, *12*(1), 65–76. doi:10.1002/kpm.218

Chi, L., & Holsapple, C. W. (2005). Understanding computer-mediated interorganizational collaboration: A model and framework. *Journal of Knowledge Management*, *9*(1), 53–75. doi:10.1108/13673270510582965

Dos Santos, B. L. (2003). Information technology investments: characteristics, choices, market risk and value. *Information Systems Frontiers*, *5*(3), 289–301. doi:10.1023/A:1025653428097

Etemad, H. (2004). Internationalization of small and medium-sized enterprises: a grounded theoretical framework and an overview. *Canadian Journal of Administrative Sciences*, *21*(1), 1–23.

Gedge, R. (2003). Symbiotic networks. *BT Technology Journal*, *21*(3), 67–73. doi:10.1023/A:1025107031136

Grover, V., & Saeed, K. A. (2007). The impact of product, market and relationship characteristics on interorganizational system integration in manufacturer-supplier dyads. *Journal of Management Information Systems*, *23*(4), 185–216. doi:10.2753/MIS0742-1222230409

Hettne, B., & Soderbaum, F. (2005). Intervening in complex humanitarian emergencies: The role of regional cooperation. *European Journal of Development Research*, *17*(3), 449–461. doi:10.1080/09578810500209247

Jaloni, P. (2007). How company and managerial characteristics influence strategic alliance adoption in the travel sector. *International Journal of Tourism Research*, *9*(4), 243–255. doi:10.1002/jtr.609

Lee, I. (2007). An architecture for a next-generation holistic e-recruiting system. *Communications of the ACM*, *50*(7), 81. doi:10.1145/1272516.1272518

Lee, In ed. (2009). *Emergent Strategies for e-Business Processes, Service and Implications: Advancing Corporate Frameworks*. Hershey: Information Science References.

Lin, H. F. (2006). Interorganizational and organizational determinants of planning effectiveness for Internet-based interorganizational systems. *Information & Management*, *43*(4), 423–433. doi:10.1016/j.im.2005.10.004

Martin, F. E. (2005). Critical analysis of the concept of peace in international relations. *Peace Research*, *37*(2), 45–61.

McKay, S. (2006). The limits of likemindedness. *International Journal (Toronto, Ont.)*, *61*(4), 875–894.

Oliver, A. L. (2001). Strategic alliances and the learning life- cycle of bio-technology firms. *Organization Studies*, *22*(3), 467–490. doi:10.1177/0170840601223004

Orlikowski, W. J., & Iacono, C. S. (2001). Research commentary: desperately seeking "IT" in IT research- A call to theorizing the IT artifact. *Information Systems Research*, *12*(2), 121–135. doi:10.1287/isre.12.2.121.9700

Robinson, D. F., Savage, G. T., & Campbell, K. S. (2003). Organizational learning, diffusion and international collaboration in telemedicine. *Health Care Management Review*, *28*(1), 68–78.

Senge, P., Carstedt, G., & Porter, P. I. (2001). Innovating our way to the next industrial revolution. *MIT Sloan Management Review*, *42*(2), 24–39.

Siau, K. (2003). Interorganizational systems and competitive advantages - Lessons from history. *Journal of Computer Information Systems*, *44*(1), 33–39.

Stiles, J. (2003). A philosophical justification for a realist approach strategic alliance research. *Qualitative Market Research*, *6*(4), 263–272. doi:10.1108/13522750310495346

Teo, H. H., Wei, K. K., & Benbasat, I. (2003). Predicting intention to adopt interorganizational linkages: An institutional perspective. *MIS Quarterly*, *27*(1), 1–31.

Townsend, J. D. (2003). Understanding alliances: A review of international aspects in strategic marketing. *Marketing Intelligence & Planning*, *21*(3), 143–156. doi:10.1108/02634500310474966

Wareham, J. L. (2003). Information assets in interorganizational governance: Exploring the property rights perspective. *IEEE Transactions on Engineering Management*, *50*(3), 337–351. doi:10.1109/TEM.2003.817291

Weiser, J. (2007). Untapped: strategies for success in underserved markets. *The Journal of Business Strategy*, *28*(2), 30–37. doi:10.1108/02756660710732639

Wilson, K. (2004). The complexities of multi-level governance in public health. *Canadian Journal of Public Health*, *95*(6), 409–413.

Wood, J. A. (2006). NLP Revisited: Nonverbal Communications and Signals of Trustworthiness. *Journal of Personal Selling & Sales Management*, *26*(2), 197–204. doi:10.2753/PSS0885-3134260206

Woodley, J. (2006). Re-visiting control in international strategic alliances. *Journal of Asia-Pacific Business*, *7*(1), 81–97. doi:10.1300/J098v07n01_05

Yemm, G. (2006). Can NLP help or harm your business? *Industrial and Commercial Training*, *38*(1), 12–18. doi:10.1108/00197850610645990

## KEY TERMS AND DEFINITIONS

**Class Order:** The ranking of a polity that has or is projected to have significant strategic import on the evolution of e-business systems.

**Eco-Space Power:** A polity that is circumscribed and measured by millions of kms$^{2 \text{ by}}$ 10% or more the largest geographical space of the Russian Federation of at 17, 075,200 km$^2$.

**Evolving International E-Business Systems:** The systemic formation, development, growth and evolutionof information and communication systems in human transactions.

**Human Capital Power:** A polity that is circumscribed and measured by projected millions of humans by 10% or more the largest demographic of the Republic of India at 1, 807,000, 000 in the year 2050.

**International Realpolitik Space:** The international geopolitical realities, whether explicit or implicit.

**Intersectorial:** Between socio-economic sectors that include aerospace, agriculture, aquaculture, biotechnology, defence, education, emergency preparedness, energy, environmental services, e-recruitment, financial services and banking, governance, health care, human capital services, humanitarian services, insurance services, information and communication technology, marketing, mining, ocean, pharmaceutical, retailing, space technology and transportation.

**Polities:** An integrated socio-political entity with a defined and internationally recognized political centrum.

**Relational Capital:** Trust between e-business system parties. This reflects the "Wu-li" dimension of Zhu's WRS-Li stage model.

**Transactional Capital:** Resources that are exchanged between e-business system agents and parties. This reflects the "Shi-li" dimension of Zhu's WRS-Li stage model.

**Transgenic Forces:** Those critical and potent socio-political elements environments, processes, structures and value constructs that are articulated through governance organizations, in which e-businesses take form, evolve and coalesce. They constitute and mirror a vital supra-level and socio-cultural "Ren-Li" dimension to Zhu's WRS-Li stage model (Caro, 2008).

**Weltanschauung:** The views and paradigms deployed to understand world structures and dynamics.

**WSR-Li Stage Model:** Zhu's "Wu-Shi-Ren Li" stage model that provides a framework to understand these dynamics in the Realpolitik of e-business systems globally. The model underscores the perspectives, sensing and the psycho-cognitive elements ("Shi-Li") with socio-political elements and power structures ("Ren-Li") to leverage technological resources ("Wu-Li") (Zhu, 2001).

# Chapter 114
# E-Recruiting:
## Sources, Opportunities, and Challenges

**In Lee**
*Western Illinois University, USA*

## INTRODUCTION

Recently, a web-enabled e-recruiting emerged quickly as a powerful method for both job seekers and recruiters. E-recruiting has driven companies to redesign the recruiting process and to move quickly to web-based integrated human resource systems that provide standardized frameworks for key personnel processes (Cullen, 2001). Currently, corporate career web sites are among the most widely deployed e-business web sites (Maurer and Liu, 2007). Job seekers visit corporate career web sites to survey a job market in addition to searching for job opportunities. Recruiting via social networks such as Facebook, LinkedIn.com, and MySpace is also getting popular.

E-recruiting systems have evolved through numerous technological developments since its introduction in the mid-1990s. A recent survey shows that Fortune 100 companies are in various stages of development (Lee, 2005). At the early stage of the corporate e-recruiting system, the purpose of the career web site was to simply post job openings on the static web page for job seekers' information. As e-commerce technologies advanced and recruiters gained more e-recruiting experience, the front-end e-recruiting systems added new features and functions, targeted job seekers better, and integrated with a back-end human resource management system. An advanced e-recruiting system of large companies has been powered by an enterprise-wide system and incorporated best practice recruiting methodologies to achieve strategic advantage.

The main purposes of this article are to classify the various e-recruiting sources and to discuss opportunities and challenges in developing and managing e-recruiting. This article is organized as follows: Section 2 compares the traditional recruiting and e-recruiting processes. Section 3 discusses six major categories of the e-recruiting sources. Section 4

DOI: 10.4018/978-1-61520-611-7.ch114

concludes with the discussions of opportunities, challenges, and future e-recruiting trends.

## BACKGROUND: TRADITIONAL RECRUITING VS. E-RECRUITING PROCESSES

The traditional recruiting process consists of the following iterative phases: identification of hiring needs; submission of job requisition and approval; job posting, submission of job applications; screening of resume/application; interviewing; pre-employment screening; and job offer and employment contract. Both hiring managers and recruiters rely on hard-copy documents and conventional delivery mechanisms to complete the recruiting process.

The traditional recruiting process is typically a step-by-step sequential process whereby the subsequent phase starts the required tasks only after the previous phase completes its tasks. Labor-intensive hiring tools like face-to-face interviews, paper and pencil tests, and job previews are widely used in traditional recruiting. The traditional process has been fraught with task delays and miscommunications, which result in the long hiring process and high hiring cost.

Computers had been used in the traditional recruiting process even before the introduction of e-recruiting. However, computer applications were limited to the automation of internal processes rather than the rationalization of the process. Software packages could not communicate with each other, and the quantity and quality of job applications remained the same. Even with automation, most recruiting processes were still batch processes. The advent of e-recruiting moved the computer application of the recruiting process to a higher level. The e-recruiting system is a web-enabled, "anytime-anyplace," ubiquitous system for both job seekers and recruiters.

We define the e-recruiting as *practices and activities carried on by the organization that utilizes a variety of electronic means to fill open positions effectively and efficiently*. The e-recruiting process consists of the following iterative steps: identification of hiring needs; submission of job requisition; approval of the job requisition via a job database; job posting on the Internet; on-line search of the job database by job seekers, on-line pre-screening/on-line self-assessment; submission of applications by applicants directly into an applicant database; on-line search of the applicant database for candidate selection; on-line evaluation of resume/application; interviewing by recruiters/hiring managers; on-line pre-employment screening; and job offer and employment contract.

While traditional recruiting is characterized as a sequential batch process, e-recruiting is characterized as a continuous and on-line process in which some of the recruiting activities may be performed concurrently. The benefits of e-recruiting are accomplished with the extensive use of a centralized job database and an array of web-enabled integrated applications. For example, when there is a need for a new employee, hiring managers may prepare the job requisition by entering the predefined job code into the job analysis database and retrieving a detailed list of the job requirements. The submission of the retrieved job requisition to division managers is electronically processed. Once the job requisition is approved, the job requisition data are used for the job posting at the career web site. The job requisition data are also used to search resumes based on specific criteria/keywords. The qualified candidates are further narrowed down with an additional screening process that utilizes various on-line and off-line interview and test tools, and then the company conducts an on-line pre-employment background check and makes a job offer to the best candidate.

*Table 1. Summary of six categories of the e-recruiting*

| E-Recruiting Source | Advantages | Disadvantages | Sample Participants |
|---|---|---|---|
| General-Purpose Job Board | Brand recognition; E-Recruiting Experience; High traffic; Industry best tools; Large candidate base; Large recruiter base | Relatively high job posting cost; Potentially low quality applications; Limited content control; Stickiness of the job board; Limited candidate relationship | Monster.com; HotJobs.com; CareerBuilder.com |
| Niche Job Board | Gathering of passive job seekers; Focused search; Community of professionals | Low brand recognition; Possibility of identity theft | Dice.com; Erexchange.com; Taon-line.com; JournalismJobs.com; MarketingJobs.com; TexasJobs.com |
| E-Recruiting Application Service Provider | Low application development cost for recruiters; Quick application development | Integration issues with existing systems; Possibility of closeout due to competition; Possibility of lock-in; Low traffic | Recruitsoft; Brassring; RecruitUSA; PeopleClick; TalentFusion; Lawson |
| Hybrid Recruiting Service Providers | Expertise in advertising industry; Portfolio of recruiting media; Price bundling with conventional media | Strong image as a conventional media; Low traffic; Low technology | New York Times, Wall Street; Chronicle of Higher Education |
| E-Recruiting Consortium | Low service cost; Direct and immediate link to corporate career site | Potential conflicts among members; Low exposure; Low technology | DirectEmployers.com; NACElink |
| Corporate Career Web Site | Candidate relationship management; High interests in jobs by job applicants; Integration with exiting systems | Needs for IT specialists; High upfront development cost | Fortune 500 companies |

Sources: Recruiters' Perspectives

## THE CATEGORIES OF E-RECRUITING SOURCES

Corporate recruiters tend to be interested in such factors as whether certain recruiting sources are more likely to yield a higher percentage of new hires, whether certain sources are likely to generate minority applicants, and whether the quality of job applicants is higher for certain recruiting sources (Barber, 1998). While numerous e-recruiting sources have been introduced to improve the recruiting effectiveness since the mid-1990s, no formal classification system for e-recruiting sources has been developed yet.

In order to give recruiters and job seekers a better understanding of e-recruiting methods, we surveyed a wide range of recruiting sources. Based on this analysis, we identify six basic categories of the e-recruiting sources: (1) general purpose job board, (2) niche job board, (3) e-recruiting application service provider, (4) hybrid (on-line and off-line) recruiting service provider, (5) e-recruiting consortium, and (6) corporate career web site. Table 1 summarizes the six categories of the e-recruiting sources.

*The general-purpose job board* provides a comprehensive on-line recruiting solution to both employers and job seekers across different industries. Monster, HotJobs, and Careerbuilder are leaders in this category. Job seekers can search for jobs by category, experience, education, location, or any combination of these job attributes. Most of the leading general-purpose job boards employ an agent technology to increase utility for the job seekers and recruiters. Personalized job agents match job seekers' profiles with the latest job postings and e-mail the list of the matched jobs to the job seekers.

The recruiters can search the job boards' database based on the skill, experience level, job preference, salary, education, and any combination of keywords to find qualified candidates. To address job seekers' and recruiters' rising dissatisfaction with services and costs, the general-purpose job board has evolved into an array of comprehensive career services, offering customized placement services, applicant assessment, and candidate relationship management.

*The niche job board* serves highly specialized job markets such as a particular profession, industry, education, location, or any combination of these specialties. Sample profession-oriented niche job boards include JournalismJobs.com, MarketingJobs.com, AllRetailJobs.com, and JobsInLogistics.com. Location-oriented niche job boards include NJ.com, TexasJobs.com, and ArizonaJobs.com. The advantage of the niche job board is a focused search with which recruiters can reach a large pool of qualified candidates most effectively. Most niche job boards operate specialized on-line communities or newsgroups that draw professionals, such as engineers, programmers, and journalists who share specific interests, skills, experience, and knowledge.

Both the general-purpose and niche job boards generate revenue by providing recruiters with applicant tracking service, hiring tools, job posting, web site hosting, pre-screening tools, and advertisements. As the success of the job boards depends on the critical mass of job applicants, the job boards typically provide job seekers with a free access to the services. Advanced services such as resume writing and interview guidance may be accessible to the job seekers for a fee. The advantages of using the job boards include access to a large pool of recruiters and job seekers and availability of state-of-the art e-recruiting tools. Medium- and small-sized recruiters with low name recognition can access a large pool of qualified job applicants at a reasonable cost.

*The e-recruiting application service provider (ASP)* develops and markets to recruiters and job boards a combination of specialized services in recruitment software, recruitment process management, education and training, and management expertise. Specialized recruitment software for the in-house development of larger-scale e-recruiting web sites is available for recruiters who want to quickly develop career web sites on their own servers. Some service providers also support the hosting of the corporate career web sites. Widely known e-recruiting application service providers include Recruitsoft, BrassRing, RecruitUSA, PeopleClick, TalentFusion, Lawson, and Development Dimensions International Inc. These e-recruiting application service providers are competing with larger enterprise system developers such as Oracle, PeopleSoft, and SAP, which have been developing recruiting software as a part of their enterprise-wide systems.

*The hybrid (on-line and off-line) recruiting service provider* is the traditional media or recruiting firm that provides e-recruiting services to both recruiters and job seekers. Employment advertising in newspapers has suffered significant percentage declines as recruiters switch to the more efficient and cost-effective recruiting methods. The Help Wanted Index, a measurement of how many help wanted ads run in newspapers, has registered a continuous decline in the past few years. In the face of losing significant revenue sources, media organizations such as the publishers of the *New York Times*, *Chronicle of Higher Education*, and the *Wall Street Journal* now provide e-recruiting services as well as paper-based job advertisement services in order to compensate for the loss of job ad revenue.

The traditional media companies have reduced job ad prices and introduced new recruiting services to differentiate themselves from the job boards and corporate career web sites. The *New York Times* now offers a variety of e-recruiting services including resume builders, search engines, and job market research reports to both employers and job seekers. CareerJournal.com, developed by the *Wall Street Journal*, focuses exclusively on the career needs of executives, managers, and professionals, leveraging the *Wall Street Journal* brand. CareerJournal.com provides recruiters and job seekers with a database of job openings and resumes as well as salary information, career news, and industry trends. The advantage of the hybrid recruiting service provider comes from the leveraging of existing resources and expertise developed in the traditional job ad industry. The premier content of CareerJournal.com comes from the editorial resources of the *Wall Street Journal* as well as from the CareerJournal.com editorial team.

*An e-recruiting consortium* is a cost-effective alternative to the services provided by the job boards. DirectEmployers.com, the first cooperative, employer-owned e-recruiting consortium, was formed by DirectEmployers Association, a non-profit organization created by executives from leading U.S. companies. While the job boards place much importance on the "stickiness" of their web sites (because job seekers who stay longer will be more likely to read the employment opportunities), DirectEmployers' search engine merely drives traffic directly to members' corporate career web sites. A vast majority of members reported that DirectEmployers.com is driving more traffic to their web sites than any other job board. NACElink is another e-recruiting consortium that was created as a result of an alliance between DirectEmployers Association and the National Association of Colleges and Employers (NACE) (http://www.naceweb.org). NACElink – a national, integrated, web-based college recruiting system – was designed to better meet the placement and recruiting needs of colleges, students, and employers. Cost saving was the greatest incentive for forming NACElink.

*The corporate career web site* is the hiring source most widely used by Fortune 500 companies. The deployment of the corporate career web site is a natural extension of the e-commerce applications when companies have already established high-traffic e-commerce web sites. The exposure of the corporate career web site to visitors is almost as great as the exposure of the existing e-commerce web site as long as the e-commerce web site has a hyperlink to the career web page.

The cost of posting an additional job opening on the corporate career web site is marginally increased, whereas the fee for posting the additional job opening is considerably higher on the job boards. The career web site also has a cost-advantage and flexibility compared with the job boards in publishing other corporate information – such as university recruiting, workplace, diversity, benefit, career, and culture – with which the applicants can make an informed decision about the job applications.

## E-RECRUITING: OPPORTUNITIES AND CHALLENGES

Hiring the most qualified employees is one of the most critical organizational decisions in the knowledge-based economy. Moving one step ahead of competitors in recruiting is a source of strategic advantage. The technology advances very quickly and with it, the recruitment practices should change accordingly. As more people search and apply for jobs through career web sites, the timely development and management of career web sites become more important. As each organization may have different e-recruiting needs, the best fit between the technological options and the organization should be identified.

Conventional recruiting methods have been plagued with high hiring cost and frequent hiring delays. Major advantages cited for the successful adoption of e-recruiting methods include cost savings, efficiency, and convenience for both recruiters and job seekers (Tomlinson, 2002; Miller, 2001; Gale, 2001; Lee, 2007). E-recruiting improves the recruiters' ability to handle job applications and job postings by minimizing paperwork and automating key recruiting activities. The widespread adoption of corporate career web sites by companies is driven by the rising cost and inflexibility of using the third-party job boards and traditional media advertisements. Companies use their career web sites to give detailed job information, to explain the culture and benefits, and to promote long-tem relationship with job seekers.

While e-recruiting has a potential to reduce the hiring cost and time and improve the quantity and quality of job applicants, there are four major challenges that remain to be overcome: organizational, managerial, legal, and technological challenges. The organizational challenges include: (1) a business process redesign is needed across the entire human resource management process to realize the benefits of the e-recruiting. Bottleneck and inefficient activities should be identified and redesigned so that the entire recruiting process moves quickly with an exchange of standardized data; (2) most qualified candidates are often passive job seekers who are currently employed but may be interested in new job opportunities. A strategy to identify qualified passive job seekers and encourage them to apply should be developed; and (3) it is difficult to benchmark the best management practice and develop a set of metrics that measure the effectiveness of different recruitment methods. There are no significant statistics available on the effectiveness of various e-recruiting tools and management practices because of a limited experience with e-recruiting.

The managerial challenges include: (1) without a user acceptance of technology, technology would be of little use in the e-recruiting process. Recruiters and hiring managers should be comfortable and knowledgeable about the use of web-based recruiting methods. A comprehensive training program for them should be developed for users; (2) the success of e-commerce does not lie in the technical sophistication of the career web site but the balanced combination of technology and management skills; (3) many job seekers are still not comfortable with using the e-recruiting method. Given the limited financial resources, finding the optimal mix of different recruiting methods is a challenge for human resources managers; and (4) e-recruiting has helped companies store and retrieve pools of talent quickly, but often fails to screen the pools adequately.

The legal challenges include: (1) different reporting requirements for governments such as EEOC report can be a problem for centralized recruiting for global companies (Flynn, 2002); (2) there is potential employer liability for violating employment discrimination laws, laws related to applicant background checks, and laws prohibiting false advertising (King, 2000). A comprehensive guideline for applicant data collection should be developed in consultation with legal professionals; (3) the e-recruiting is likely to affect the diversity of the company if conscious efforts are not made. Web users are computer-savvy non-minority young people who are typically educated well. These biased demographic characteristics can create serious impact on diversity; certain protected groups have less chance to be hired than others (Flynn, 2002). One way to solve the diversity issue is to maintain a portfolio of recruiting methods that will bring the right level of diversity at the company.

The technological challenges include: (1) integrating the e-recruiting process with existing recruiting processes is difficult due to limited software solutions. Paper-based resumes should be converted into a digitized form and stored at the database; (2) lack of security discourages the online job application. While security is one of the most important issues with job applicants, many leading companies do not explicitly address it at the career web site; and (3) designing career database is a complex task. Job database should be designed to minimize redundant data and optimize the performance of job search and candidate search. The search behavior of the applicants and recruiters should also be fully understood.

## FUTURE RESEARCH DIRECTIONS

There are numerous research opportunities in e-recruiting. Research on the perception of job seekers on different e-recruiting methods and web site features will give a valuable design guideline to system designers. The longitudinal study of recruiting methods and job performance may provide important results that can be used to optimize the mix of recruiting methods and budget allocations. Many professionals such as hiring managers, recruiters, software engineers, and human resource professionals are involved in the recruiting process. An in-depth understanding of what information they ask for, how they use it, and how they interact with each other can be another interesting avenue of research.

## CONCLUSION

The purposes of this chapter were to classify e-recruiting sources and to discuss the opportunities and challenges in the e-recruiting development and management. We classified e-recruiting methods into six categories: (1) general purpose job board, (2) niche job board, (3) e-recruiting application service provider, (4) hybrid (on-line and off-line) recruiting service provider, (5) e-recruiting consortium, and (6) corporate career web site. Among them, the corporate career web site is the most popular recruiting method. We expect that with the growth of Internet users and advances in e-recruiting technologies, the deployment of the corporate career web site will increase.

While e-recruiting has the potential to reduce the hiring cost and time and improve the quantity and quality of job applicants, four major challenges remain to be overcome: organizational, managerial, legal, and technological challenges. The problems with discouraged job applicants, differential access to e-recruiting technologies across ethnic groups, and the differences in access by other demographic features have yet to be addressed.

## REFERENCES

Barber, A. E. (1998). *Recruiting employees*. Thousand Oaks, CA: Sage Publications.

Cappelli, P. (2001). Making the most of on-line recruiting. *Harvard Business Review*, *79*(3), 5–12.

Cullen, B. (2001). e-Recruiting is driving HR systems integration. *Strategic Finance*, *83*(1), 22–26.

Flynn, G. (2002). E-recruiting ushers in legal dangers. *Workforce*, *81*(4), 70–72.

Gale, S. F. (2001). Internet recruiting: better, cheaper, faster. *Workforce*, *80*(12), 74–77.

King, N. J. (2000). Is paperless hiring in your future? E-recruiting gets less risky. *Employee Relations Law Journal*, *26*(3), 87–116.

Lee, I. (2005). The evolution of e-recruiting: a content analysis of Fortune 100 career web sites. *Journal of Electronic Commerce in Organizations*, *3*(3), 57–68.

Lee, I. (2007). An architecture for a next-generation holistic e-recruiting system. *Communications of the ACM*, *50*(7), 81–85. doi:10.1145/1272516.1272518

Maurer, S. D., & Liu, Y. (2007). Developing effective e-recruiting websites: Insights for managers from marketers. *Business Horizons*, *50*(4), 305–314. doi:10.1016/j.bushor.2007.01.002

Miller, S. M. (2001). Help wanted: Is the on-line job market working for your business. *Office Solutions*, *18*(4), 27–29.

Tomlinson, A. (2002). Energy firm sharpens recruiting, saves money with in-house job board. *Canadian HR Reporter*, *15*(20), 7–8.

## KEY TERMS AND DEFINITIONS

**E-Recruiting:** Practices and activities carried on by the organization that utilizes a variety of electronic means to fill open positions effectively and efficiently.

**General-Purpose Job Board:** A web site which provides a comprehensive on-line recruiting solution to both employers and job seekers across different industries. Monster, HotJobs, and Careerbuilder are leaders in this category.

**Niche Job Board:** A web site which serves highly specialized job markets such as a particular profession, industry, education, location, or any combination of these specialties.

**E-Recruiting Application Service Provider (ASP):** A service provider which develops and markets to recruiters and job boards a combination of specialized services in recruitment software, recruitment process management, education and training, and management expertise. Specialized recruitment software for the in-house development of larger-scale e-recruiting web sites is available for recruiters who want to quickly develop career web sites on their own servers.

**Hybrid (On-line and Off-line) Recruiting Service Provider:** A traditional media such as newspapers or recruiting firm which provides e-recruiting services to both recruiters and job seekers.

**E-Recruiting Consortium:** A third party consortium which provides cost-effective alternatives to the e-recruiting services provided by job boards. DirectEmployers.com, the first cooperative, employer-owned e-recruiting consortium, was formed by DirectEmployers Association, a non-profit organization created by executives from leading U.S. companies.

Section 12

# Emerging Trends

Chapter 115
# Emerging Trends of E-Business

**Pengtao Li**
*California State University, Stanislaus, USA*

## ABSTRACT

*E-business has grown dramatically in the last ten years. Its only constant is change. Awareness of these changes can help both business and customers better utilize and take advantage of e-business. This chapter presents the emerging trends of e-business in various areas, including Web services, Web 2.0, Mobile Commerce (M-Commerce), and corresponding ethical and social issues.*

## INTRODUCTION

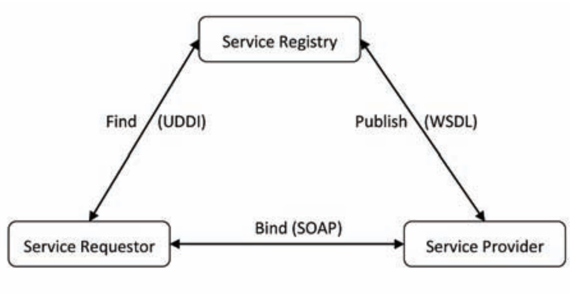
E-business has grown dramatically during the last ten years. The Internet has provided companies with access to new markets and customers. And customers have found e-business an effective way of researching and purchasing products/services. Things have constantly changed since e-business emerged and will keep changing in the future. The benefit of e-business cannot be gained if companies do not understand or adapt properly to these changes. In this chapter, we will not focus on those full-fledged e-business technologies or applications, but on emerging trends of e-business in recent years. These could be the super stars in the near future, or, if not properly handled, the fatal disasters for some companies. Topics include: Web services, Web 2.0, Mobile Commerce, and emerging ethical and social issues.

DOI: 10.4018/978-1-61520-611-7.ch115

### Web Services

The growth of e-business depends on business-to-business (B2B), application-to-application (A2A) and business-to-consumer (B2C) interaction over the Web. This requires a technology that supports cross operating system, cross hardware platform transaction, and integration of software modules written in any language, sometime with legacy systems. However, no previous distributed computing architecture (such as Sun Java Remote Method Invocation (RMI), OMG Common Object Request

*Figure 1. Web services architecture*




Broker Architecture (CORBA), Microsoft Distributed Component Object Model (DCOM)) can deliver such benefits (Lim & Wen, 2003), because these technologies are heavily dependent on the particular proprietary environment and tight-coupling of client and server, where one application that calls a remote network is tied strongly to it by the function call it makes and the parameters it requests (Joshi et al., 2004).

Web services refer to a group of loosely coupled software components that exchange information with each other using standard network protocols and languages (Laudon & Laudon, 2006). It is a technology that allows applications to communicate with each other in a platform- and programming language-independent manner. It uses protocols based on the XML language to describe operations to execute or data to exchange with another Web service. A set of Web services interacting together in this manner defines a particular Web service application in a Service-Oriented Architecture (SOA) (Laudon & Laudon, 2006). Furthermore, Web services can work on a more abstract level where data types can be re-evaluated, revised or handled dynamically. So, on a technical level, Web services can deal with data much more easily and allow software to communicate more freely than most previous systems (IBM, 2007a). For instance, Google and Yahoo both provided the Web service APIs (application programming interface) allowing other applications to integrate Google's and Yahoo's map and satellite images. Google has even simplified that process to the level of embedding only four lines of Java codes.

There are separate core standards developed for various Web services activities. The most important ones are Web Services Description Language (WSDL), Universal Description, Discovery, and Integration (UDDI), and Simple Object Access Protocol (SOAP). A basic Web services architecture is described in Figure 1. Web services providers use WSDL to describe a Web service. UDDI registries hold the Web service descriptions. And service requestors around the globe can access UDDI registries to browse and find the specific Web service. Then service requestors bind (invoke as required) the service from the provider based on SOAP.

SOA is a popular way to implement Web services. It is defined as a set of self-contained services that communicate with each other to generate a software application (Laudon & Laudon, 2006). These services interact by passing data from one service to another, or by coordinating an activity between two or more services. With SOA, loose-coupling of software components is more likely. Instead of embedding calls to each other in their source codes, services use defined protocols to describe how they communicate with each other. Often, Business Process Execution Language (BPEL) is used to extend the service concept by specifying the interaction among Web services to support business transactions. BPEL could facilitate the expansion of automated process integration both within and between businesses.

Following the service-oriented trail, one can also find some more recent concepts such as mashups, SaaS (Software as a Service) and cloud computing, among which cloud computing has attracted a lot of attention recently. Gartner stated that cloud computing would be as influential as e-business (Stevens & Pettey, 2008). Evolved from SaaS, cloud computing is service-centered. Gartner defines cloud computing as "a style of computing where massively scalable IT-related capabilities are provided 'as a service' using Internet technologies to multiple external customers" (Stevens & Pettey, 2008). Cloud computing services usually provide regular business applications online that are accessible from a web browser, while the software and data are stored on the servers. The term "cloud" refers to the Internet, based on the way people draw the Internet in computer network diagrams, and is an abstraction for the sophisticated infrastructure it hides (Erdogmus, 2009; Scanlon & Wieners, 1999).

By 2006 Harvard Medical School and its hospital affiliates have smoothed their business processes through the sharing of medical data transparently by building an SOA integrating about 25 categories of Web services shared between 400 different departments with 14,000 employees (McKendrick, 2006); Amazon uses SOA to create a sales platform supporting 55 million active customers, and more than one million retail partners worldwide. Its operation is an integration of hundreds of services from a number of application servers (Laudon & Laudon, 2006). In 2002, Amazon started to provide Web services, such as storage service and shopping cart functionality, at http://aws.amazon.com, for other web sites or client-side applications. It is called Amazon Web Service or AWS. AWS also supports cloud computing. In June 2007, Amazon claimed that more than 330,000 developers had signed up to use AWS (Storani, 2008); Founded by a former Oracle executive, Salesforce.com is another well-known Web services provider who offers a Web service version of customer relationship management (CRM) software and has been very successful.

Web services allow programmers to pull data from many different Web sites and combine them with other information to make entirely new applications. Thus, the Web becomes a platform where programmers can create many new services quickly and inexpensively (Laudon & Laudon, 2006). Because of the loose coupling nature, high-level interoperability, easy integration and simplicity, Web services architecture has been adopted by all major technology vendors, including Microsoft, Oracle, IBM and Sun (Joshi et al., 2004). For example, Sun had built Web services support into J2EE (Java 2 Enterprise Edition) and Microsoft has built it into .NET framework.

However, Web services could expose business methodologies, business applications, or confidential business details, which need to be protected from unauthorized access and use (Joshi et al., 2004). For B2B applications, companies need to connect services outside of their firewalls, thus more security concerns arise. It is an ongoing effort to develop various security protocols and methods to address these concerns. Examples of such protocols include WS-Security 1.0 and Security Assertion Markup Language (SAML) (IBM, 2007b).

## Web 2.0

Since Tim Berners-Lee created the WWW in 1990, it started as a way to allow the users to navigate among the Web pages electronically. But later the Web has evolved to such a level that users can publish content to millions of others; share their preferences, bookmarks and online personas with each other; create virtual lives; and join online communities. This "new" Web has been referred to "Web 2.0" (Laudon and Traver, 2008):

YouTube, purchased by Google with $1.65 billion, grows to the largest online consumer-generated video posting site. It draws 70 million monthly visitors, and accounts for 60% of all videos watched online (Laudon & Traver, 2008); MySpace and Facebook make to the lead of online social networking sites, each with over 100 million registered users; Google attracts the largest Internet audience with 140 million unique monthly U.S. users, and over 575 million international users; Wikipedia allows people around the world to share their knowledge and has become the most popular online encyclopedia, much more successful than early professional encyclopedias such as Encarta or even Britannica (Laudon & Traver, 2008). It is one of the largest collaboratively edited reference projects in the world, and one of the top ten most visited sites globally (Alexa.com, 2009).

Tim O'Reilly (2005), who coined the term "Web 2.0", stated that the strategic positioning of Web 2.0 is to use "the Web as Platform". He defined Web 2.0 as "the business revolution in the computer industry caused by the move to the Internet as platform, and an attempt to understand the rules for success on that new platform" (O'Reilly, 2006). More easily to understand, Web 2.0 refers to a perceived new generation of web development and design, targeting to facilitate communication, secure information sharing, interoperability, and collaboration on the WWW (Wikipedia, 2009). Although the term suggests the second version of the Web, it does not refer to any new technology, but rather to new ways software vendors and end-users design and use the Web.

Web 2.0 concepts have facilitated the development of web-based communities, hosted services, and applications such as social-networking, photo/video-sharing, wikis, blogs/microblogs, tagging and social bookmarking, RSS (Really Simple Syndication), and AJAX applications (Asynchronous JavaScript and XML).

However, some argue that "Web 2.0" is not a new version of the Web, but simply continues to use "Web 1.0" technologies and concepts. Techniques such as AJAX cannot replace communication protocols like HTTP, but add an additional layer of abstraction on top of them (Wikipedia, 2009). Some people think it is just a marketing buzzword. In an interview with an IBM developerWorks podcast editor, Tim Berners-Lee, the inventor of WWW, said:"... I think Web 2.0 is, of course, a piece of jargon, nobody even knows what it means..." (Laningham, 2006). Furthermore, some people worry it is another Internet bubble (Dvorak, 2007; Waters, 2007). Graham (2005) stated "It seemed that it was being used as a label for whatever happened to be new—that it didn't predict anything."

Social media is another popular term in the recent years, and is often used along with "Web 2.0", with many people thinking that they are interchangeable. However, it could be better defined as a major subset of Web 2.0. In the simplest way, social media refers to "content that has been created by its audience" (Comm, 2009). The keywords are participation and interactivity. Businesses also use the term user-generated content (UGC) or consumer-generated media (CGM). Examples include, but are not limited to: blogs (WordPress), micro-blogs (Twitter), social networking (Facebook, MySpace, and LinkedIn), Wikis (Wikipedia), social bookmarking (Delicious), social news (Digg), media sharing (Flickr, YouTube, and Last.fm), and virtual world (Second Life and World of Warcraft).

Without doubt, social media have shaken the foundation of traditional publication industry. Moreover, it even changes the world of politics, and certainly generates new business opportunities.

Although a lot of people laughed at Twitter when it was founded in 2006, it has grown dramatically since then. From February 2008 to February 2009, Twitter grew by 1,689% (Whitworth, 2009). Now there are more than 2 billion messages (or Tweets) posted on Twitter and the number is still counting (http://popacular.com/gigatweet/). Now some believe Twitter is the most important website since Google. Based on a survey in January 2009, Twitter is the most often used tool for social media marketing (Stelzner, 2009). Market researchers look to it to find out up-to-minute trends. Although its functionality needs to be improved, Twitter Search (http://search.twitter.com) could be the best "real-time" search engine available today, even timelier than Google, especially for time-critical information such as world events and sports. Businesses such as H&R Block and Zappos are now using Twitter to facilitate customer service. Media groups are focusing on Twitterers as first-to-the-scene reporters (such as China earthquake and Mumbai attacks in India in 2008). Due to Twitter's popularity, CNN started its Twitter news channel: CNNBRK (http://twitter.com/cnnbrk).

Israel is believed to be the first country to have its own official blog, MySpace page, YouTube channel, Facebook page and a political blog. The Israeli Ministry of Foreign Affairs created the country's video blog and its political blog (Simon, 2008). The Foreign Ministry also held a microblogging press conference via Twitter about its war with Hamas. The conference notes were later posted on the country's official political blog (Cohen, 2009).

In the news industry, companies like CNN use professional reporters to get stories and take pictures. Now people can post their pictures on iReport.com and describe the events. Some of pictures and stories are chosen and used by CNN. Similarly, former publications need to purchase the stock photographs from professional photographers and pay a huge amount of money. Today, everyone can sell or buy stock photographs, illustrations, or even audio and video on Web sites such as iStockPhoto.com with very low prices. This phenomenon is referred as crowdsourcing (Jessup & Valacich, 2007).

Massively Multiplayer Online games, or MMOGs, are often treated as virtual worlds or online communities. They even change the way the young generation lives. With more than 11.5 million monthly subscribers (Blizzard, 2008b), World of Warcraft (WOW) is the world's most popular subscription-based MMORPG (Massively Multiplayer Online Role-Playing Game) (Blizzard, 2008a; Snow, 2007). In April 2008, WOW was estimated to hold 62% of the MMOG market (Woodcock, 2008). With monthly subscription around $15 per player, one can easily do the math. Furthermore, interestingly WOW opened a market for the trading of accounts with well-equipped characters. Based on BBC news, the highest record of account trade was for £5000 (about $9,900 USD) in early September 2007 (Jimenez, 2007). Some players even pay to level up their own characters. And it is estimated that the global real money trade (people paying real cash for online gaming virtual items) is worth around $300 - $400 million (Jimenez, 2007).

Because social media attracts large population; the audience gathers in groups by common interests; and there is basically no cost to publish content, it is a perfect place to conduct marketing. Social Media Marketing (SMM) is a type of Internet marketing which targets to accomplish branding and marketing goals by participating in various social media networks (Rognerud, 2008). It can involve developing content that aims social media audience, building a network, requesting votes, and getting traffic and exposure from social media websites (Scocco, 2009). Based on Williamson (2008), SMM has a huge business potential. For instance, MySpace generated $850 million in online advertising revenues in 2008, and Facebook $325 million (increased more than 300% since 2007).

Although the current Web 2.0 applications such as social networking provide new ways of communication and collaboration, they are "walled gardens" and isolated from each other (Chartier, 2009). It means that a person who picked one social networking service cannot easily share the content with another person who picked a different service. The social activities are more or less locked away in each of these services, not matter whether it is Facebook, Twitter, or others. In the Report of W3C Workshop on the Future of Social Networking in January (W3C, 2009), it is also concluded that with the current architecture, users have to create many accounts and record their data separately, which is "counter-productive" and obstacles innovation. Future social networking should be discentralized so that the data could be more freely moved across the social networks.

Google has made the first hit to break down the barriers. On May 28, 2009, Google Wave is announced (It will be released later in 2009) (Google, 2009). It is a web-based service to merge e-mail, instant messaging, wiki, and social networking, providing real-time communication and collaboration. It has the potential to unite various social media services, making it much easier to communicate and manage with a single log-in.

## M-Commerce

In July 2008, there were about 255 million cell phone users in the United States and about 3 billion worldwide. The number easily dwarfs the global PC population of about 1 billion (TIA, 2008). Due to their portability and convenience, mobile devices are starting to be used to purchase goods and services. The use of mobile devices for purchasing goods and services from any place has been termed mobile commerce or m-commerce (Laudon & Laudon, 2006). So far, m-commerce is used most widely in Japan and Europe (especially in Scandinavia) where cell phones are more prevalent than in the United States. For example, NTT DoCoMo has provided wireless services (called i-mode) in Japan. The subscribers can access wireless Web sites to check train schedules, obtain movie listings, browse restaurant guides, purchase tickets on Japan Airlines, trade stocks, view cartoons, and read daily newspapers.

Till 2007, m-commerce in the United States still has been a disappointment. Only 2% of the retail brands in the top 1,000 U.S. brands in 2007 operated a mobile Web site, and m-commerce counted for less than 1% of all B2C e-commerce (Laudon & Traver, 2008). However, m-commerce is expected to grow rapidly in the United States in the next few years because of smart phones such as iPhone and broad-band cellular networks such as 3G network. The less price-sensitive early adopters with age of 13-25 could lead the initial growth (Frost & Sullivan, 2007).

The m-commerce applications include the following:

- *Mobile Ticketing*: Tickets (e.g. for parking, movie, concert and event) can be sent to mobile phones. Customer can use their tickets instantly by showing their phones at the venue. It increases customer convenience and reduces transaction cost. *Mobile vouchers, coupons and loyalty cards* could work in a similar way.
- *Mobile Entertainment*: Currently mainly the sale of ring-tones, wallpapers, and games for mobile phones. In the future, it may include full-length music tracks and video, or even the whole movies (with 4G-level wireless network).
- *Information services*: News, stock data, sports results, financial records, traffic information. This could include l*ocation-based services* such as local maps, offers, and weather.
- *Mobile purchase*: Mobile purchase allows customers to shop online at any time in any location. *Mobile Auction* starts to gain popularity as well.
- *Mobile banking and brokerage*: Financial institutions are exploring the possibility to allow their customers to not only access bank account information, but also make transactions, such as purchasing stocks and remitting money, via mobile device in a timely matter. It still needs the support of better mobile network security technologies to be widely implemented.
- *Mobile marketing and advertising*: Advertisement could be displayed on the screen of mobile devices.

The main payment methods used to enable m-commerce include premium-rate calling numbers; charging to the mobile device users' bill or deducting from their calling credit; a credit card that is linked to a SIM (Subscriber Identity Module) card; and PayPal Mobile checkout services (Laudon & Laudon, 2006).

Although m-commerce is promising, there are still some obstacles: keyboards and screens of mobile devices are usually tiny and uncomfortable to use (which started to change with iPhone); Most Internet-enabled cell phones have limited memory and power supplies; Using mobile devices while driving could be unsafe; Data transfer speed on second-generation cellular networks is very slow compared to high-speed Internet connection to PC. With the 3G network and other broad-band cellular services, the speed problem could be alleviated. But beyond usability, greater concerns, involving privacy (Tarasewich et al., 2002), standardization, and security issues (Kim, 2006), still need to be addressed to popularize m-commerce.

## Ethical and Social Issues

### Data Security and Privacy

In mid-December 2006, the TJX companies, the largest international apparel and home fashions off-price department store chain in the United States, discovered that its computer systems were compromised and credit card information of about 45.7 million customers was stolen (Vijayan, 2007). The number was not final since the full investigation would take very long time (Jewell, 2007). So far it is the world's largest data breach (McGlasson, 2008; Simpson, 2007; Vijayan, 2007). In August 2008, 11 alleged hackers around the globe were arrested (McGlasson, 2008). However, this is not the only story. If you search "Top 10 data/security breach" online, you will find many similar cases, with large amounts of economic lost especially in the recent years.

In typical e-business architecture, basically every part could go wrong: from the client and the server to the communications pipeline (wired or wireless). There are a number of security threats to both e-business consumers and site operators: malware (e.g. virus, worm, Trojan horse, spyware, and botnet), identity theft (e.g. phishing), cyber vandalism (e.g. hacking), credit card fraud/theft, spoofing and span Web sites, DoS (Denial of Service) and DDoS (Distributed Denial of Service) attacks, sniffing, insider attacks, and software flaws/security holes. In order to secure e-business, we need help from more advanced technologies, better management policies and business procedures, and new public laws.

Better, more effective, and more personalized services require business to collect and analyze a huge amount of customer data. Along with the openness of Internet and mobile network, customers' privacy and information security are more vulnerable than ever. To e-businesses, the ability to give consumers control of their privacy in order to create an acceptable level of trust is highly essential (Smith & Shao, 2007). Protecting individual privacy and information security is important and beneficial to both consumers and businesses. While the existing technologies make a promising start to enhance consumer privacy and security in e-business, much still needs to be accomplished.

For example, Doubleclick (www.doubleclick.net), an Internet advertising broker, is allowed by hundreds of Web sites to track the activities of their visitors. Over time Doubleclick can create a detailed profile of a person's spending and computing habits on the Web that can be sold to companies to help them target the Web advertisement more precisely. ChoicePoint, one of the largest data brokers, uses an extensive network of contractors to collect data from police and motor vehicle records; credit and employment histories; addresses; licenses; insurance claims; loan applications; and so on. The company has collected information on almost every adult in the United States, and sells the personal information to businesses and government agencies. However, these private data brokers are largely unregulated (Laudon & Laudon, 2006). There has been very little or no federal/state control of how they collect, maintain, and sell their data. A specific federal law for privacy protection is highly expected (Laudon & Laudon, 2006). New technologies could also help to protect privacy. P3P (the Platform for Privacy Preferences) is a good start.

In Europe, especially with the European Commission's Directive on Data Protection coming into effect in 1998, the privacy protection is much stronger and more comprehensive than in the U.S. In EU (European Union) nations, the businesses are not allowed to use personally identifiable information without consumer's prior informed consent. Furthermore, the customers have the right to access that information, correct it, and request that no further data be collected.

Over the past decades, due to the extensive concerns about privacy issue, more and more companies added a new position to their senior management ranks, chief privacy officer (CPO).

## Intellectual Property Rights

Since the first federal Copyright Act of 1790, the intent behind intellectual property laws has been to encourage creativity and authorship by ensuring that creative people received the financial and other benefits of their work. But the intellectual property laws are always challenged by the new technologies, such as, mainly in the past ten years, Internet and E-commerce technologies. Although the Digital Millennium Copyright Act (DMCA) of 1998 tried to adapt the copyright laws to the Internet age, its effectiveness still need to be tested. In 2007, Viacom filed a $1 billion lawsuit against YouTube and Google for copyright infringement, claiming YouTube was engaging in "massive intentional copyright infringement" for making available about 160,000 unauthorized Viacom clips. Google lawyers said they are relying on the 1998 DMCA's safe harbor and fair use to shield them from liability. The case is still unsettled.

Another big headache in the Internet age, especially for record industry, is illegal file sharing over P2P network. By 2008, the record industry had filed over 30,000 lawsuits for file sharing (Kravets, 2008).

Furthermore, social media bring us new questions. For example, Wikipedia is an online "e-book" encyclopedia written and updated by thousands of, if not more, contributors. Its cousin, Wikibooks, create textbooks that can be edited by anyone. Then, who owns the copyright of these encyclopedia and textbooks?

## Child Protection

In 1998 after FTC (Federal Trade Commission) found that 80% of Web sites were collecting personal information from children, but only 1% required their parents' permission, U.S. congress passed the Children's Online Privacy Protection (COPPA) (Laudon & Traver, 2008). COPPA requires that companies are not permitted to collect or use personal information from children under 13 without the prior, verifiable consent of parents. It appeared to have been successful (Laudon & Traver, 2008).

In order to protect children from online pornography, in 1996, Communications Decency Act (CDA) and Child Pornography Prevention Act were passed. But both were struck down by the Supreme Court, in 1997 and 2002 respectively. A 1998 law, Children's Online Protection Act (COPA) has been struck down five times (1999, 2003, 2004, 2007, and 2008), mainly because that COPA violated the First Amendment of freedom of speech (Laudon & Traver, 2008). In January 21, 2009, the U.S. Supreme Court refused to hear the government's appeal against the banning of the COPA, effectively killing the bill (Nichols, 2009). In 2001, Congress passed the Children's Internet Protection Act (CIPA), which required schools and libraries to install "technology protection measures" (filtering software) to shield children from pornography. In June 2003, the Supreme Court upheld CIPA. However, all the justices agreed that current filtering software was unable to distinguish child pornography from sexually explicit material (which is protected by the First Amendment), and generally unreliable (Greenhouse, 2003).

It seems that better filtering technology would help. But as far as legislation is concerned, it is still unsettled. And there are arguments that individual families should take actions to block inappropriate content on the Internet, rather than the government deciding what can and cannot be seen by all children.

Besides online privacy and pornography issues, cyberbullying is also a concern that troubles parents. With flourishing of social networking services, such as MySpace, Facebook and Twitter, it becomes even severer. In 2006, 43% of U.S. teens surveyed by Harris Interactive reported having experienced some form of cyberbullying in the past year (Wagner, 2008). In the same year, Megan Meier, a 13 years old girl at Missouri, committed suicide, which was attributed to cyberbullying through MySpace (Associated Press, 2009). Because of the case, the Megan Meier Cyberbullying Prevention Act was introduced in Congress in May 2008. And by the beginning of 2009, at least 19 states passed laws addressing cyberbullying. Federal lawmakers are also considering action (Michels, 2008). There are also software tools such as Cyber Bullying Alert to help children to report and further prevent cyberbullying. Online safety education services such as i-SAFE (http://www.i-safe.org/) can empower public to make Internet a safer place. All these efforts, combined with parents' closer attention, hopefully will make us stand a better chance to prevent cyberbullying tragedies like Megan's suicide.

Online sexual predators are another notorious threat to children. A number of families from multiple states have attempted to sue or sued MySpace and Facebook about sexual assaults. Facebook, in its agreement with New York legislation, promised to respond faster to complaints about sexual messages and to warn users in stronger language that the site could not guarantee children's safety. On January, 2008, MySpace, has signed an agreement with attorneys general of 49 states (without Texas) to take new steps to protect children from sexual predators on its site. It also agreed to lead a nationwide effort to develop technologies (such as Zephyr) to verify the ages and identities of Internet users (Bernard, 2008). And by February 2009, MySpace have been used a tool called Sentinel SAFE to identify and remove about 90,000 registered sex offenders from its Website. The number was almost double what MySpace officials initially estimated last year (Walker, 2009). "This is an industry-wide challenge, and we must all work together to create a safer Internet," said Hemanshu Nigam, the chief security officer of MySpace (Bernard, 2008).

### Taxation

The Internet Tax Freedom Act of 2007 extended the moratorium on no new Internet taxes until 2014 (Griffin et al., 2008). While this might ease the pressure to tax e-business on the Internet in a short term, it remains a national or even a global problem. The supporters of Internet taxation point to the loss of tax revenue over the Internet. The opponents insist that increasing taxes will cause higher expense for the consumer and thus will limit the growth of e-business. It is estimated that by 2011 the revenue loss from not taxing e-business will be $54.8 billion (Bruce & Fox, 2004). This is a huge force pushing the efforts to tax e-business. Since the current tax collection system is not feasible for e-business, new sales or use tax methods need to be developed to reduce the confusion of e-business tax collections (Griffin et al., 2008).

## CONCLUSION

It has been almost twenty years since we had World Wide Web in 1990. E-business has offered us one surprise after another. Without doubt we are facing another set of new technologies, and the corresponding business applications and services. New standards, policies, regulations and legislations will then be developed to control, accommodate, utilize and benefit from them.

Different from traditional computing architecture, Web services allow applications to communicate with each other in a platform-free and programming language-independent manner, which leads to an easier and more flexible way to build new software applications. Web 2.0 concept and social media allow users to publish content online for almost free, facilitating sharing and collaboration. M-commerce pushes the ubiquity of e-commerce to the next level. It will offer customers more freedom. And with these new phenomena, we need to reconsider many of such issues as data security, privacy, intellectual property, children protection, and taxation (and the list could go on and on); and new legislations will be passed to address some or all of these issues.

Being aware of these emerging trends of e-business, entrepreneurs will be better prepared for their adventures in the business world; while customers may expect more convenient, enjoyable and secure online shopping experiences.

## REFERENCES

W3C (2009). Final report of W3C workshop on the future of social networking. Retrieved June 12, 2009, from http://www.w3.org/2008/09/msnws/report

Associated Press. (2009). Sentencing delayed in MySpace suicide case. Retrieved June 18, 2009, from http://www.msnbc.msn.com/id/30814538/

Bernard, A. (2008). MySpace agrees to lead fight to stop sex predators. Retrieved June 18, 2009, from http://www.nytimes.com/2008/01/15/us/15myspace.html?_r=3

Blizzard Entertainment. (2008a). World of Warcraft®: Wrath of the Lich King™ shatters day-1 sales record. Retrieved March 12, 2009, from http://www.blizzard.com/us/press/081120.html

Blizzard Entertainment. (2008b). World of Warcraft® subscriber base reaches 11.5 million worldwide. Retrieved March 12, 2009, from http://www.blizzard.com/us/press/081121.html

Bruce, D., & Fox, W. (2004). State and local sales tax revenue losses from E-Commerce: Estimates as of July 2004. Center for Business and Economic Research, University of Tennessee.

Chartier, D. (2009). The future of social media: The walls come crumbling down. Retrieved June 12, 2009, from http://www.wired.com/dualperspectives/article/news/2009/06/dp_social_media_ars

Cohen, N. (2009). The toughest Q's answered in the briefest tweets. The New York Times. Retrieved March 10, 2009, from http://www.nytimes.com/2009/01/04/weekinreview/04cohen.html

Comm, J. (2009). Twitter Power. Hoboken, NJ: Wiley & Sons, Inc.

Dvorak, J. C. (2007). Web 2.0 showing signs of bubble 2.0 already. Retrieved March 6, 2009, from http://www.marketwatch.com/news/story/web-20-showing-signs-bubble/story.aspx?guid={028C8E7D-4AA8-4746-BE28-6454EFD675CA}

Erdogmus, H. (2009). Cloud computing: Does nirvana hide behind the nebula? *IEEE Software*, *26*(2), 4–6. doi:10.1109/MS.2009.31

Frost & Sullivan. (2007). World Mobile Handheld Device Markets. Retrieved February 20, 2009, from http://www.researchandmarkets.com/reports/358713

Google (2009). Google Wave. Retrieved June 12, 2009, from http://wave.google.com/

Graham, P. (2005). Web 2.0. Retrieved March 2, 2009, from http://www.paulgraham.com/web20.html

Greenhouse, L. (2003). Justice back law to make libraries use Internet filters. Retrieved June 17, 2009 from http://www.nytimes.com/2003/06/24/politics/24INTE.html

Griffin, K., McMurtrey, M., & Smith, L. (2008). To tax or not to tax? Foreign and domestic taxation of the Internet. Proceedings of the Academy of Legal, Ethical and Regulatory Issues, Allied Academies International Conference, 12(1), 1-4.

IBM. (2007a). New to SOA and Web service. Retrieved February 18, 2009, from http://www.ibm.com/developerworks/webservices/newto/websvc.html

IBM. (2007b). Standards and Web services. Retrieved February 16, 2009, from http://www.ibm.com/developerworks/webservices/standards/

Jessup, L., & Valacich, J. (2007). Information Systems Today: Managing in the Digital World (3rd Edition). Upper Saddle River, NJ: Prentice Hall.

Jewell, M. (2007). TJX breach could top 94 million accounts. Retrieved June 14, 2009, from http://www.msnbc.msn.com/id/21454847/

Jimenez, C. (2007). The high cost of playing Warcraft. Retrieved June 14, 2009, from http://news.bbc.co.uk/2/hi/technology/7007026.stm

Joshi, P., Singh, H., & Phippen, A. D. (2004). Web services: measuring practitioner attitude. *Internet Research*, *14*(5), 366–371. doi:10.1108/10662240410566962

Kim, S. H. (2006). Impact of mobile-commerce: Benefits, technological and strategic issues and implementation. *Journal of Applied Sciences*, *6*(12), 2523–2531. doi:10.3923/jas.2006.2523.2531

Kravets, D. (2008). File Sharing Lawsuits at a Crossroads, After 5 Years of RIAA Litigation. Retrieved June 15,2009, from http://www.wired.com/threatlevel/2008/09/proving-file-sh/

Laningham, S. (2006). developerWorks Interviews: Tim Berners-Lee. Retrieved March 2, 2009, from http://www.ibm.com/developerworks/podcast/dwi/cm-int082206txt.html

Laudon, K. C., & Laudon, J. P. (2006). Management Information Systems: Managing the Digital Firm (10th ed.). Upper Saddle River, NJ: Prentice Hall.

Laudon, K. C., & Traver, C. G. (2008). E-Commerce: Business, Technology, Society (5th edition). Upper Saddle River, NJ: Prentice Hall.

Lim, B., & Wen, H. J. (2003). Web services: An analysis of the technology, its benefits, and implementation difficulties. *Information Systems Management*, *20*(2), 49–57. doi:10.1201/1078/43204.20.2.20030301/41470.8

McGlasson, L. (2008). TJX arrests are 'tip of the Iceberg': Largest ID theft case in history is just a symptom of true global threat, experts say. Retrieved June 14, 2009, from http://www.bankinfosecurity.com/articles.php?art_id=930

McKendrick, J. (2006). Ten examples of SOA at work, right now. Retrieved June 9, 2009 from http://blogs.zdnet.com/service-oriented/?p=508&tag=rbxccnbzd1

Michels, S. (2008). Prosecutors bringing charges under law inspired by Megan Meier suicide. Retrieved June 18, 2009, from http://abcnews.go.com/TheLaw/Story?id=6520260&page=1

Nichols, S. (2009). COPA Child-Porn Law Killed. Retrieved June 17, 2009, from http://www.pcworld.com/article/158131/copa_child-porn_law_killed.html

O'Reilly, T. (2005). What is Web 2.0? Design patterns and business models for the next generation of software. Retrieved March 1, 2009, from http://www.oreillynet.com/pub/a/oreilly/tim/news/2005/09/30/what-is-web-20.html

O'Reilly, T. (2006). Web 2.0 compact definition: Trying again. Retrieved June 20, 2009 from http://radar.oreilly.com/archives/2006/12/web-20-compact.html

Rognerud, J. (2008). Social media marketing beginner's guide. Retrieved March 8, 2009, from http://www.marketingpilgrim.com/2008/04/social-media-marketing-beginners-guide.html

Scanlon, J. H., & Wieners, B. (1999). The Internet cloud. Retrieved June 10, 2009, from http://www.thestandard.com/article/0,1902,5466,00.html

Scocco, D. (2009). Social media marketing FAQ. Retrieved March 8, 2009, from http://traffikd.com/smm/faq/

Simon, S. J. (2008). Israel uses YouTube, Twitter to share its point of view. Retrieved March 9, 2009, from http://edition.cnn.com/2008/WORLD/meast/12/31/israel.youtube/

Simpson, G. (2007). Top 10 security stories of the year. Retrieved June 13, 2009, from http://software.silicon.com/security/0,39024655,39169438,00.htm

Smith, R., & Shao, J. (2007). Privacy and E-Commerce: A consumer-centric perspective. *Electronic Commerce Research*, *7*(2), 89–116. doi:10.1007/s10660-007-9002-9

Snow, B. (2007). GigaOM top 10 most popular MMOs. Retrieved March 12, 2009, from http://gigaom.com/2007/06/13/top-ten-most-popular-mmos/

Stelzner, M. A. (2009). Social media marketing industry report. Retrieved June 11, 2009, from http://www.whitepapersource.com/socialmedia-marketing/report/

Stevens, H., & Pettey, C. (2008). Gartner says cloud computing will be as influential as e-business. Retrieved June 10, 2009, from http://www.gartner.com/it/page.jsp?id=707508

Storani, M. (2008). Amazon Web Services: Overview and example with Java and PHP. Retrieved June 9, 2009, from http://mauriziostorani.wordpress.com/2008/07/20/amazon-web-services-overview-and-example-with-java-and-php/

Tarasewich, P., Nickerson, R. C., & Warkentin, M. (2002). Issues in mobile E-Commerce. *Communications of the Association for Information Systems*, *8*, 41–64.

Telecommunications Industry Association (2008). TIA's 2008 Telecommunications Market Review and Forecast.

Vijayan, J. (2007). TJX data breach: At 45.6M card numbers, it's the biggest ever. Retrieved June 14, 2009, from http://www.computerworld.com/action/article.do?command=viewArticleBasic&articleId=9014782

Wagner, C. G. (2008). Retrieved June 18, 2009, from http://www.allbusiness.com/technology/software-services-applications-internet-social/11579506-1.html

Walker, M. A. (2009). MySpace removes 90,000 sex offenders. Retrieved June 18, 2009, from http://www.msnbc.msn.com/id/28999365/

Waters, R. (2007). Bubble 2.0? Retrieved March 5, 2009, from http://www.ft.com/cms/s/0/c81136ba-f747-11db-86b0-000b5df10621.html?nclick_check=1

Whitworth, D. (2009). Twitter growth explodes in a year. Retrieved June 11, 2009, from http://news.bbc.co.uk/newsbeat/hi/technology/newsid_7948000/7948092.stm

Williamson, D. A. (2008). B2B Marketing on Social Networks: Engaging the Business Audience. New York: eMarketer, Inc.

Woodcock, B. S. (2008). MMOG subscriptions market share April 2008. Retrieved March 12, 2009, from http://www.mmogchart.com/charts/

## KEY TERMS AND DEFINITIONS

**M-Commerce:** Mobile Commerce, the use of handheld wireless devices for purchasing goods and services from any location.

**SOA:** Service-Oriented Architecture, a set of self-contained services that communicate with each other to generate a software application. Software vendor can reuse these services in other combinations to build a different application. It is a completely new way of developing software.

**SOAP:** Simple Object Access Protocol, a set of rules for structuring messages that enable applications to pass data and instructions to one another.

**Social Media:** Information content created by people using highly accessible and scalable publishing technologies that facilitate communications, influence and interaction with peers and public audiences. It is sometime called user generated content.

**UDDI:** Universal Description, Discovery, and Integration. It enables a Web service to be listed in a directory so that it can be easily located, just as you can locate services in a yellow page book.

**Web 2.0:** A perceived second generation of web development and design, that aims to facilitate communication, secure information sharing, interoperability, and collaboration on the World Wide Web.

**Web Services:** A set of loosely coupled software components that exchange information with each other using standard Web communication protocols and languages, a technology that allows applications to communicate with each other in a platform- and programming language-independent manner.

**WSDL:** Web Services Description Language, a common framework for describing the tasks performed by a Web service and the commands and data it will accept so that it can be used by other applications.

# Chapter 116
# Virtual Commerce

**Suzanne Altobello Nasco**
*Southern Illinois University Carbondale, USA*

**Robert E. Boostrom Jr.**
*University of Wisconsin - Whitewater, USA*

**Kesha K. Coker**
*Eastern Illinois University, USA*

## INTRODUCTION

Virtual reality, in a variety of implementations, is becoming more popular every day. Internet technology originally designed for education, information, and gaming is now three-dimensional, multifunctional, and morphing into loci for international economic activity. The virtual world population is quite immense. In Second Life alone, as of 2007, there was an estimated 3.1 million registered residents (Linden, 2007). There is also much user activity in Second Life with 1.4 million residents logged in within the last 60 days from March 25, 2009 (Second Life, 2009). In fact, the virtual world population is expected to reach 50 - 60 million by 2011 (Au, 2007). Of even greater interest is the revenue generated from virtual world activity. The worldwide virtual world economy is valued at approximately $1.8 billion (Dibbell, 2007).

Although virtual spaces are relatively new, there are numerous economic opportunities and implications for companies. This encyclopedic entry first provides a background on the history of virtual commerce in order to create an agreed-upon definition, incorporating v-commerce into a typology of commerce. We then discuss virtual commerce in the context of virtual reality, by illustrating how people buy and sell products and services in virtual worlds, often through the use of avatars. A discussion of legal issues associated with virtual commerce follows, with an emphasis on patents, real estate, and taxation. We offer some recommendations to these legal issues before finally discussing how companies can incorporate virtual commerce into their exist-

DOI: 10.4018/978-1-61520-611-7.ch116

ing marketing and overall business strategy. Also provided are definitions of key terms used in this encyclopedia entry.

## BACKGROUND

The Internet as we know it today is vastly different from the Internet of ten years ago. The improvements in technology related to the applications and software, the computational power of the hardware, and the speeds at which users access the Internet have all changed in very noticeable ways. These factors have led to the development of online environments that greatly widen the scope of potential Internet uses. One promising direction for the Internet is the evolution from simple two-dimensional (2D) web pages to three-dimensional (3D) virtual spaces.

Virtual reality, as the term is used here, is a computer-mediated environment and represents a space that does not necessarily exist in the physical world. Schroeder (2008) states a similar definition for virtual reality, saying that this environment should allow or compel the user to interact with it. In virtual reality websites or games, it is possible for users to interact using avatars. Avatars are the representations of users in virtual worlds, often graphically displayed as 3D characters and are central to the way that users interact with people and objects in virtual spaces. A subset of virtual reality is virtual worlds. Virtual worlds are persistent virtual reality spaces (Schroeder, 2008). In other words, these virtual reality spaces exist and can change. One user can make an alteration (such as buying land and building a store) and that alteration will persist unless it is acted upon by that, or another, user. Much like physical reality, the world doesn't "go away" just because a person isn't there to experience it. Reflecting both the technical and social elements of virtual worlds, Bell (2008) defines a virtual world as "a synchronous, persistent network of people, represented as avatars, facilitated by networked computers" (p. 2).

The virtual world Second Life is one of the largest user-created, 3D virtual world communities. In Second Life, users are called "residents." Many residents of Second Life use the virtual world to interact socially with other residents, run businesses, or learn how to do things in the real world. Beyond Second Life, other virtual worlds have also developed user bases large enough to inspire marketing efforts. For instance, Coca-Cola has developed a section of the virtual world There.com called MyCoke. This site features large promotional displays, Coke-branded virtual clothing, and activities for visitors. Based on marketing efforts from Coke and other companies, it seems clear that corporations are very interested and relatively optimistic about the idea of using virtual reality for business communications.

More importantly from a marketing perspective, these virtual worlds create opportunities for a new form of commerce – virtual or v-commerce. V-commerce is an alternative and/or supplement to traditional forms of commerce. In a world economy plagued by increasingly diminishing natural resources, virtual commerce presents itself as a viable type of commerce in which products are created with infinite virtual resources and exchanged for real world money, thereby fostering economic development of world economies.

## COMMERCE IN VIRTUAL WORLDS

Although some preliminary attempts have been made highlighting the business opportunities that virtual reality can offer (e.g. Chung, 2005; Hemp, 2006; Holzwarth, Janiszewski, and Neumann, 2006), there has been little effort to compare commerce that occurs in virtual worlds and other types of marketing exchanges. Hemp (2006) has come the closest to providing such a comparison, but though his work outlines some important new considerations of marketing to avatars, it fails to offer a rich and satisfying categorization and assessment of the types of exchanges that are possible. Various definitions of virtual commerce have emerged. For example, virtual commerce has been defined as an application that facilitates electronic commerce (e-commerce) and there is indication that the term itself is used synonymously with e-commerce (John Hopkins Information Technology Glossary). V-commerce has also been described as an educational tool through which the business environment is simulated with virtual businesses and virtual money (Whatis.com). However, very few researchers have sought to show how this type of commerce is distinct from pre-existing forms of commerce. In this regard, Boostrom, Nasco, and Coker (2010) proposed and validated a typology of commerce that spans from traditional physical commerce to e-commerce to mobile commerce (m-commerce) and finally, to v-commerce. Traditional commerce is defined as trade that occurs in traditional retail environments, such as face-to-face or over the phone. Buying a sweater from a mail-order catalog or calling a pizza place to have pizza delivered are examples of traditional commerce. E-commerce is trade that occurs over a retail website and m-commerce refers to trade that occurs via the use of a web-enabled mobile phone. Visiting the website of a mobile phone carrier to purchase a new mobile phone would be an example of e-commerce while using a cellular phone to purchase concert tickets serves as an example of m-commerce.

The typology also revealed two distinct categories of virtual commerce. First, pure v-commerce is defined as buying or selling products or services in virtual worlds. For example, buying a ticket to a concert in a virtual world is an example of pure v-commerce. Second, a hybrid form of virtual commerce is found to exist. Named dual v-commerce, the hybrid form combines pure v-commerce with traditional commerce and refers to buying or selling products/services in a virtual world and buying the same product/service in the real world. Dual v-commerce occurs when an individual makes a related purchase for herself in physical reality to one that is made for her avatar in virtual reality. These events could be relatively disconnected, for example, getting a motorcycle in a virtual world and then buying a used one in real life. However, these events could be closely tied together, such as when American Apparel offered clothing for avatars which, when purchased, would earn the customer a 15% discount on clothing purchased in the physical world (Jana, 2006).

Purchases made in the virtual world differ from purchases made in the physical world because in the virtual world, a consumer usually buys intangible products or services for his/her avatar. These products are intangible in the sense that they are virtual – they are the graphic and/or sound representation of something generated by computer code. All virtual worlds have internal economies and many have their own virtual currency (Castronova, 2005). In some cases these virtual world economies are closed, with no platform-sanctioned connection to physical world economies, and in some situations they are open and currency from virtual worlds can be exchanged for physical world currencies (Castronova, 2006). For example, in Second Life, the official unit of trade is the Linden dollar (L$) which has a fluctuating exchange rate tied to the U.S. dollar. Residents can purchase Linden dollars directly from the website or from other third party websites (similar to currency exchanges) or residents can earn Linden dollars by mailing and selling goods and services, holding events, or playing games. Linden dollars can then be used to “purchase anything that can be made in-world, from clothes, skins, wigs, jewelry, and custom animations for avatars, to furniture, buildings, weapons, vehicles, games, and more” (Second Life, 2009). It is important to note that even though all virtual worlds have some sort of economic system, for some online games and virtual communities, there is no exchange market to convert real money to virtual currency (and vice versa). In this situation, the only way to get the virtual money is to earn it by continuing to participate in virtual games or providing a contribution to the virtual communities. In other situations, users can purchase virtual currency by paying real money but cannot convert the virtual currency back to a real currency.

As the avatar is the agent through which one operates in a virtual world, much of a user's v-commerce revolves around it, such as buying a dinosaur body for one's avatar or buying gifts to present to other players' avatars. As such, the use of the avatar and the construction of its identity and lifestyle motivate v-commerce. In fact, becoming a socialized member of a community in a virtual world can require an individual to purchase the proper accouterments for one's avatar that show an understanding of how one is supposed to look and operate in certain social environments (Boostrom, 2008). Consumption practices can be pursued that mirror physical world practices; experiment with an idealized version of physical reality that includes consumption that may yet be pursued by the user in physical reality; or consumption that may be based on a completely unrealistic, fantastic pursuit of a totally different existence. As with consumption in physical reality, consumption in virtual reality can even incorporate the use of brands to help communicate an individual's identity.

The fascinating thing about commerce in the virtual world is that the brands that are bought can either be brands that only exist in the virtual world (e.g., brands can be businesses created by users for sole use in the virtual world, such as buying clothing for an avatar that cannot be purchased in real life) or the brands that are bought in the virtual world may be brands that are also available for purchase in real life (e.g., buying a Coca-Cola for your avatar to drink in the virtual world). Thus, once a user purchases products for use in the virtual world, he/she may then buy those same branded products in the real world. Several real world companies exist to help existing brands enter a virtual world and most virtual worlds also have centrally controlled advertising networks, so as a user enters the virtual world and explores different locations, he/she may see branded advertisements during his/her visit.

## LEGAL ISSUES IN VIRTUAL COMMERCE

There are important legal issues in virtual commerce and, although they may seem to require totally new approaches, there are suggestions that current real and intellectual property laws can address most of the issues that arise (Jankowich, 2005). Most predominantly, real estate issues exist in virtual worlds. For instance, Second Life is comprised of the Main Land, private islands that can be purchased and open spaces. Residents can buy, rent, or sell land in different virtual worlds depending on their membership status and how much they are willing to spend. In Second Life, real estate is much like in physical reality where it can be purchased as land that needs to be developed or with houses, buildings, or other material on it. Residents can use their land to build homes or businesses, hold events, create attractions, or build multi-leveled games (Learmonth, 2004). In other virtual worlds, real world items can be claimed and "owned." For instance, in the virtual world Weblo, members purchase ownership to landmarks, cities, or states that exist in the real world to create sites to attract visitors for profit (Krieger, 2007). In this sense, Weblo creates a kind of virtual ownership without involving an avatar. Real world businesses are involved in many of these real estate transactions, such as eBay, which powers the land auction technology and Coldwell Banker, which was the first national real estate firm to establish a corporate presence in Second Life.

A second legal issue that warrants attention in virtual worlds deals with intellectual property, trademark issues, patents, and copyright issues (Virtual Worlds News, 2007). The United States

Patent & Trademark Office (USPTO) is soliciting information from virtual reality users regarding virtual worlds and different types of credit accounts, charge accounts, escrow transactions, risk mitigation used within these worlds for purposes of validating trademark applications (Terra Nova, 2008). In November 2008, the USPTO awarded the first trademark for a Second Life avatar, marking a landmark case for trademarks in the virtual world (Virtual Worlds News, 2008). By awarding this trademark, the U.S. courts are clearly recognizing that virtual world trademarks can be enforced in U.S. courts and are governed by Congress. Presumably, then, real-world trademark owners can file infringement claims when the trademarks are used without permission in virtual worlds, covered by the Online Copyright Infringement Liability Limitation Act under the 1998 Digital Millennium Copyright Act.

Finally, a key commerce-related issue that has recently come to the forefront in virtual reality is the issue of taxation. Almost all of the commerce that is occurring in virtual worlds, either legally inside of a game or illegal through gold mining (hiring people to play as your character or avatar to get virtual currency or character experience), happens in a tax-free environment. It should be noted that commerce in virtual worlds is unique in the sense that currency used in transactions can be either real currency or virtual currency. For example, property purchases or exchanges can be transacted using real money or virtual money (which is then converted into real money) (de Andrade, 2009). Sheehan (2009) remarked that as policymakers and the public have become aware of the real currency exchanges for both tangible items and intangible items or services within virtual worlds, "there are signs that the 'duty free' days of virtual exchanges are coming to an end." China was the first to impose a 20% tax on any profit generated from virtual money with the Chinese State Administration of Taxation in October 2008. The virtual currency market in China is already worth several billion Yuan and is growing between a 15% and 20% rate (Ye, 2008). The United States Internal Revenue Service is also concerned with the taxation of virtual commerce and is prepared to address the challenges of extending taxation into virtual worlds. "If a taxpayer spends more money on an activity than received, the taxpayer cannot claim a loss on an income tax return. If a taxpayer receives more money from an activity than spent, then the taxpayer may be required to report taxable income" (Internal Revenue Service, 2008).

## THE FUTURE OF VIRTUAL COMMERCE

Virtual commerce will become more popular as broadband access extends deeper into the U.S. and into other countries, and as personal computer graphics capabilities increase. There is also ample opportunity to explore virtual commerce opportunities within the context of mobile technology as more people around the world use their mobile phones to access the Internet. Although the majority of Internet experiences will continue to be 2D web experiences well into the future, the number of Internet users that look for 3D experiences and the amount of time that they spend in virtual environments are likely to increase exponentially. V-commerce will be a key to enhancing the virtual world experience for users and allow business opportunities for those companies that wish to participate. Although there has been a degree of hype associated with making money in virtual worlds, there are also very real opportunities (Terdiman, 2008). Much like the emergence of the Internet allowed for "pure-play" e-commerce companies, virtual worlds allow for "pure-play" v-commerce companies.

Additionally, for brands that have a presence in physical reality, virtual worlds will be a good way to connect to people and positively affect consumer behavior in real life shopping experiences (similar to the dual v-commerce experiences described by Boostrom et al., 2010). Companies that ignore virtual commerce opportunities or dismiss virtual worlds as niche markets that will not affect real-world transactions and relationships are myopic and at risk of being overshadowed by more progressive competitors. Legal concerns will have to be addressed and businesses will have to consider how to incorporate virtual worlds into their existing marketing and general business strategies.

## REFERENCES

Au, W. J. (2007). Virtual world population: 50 million by 2011. Retrieved March 27, 2009, from http://gigaom.com/2007/05/20/virtual-world-population-50-million-by-2011/

Bell, M. W. (2008). Toward a definition of 'virtual worlds'. *Journal of Virtual Worlds Research*, *1*(1), 1–5.

Boostrom, R. E. Jr. (2008). The social construction of virtual reality and the stigmatized identity of the newbie. *Journal of Virtual Worlds Research*, *1*(2), 1–19.

Boostrom, R. E., Jr., Nasco, S. A., & Coker, K. K. (2010). The Evolution of e-tailing. Presentation at the Marketing Management Association.

Castronova, E. (2005). Synthetic worlds: The business and culture of online games. Chicago: University of Chicago Press.

Castronova, E. (2006). The right to play. In The state of play: Law, games, and virtual worlds. Edited by J. M. Balkin and B. S. Novak. New York: New York University Press.

Chung, D. (2005). Something for nothing: Understanding purchasing behaviors in social virtual environments. *Cyberpsychology & Behavior*, *8*(6), 538–554. doi:10.1089/cpb.2005.8.538

de Andrade, N. (2009). Striking a balance between property and personality: The case of the avatars. *Journal of Virtual Worlds Research*, *1*(3), 3–63.

Dibbell, J. (2007). The life of the Chinese gold farmer. The New York Times. Retrieved March 25, 2009, from http://www.nytimes.com/2007/06/17/magazine/17lootfarmers-t.html?_r=1&pagewanted=all

Glossary, J. H. I. T. (n.d.).Virtual commerce. Retrieved February 10, 2009, from http://it.jhu.edu/glossary/tuv.html

Hemp, P. (2006). Avatar-based marketing. *Harvard Business Review*, *84*(6), 48–57.

Holzwarth, M., Janiszewski, C., & Neumann, M. M. (2006). The influence of avatars on online consumer shopping behavior. *Journal of Marketing*, *70*(4), 19–36. doi:10.1509/jmkg.70.4.19

Internal Revenue Service (2008, December 31). National taxpayer advocate 2008 annual report to Congress.

Jana, R. (2006). American Apparel's virtual clothes. Business Week, June 27. Retrieved May 27, 2009, from http://www.businessweek.com/innovate/content/jun2006/id20060627_217800.htm

Jankowich, A. E. (2005). Property and democracy in virtual worlds. *Boston University Journal of Science and Technology Law*, *11*(2), 1–49.

Krieger, S. (2007). Amassing properties in a virtual world. Retrieved May 28, 2009, from http://www.nysun.com/real-estate/amassing-properties-in-a-virtual-world/57485/

Learmonth, M. (2004). Virtual real estate boom draws real dollars. Retrieved May 28, 2009, from http://www.usatoday.com/tech/webguide/internetlife/2004-06-03-virtual-realty_x.htm

Life, S. (2009). Economic statistics (raw data files). Retrieved March 27, 2009, from http://secondlife.com/statistics/economy-data.php

Linden, Z. (2007). State of the virtual world - key metrics. Retrieved March 27, 2009, from https://blogs.secondlife.com/community/features/blog/2007/02/09/

Schroeder, R. (2008). Defining virtual worlds and environments. *Journal of Virtual Worlds Research.*, *1*(1), 1–3.

Sheehan, J. (2009). The end of free virtual commerce: The taxman cometh. Retrieved February 10, 2009, from http://www.signtific.org/en/node/52951

Terdiman, D. (2008). The entrepreneur's guide to Second Life: making money in the metaverse. Indianapolis, IN: Wiley Publishing.

Terra Nova. (2008). Patenting virtual commerce. Retrieved February 10, 2009, from http://terranova.blogs.com/terra_nova/2008/06/last-week-i-rec.html

Virtual Worlds News. (2007). Blogging the SLCC: IP rights and law in Second Life. Retrieved February 10, 2009, from http://www.virtualworldsnews.com/2007/08/blogging-the--2.html

Virtual Worlds News. (2008). Second Life avatar gets trademarked. Retrieved March 30, 2009, from http://www.virtualworldsnews.com/2008/11/second-life-avatar-gets-trademarked.html

Whatis.com. (n.d.). What is virtual commerce? Retrieved February 10, 2009, from http://wrhatis.techtarget.com/definition/0,sid9_gci1124613,00.html

Ye, J. (2008). Real taxes for real money made by online game players. Wall Street Journal. Retrieved October 31, 2008, from http://blogs.wsj.com/chinajournal/2008/10/31/real-taxes-for-real-money-made-by-online-game-players/

## KEY TERMS AND DEFINITIONS

**Avatar:** A digital representation of the user (either two- or three-dimensional) within the context of the computer-generated environment.

**Dual V-Commerce:** When an individual makes a related purchase for herself in physical reality to one that is made for her avatar in virtual reality.

**Mobile Commerce (m-commerce):** Trade that occurs via the use of a web-enabled mobile phone.

**Virtual Commerce (v-commerce):** Buying and/or selling products/services in a virtual world.

**Virtual Currency:** Currency for use in virtual worlds that is accumulated through activity in the virtual world, through purchase using some form of currency exchange, or as a reward for consumer activity in the physical world. It can sometimes be exchanged for physical world currency through exchanges or other trade mechanisms.

**Virtual World:** An interactive, simulated, persistent, computer-generated environment accessed by multiple users through an online interface. A subset of virtual reality.

**Virtual Reality:** An interactive, simulated, computer-generated environment.

# Chapter 117
# The Web 2.0 Trend:
## Implications for the Modern Business

**Michael Dinger**
*Clemson University, USA*

**Varun Grover**
*Clemson University, USA*

## ABSTRACT

*This article introduces and describes the use of Web 2.0 technologies in contemporary business environments. Web 2.0 refers to many current generation internet technologies that are characterized by rich media, a dynamic nature, social networking elements and distributed contributions. The chapter presents three major Web 2.0 archetypes: blogs, wikis and social networking sites. It concludes with a value-oriented framework designed to guide firms in the development of Web 2.0 initiatives.*

## INTRODUCTION

Web 2.0 represents a new wave of technologies that enable high levels of interactivity and participation via the internet. It is an umbrella term that describes a variety of dynamic and community-based web initiatives that place value on the power of distributed knowledge, leverage data, and provide users with rich multimedia experiences (O'Reilly, 2005). For example, Amazon's attempt to create social networks around book readership may be considered a prototypical Web 2.0 initiative. However, there are newer technologies like context-based advertising (e.g., Google AdSense), distributed file sharing (e.g., BitTorrent), and user-generated content organization via 'tagging' or 'folksonomies' (O'Reilly, 2005) that truly epitomize the term.

Businesses are beginning to capitalize on this set of technologies in a variety of ways. Many companies are expanding Web 2.0 efforts by capturing customer data and leveraging it to generate instantaneous, custom-tailored customer experiences (Bughin, Chui, & Johnson, 2008). For instance, Amazon uses data captured from site visitors in order to provide targeted product suggestions to regular site visitors. On each product page, Amazon lists products that purchasers of that product also looked at and purchased. Netflix aggregates and analyzes subscriber movie preferences in order to provide accurate movie recommendations. Busi-

DOI: 10.4018/978-1-61520-611-7.ch117

nesses can leverage Web 2.0 technologies in order to dynamically cooperate with customers and partners in efforts to generate new design innovations (Brown, 2008). Both online and traditional businesses must understand how to navigate and capitalize on the changing internet terrain to stay competitive in the Web 2.0 era.

## BACKGROUND

Web 2.0 thinking emphasizes the distributed and interactive nature of information technologies. Therefore, the core concept of a web page is altered to allow for distinct interaction from site visitors. This mindset is represented in the way that users can create, remove or edit informational content on wikis, comment on blogs, or drive the content of media-sharing sites like YouTube. The distributed nature of Web 2.0 technologies allows many users to create and participate while needing little technical knowledge.

### Characteristics of Web 2.0

Web 2.0 technologies can be identified by a number of common characteristics. These technologies generally capitalize on the ability of websites to embed rich media, which can enhance user experiences. Web 2.0 initiatives are dynamic in nature, enabling constant change and updates. Also, Web 2.0 technologies regularly include social networking elements which enable users to form connections with one another. Finally, these endeavors are noted for their reliance on the distributed contributions of many participants.

### Rich Media

Rich media is a common characteristic of Web 2.0 technologies. Some Web 2.0 sites are compiled solely of user-generated content, including YouTube (videos) and Flickr (images), but rich media can enhance any user experience. For instance, many news sites, such as CNN.com and ESPN.com, embed video in conjunction with print stories. Similarly, in conjunction with written guides, About.com provides a variety of how-to videos. Furthermore, social networks, such as Facebook, have enabled users to post and store digital images and video.

### Dynamic Nature

The dynamic nature of Web 2.0 technologies is driven by their ability to be quickly changed. A core design element of wikis is the ability to add, remove or change content quickly. On social networking sites, users are able to make changes to their profile with ease. Twitter thrives on constant change and updates. In what might best be described as a micro-blog, Twitter users are able to make regular posts, but such posts can contain a maximum of 140 characters. Due to the dynamic nature of Web 2.0 technologies, companies like Dell can quickly respond to customer complaints and concerns through a corporate blog (en.community.dell.com/blogs/direct2dell/).

### Social Networking Elements

Social networking leverages people-to-people interactions. For example, blog users can form connections to other bloggers. Analysis suggests that users of media sharing websites, specifically YouTube, can engage in social networking activity through the manner in which they manipulate access to their contributed media (Lange, 2007). Finally, social networking platforms can be embedded in a variety of different websites. For instance, ESPN.com has introduced a profile-based initiative called myESPN (myESPN.com). myESPN users can create their own profile, form social connections with other members, customize the manner in which they receive ESPN news, and use their profiles to comment on ESPN.com stories. In an online retail setting, individual online store owners may form connections to one other, thus leading to a type of online ‘mall’ that enhances economic activity (Stephen & Toubia, 2009).

### Distributed Contributions

Many Web 2.0 initiatives would not exist if not for the distributed contributions of many users. Wikis particularly rely on the contributions and efforts of many users. The intent of wikis is to represent a culmination of the knowledge of all participating users. Media driven sites like YouTube and Flickr entirely consist of user contributions. Facebook has opened up its software platform so that users can create and contribute original applications (developers.facebook.com). Similarly, Apple has enabled a wide range of developers to create new and innovative applications for the popular iPhone (developer.apple.com). The ability to harness the distributed contributions of many participants plays a significant role in a firm’s ability to generate value from these initiatives.

## ARCHETYPES OF WEB 2.0

The Web 2.0 trend has popularized three general archetypes of technology: blogs, wikis, and social networking sites (SNS). Blogs, short for weblogs, are perhaps the most traditional of the technologies and are essentially websites that can be dynamically and regularly updated. Wikis are sites that exist through the collective efforts of many users. Wikis are intended to efficiently harness the collective knowledge of all willing participants. In general on a wiki, all users can generate original content and edit or remove published content. The core concept of the wiki is that all changes can be made, or undone, quickly. SNS represent the ability of internet technologies to connect users and provide a platform that enables these connections.

### Blogs

Blogs are simple websites that are largely defined by the fact that they are updated easily and regularly. Blogs are inherently flexible and can be used for a variety of purposes, ranging from knowledge management initiatives to customer relation tools (Ives & Watlington, 2005). In fact, blogs are challenging traditional media outlets for the attention of many online users (Singh, Veron-Jackson, & Cullinane, 2008). Blogs can serve as rallying points for people of similar interests, such as consumer advocates at the Consumerist (www.consumerist.com). Organizations can offer their own blogs as a platform on which to interact directly with customers.

The nature of blogs ranges from topics concerning public relations in India (www.indiaprblog.com) to an ongoing community-based art project featuring ‘secrets’ submitted by post card (postsecret.blogspot.com). However, blogs also serve as a platform for complaints, as they not only enable individuals to publically voice their own concerns, but entire communities can form regarding common complaints. For example, in 2005, a writer for BusinessWeek chronicled his complaints with Dell on his own personal blog (Jarvis, 2007). Eventually, he penned an open letter to Michael Dell and challenged him to respond to the public complaints and concerns of bloggers. The following year, Dell created a blog to interact directly with consumers (en.community.dell.com/blogs/direct2dell/).

Within-firm blogs offer a platform for individual employees to express themselves inside the firm. These repositories can be used to store thoughts or voice opinions, and as such, internal blogs can be used as an ad-hoc knowledge repository (Cayzer, 2004). Executives have been regularly using internal blogs to publicize statements within firms (Schwartz, 2005). Firms can use a public blog in order to provide a ‘face’ for the organization (Lee, Hwan, & Lee, 2006). The publication of a blog enables the firm to interface directly with consumers. By allowing customers to interact directly with the firm, the organization may seem more human and down-to-earth (Singh, et al., 2008). While the blog can be used for impression management, it can also be used to gauge consumer reactions to changes or investigate the potential for new products. For instance, Facebook makes public announcements on their blog and updates users on potential changes to Facebook (blog.facebook.com).

## Wikis

Wikis are a type of technology that allows many users to combine their collective knowledge (Wagner, 2004). The wiki is a type of technology that also embodies a specific mindset towards the accumulation of knowledge. Wikis are designed such that participants can quickly and easily create new wiki pages, edit existing wiki pages, and trim unnecessary wiki pages. Wikis offer the ability for many users to converge on a given topic. As such, wikis represent an excellent technological platform for knowledge generation and can be harnessed to inspire innovations and growth (Tapscott & Williams, 2007). Wiki technology enables users to search for information, link other articles, author new articles, and tag articles (McAfee, 2006). Furthermore, wikis can use extensions to enhance user ability to find related content and set up signals which notify users of new content (McAfee, 2006).

A popular source of online information, Wikipedia hosts over 2.8 million articles in English alone. However, the collaborative nature of public wikis raises concern about the validity of information contained in such a source (Priedhorksy, et al., 2007). Therefore, a number of checks are implemented to insure the validity of contributions to a given wiki topic. A common wiki tenet is to make it easy to correct mistakes. Changes are tracked and edits are easily undone. This makes it a simple task to undo vandalism. Firms have the opportunity to derive value from the collective of the public that participates in wikis. Wikis can form around any given subject. For example, users of the Linux-based operating system Ubuntu operate a wiki to assist all Ubuntu users (wiki.ubuntu.com).

Firms have the opportunity to harness the power of their consumers by creating and driving wikis that feature the firm's products. By allowing consumers to create content revolving around the firm's products, the firm is both developing the core consumer base in a positive manner and enabling the creation of additional value for any consumer that can benefit from this knowledge and experience. For instance, owners of Honda vehicles have created the Honda wiki (hondawiki.com). By actively sponsoring such a site, corporations like Honda could encourage a loyal owners group and interact with their customers in a positive manner.

Internal wikis can be applied to a number of possibilities. Wikis offer value as tools for collaborative knowledge management (Wagner, 2004). The wiki becomes a repository of knowledge that users can improve over time. For example, one report suggests that the U.S. Government leverages wikis in a variety of ways, including an Army-based wiki on Afghanistan, an intelligence wiki full of non-classified information for government personnel (Intellipedia), and a wiki for diplomats (Diplopedia) (Bell, 2009). Wikis are relatively easy to set up and modify, which makes them ideal for projects and routine use. Wikis can be created at the beginning of a project and then modified according to project progress. Alan Mansfield, a small business owner, estimates that using wikis to manage projects cuts down time spent on each project by 25 percent (Miller, 2006). In running his literary agency, Mansfield uses wikis to "store drafts, e-mails, proposals, contracts, contacts, and anything else to do with the project" (Miller, 2006).

## SNS

Social network sites (SNS) use internet-enabled technologies to allow users to form or maintain social connections. Boyd and Ellison define social networks as "web-based services that allow individuals to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection, and (3) view and traverse their list of connections and those made by others within the system" (2007 p 211). The core factors driving SNS are the platforms on which many users can engage and interact with one another. SNS have become so extensive that firms are having trouble with employees who insist on accessing social networking sites during regular working hours (CU360 "Employees Using Web 2.0 Tools," 2008). These SNS are seeking to aggressively expand internationally and are facing stiff competition from international competitors (MacMillan, 2009).

While firms may view social networking as a distraction to employees, firms can seek to engage with social networking software in a value-generating manner. Organizations can leverage social networks in a variety of ways. For instance, one report suggests that many companies leverage social networking software internally, and that these internal social networking channels contribute to increased efficiency in the workplace (Middleton, 2008). Social networks also facilitate recruiting and connecting potential participants for distributed innovation processes (Cash, Earl, & Morison, 2008). As recruitment tools, social networks allow recruiters to view the manner in which potential recruits behave in online settings and the type of people they associate with (Henricks, 2009). Organizations can also use social networks to engage in direct market research (Henricks, 2009). Also, by maintaining an online presence in social networks, firms can engage in a positive discourse with customers (Parise, Guinan, & Weinberg, 2008).

## A FRAMEWORK FOR WEB 2.0 INITIATIVES

This framework attempts to simplify and direct Web 2.0 initiatives. Due to the broad range of potential Web 2.0 initiatives, we propose a framework for understanding the value generated from these initiatives.

### Value Derived within the Firm

This part of the framework addresses the ability of the firm to generate value through Web 2.0 initiatives. These applications may take a variety of forms, but the focus is on the benefits of the internal applications of the Web 2.0 applications. These applications may take form in terms of knowledge management initiatives (Cayzer, 2004; Wagner, 2004), project management efforts (Miller, 2006), and social networks that connect employees (Middleton, 2008). Firms must understand the type of benefit they intend to achieve before installing Web 2.0 technologies. The application of multiple Web 2.0 endeavors allows for firms to integrate across technology, thus potentially giving rise to super-additive value due to the complex interactions between multiple Web 2.0 platforms (see Figure 1).

### Value Derived from External Sources

The firm should consider how to derive value from Web 2.0 instances that exist in the public space. The firm should evaluate all potential sources of access to these instances. Once the sources are identified, the firm can approach the issue of deriving value from these websites. For instance, firms can leverage social network sites to evaluate job applicants or to actively recruit individuals (Henricks, 2009). Firms can also capitalize on externally-run blogs in order to understand the mindset and concerns of customers, as external sites provide access to the unfiltered complaints of customers (Jarvis, 2007). Due to the open and simple nature of Web

*Figure 1. Value derived within the firm*

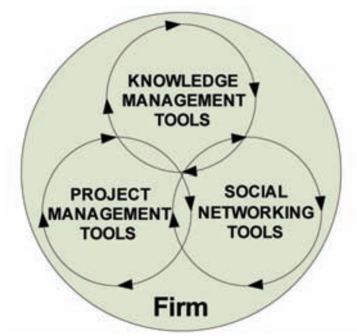
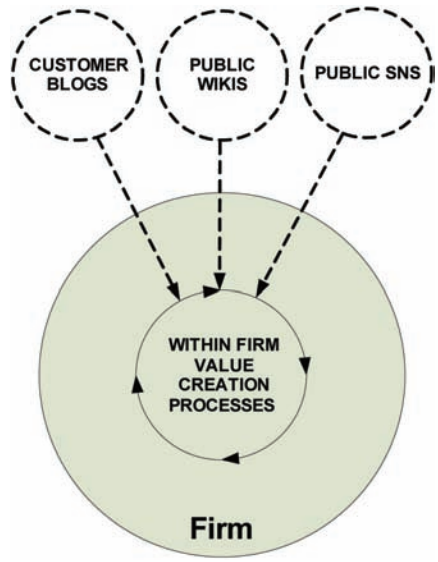



*Figure 2. Value derived from external sources*




2.0 technologies, many users are participants on multiple platforms. Furthermore, users, and Web 2.0-savvy businesses, form connections between multiple Web 2.0 initiatives. For instance, Netflix and Facebook are joining their platforms, and Facebook users can post their movie ratings from their Netflix accounts on their Facebook profiles (www.facebook.com/netflix). The challenge for firms is to identify potential sources of value and to effectively funnel value from those sources into the firm (see Figure 2).

## Value Derived from the Interaction Between the Firm and Public

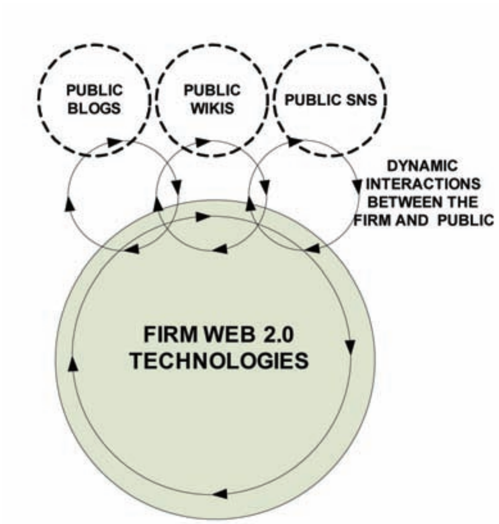
Firms should evaluate how to generate value from dynamic interactions with their customers or other public sources. This proposition deals with two fronts: social and technical. The social aspect of this interaction deals with the actual exchange between firm and public. For instance, Dell responded to customer complaint blogs directly (Jarvis, 2007). Beyond interacting directly with customers and other external parties, a firm may choose to create a platform to facilitate this interaction. For instance, Dell chose to publish a blog (a technical issue) for the purpose of interacting with customers (a social issue) (Jarvis, 2007). This suggests that firms must first understand and engage Web 2.0 technologies from a technical perspective before progressing to capitalizing on potential social interactions via firm-driven technologies.

Furthermore, firms can capitalize on direct involvement with customers and third parties by creating a platform to drive distributed innovation (McAfee, 2006). Many design initiatives focus on distributing design (Brown, 2008) or innovation (Cash, et al., 2008) processes within the firm. However, firms can leverage these technologies and allow customers to become involved in the creation processes. In doing so, firms can engage in dynamic value generation in conjunction with customers and third parties. Firms can seek to integrate technologies within the firm and with external sources in order to reach out and provide a platform for dynamic social interactions and distributed innovation processes (see Figure 3).

## Value Derived from Innovative Business Models

Firms must stay current amidst the constant change of business models. For instance, firms are attempting to develop retail environments within online virtual worlds (Hemp, 2006). Furthermore, firms

*Figure 3. Value derived from the interaction between the firm and public*




may consider how to develop or leverage web or mobile applications to advance firm goals (Holloway, 2008). Many Web 2.0 startups arise from identifying a new way to leverage Web 2.0 technologies, such as Twitter. Similarly, online firms may focus on implementing aspects of Web 2.0 technologies into their existing business models. For instance, online retailing environments may enable individual sellers to connect their web stores, thus leading to a virtual mall for online shoppers (Stephen & Toubia, 2009). Firms, both online and traditional, must stay on top potential changes to their business model in order to be competitive in this fast-paced environment.

### Risks Posed by Web 2.0 Initiatives

In seeking to gain value from Web 2.0 endeavors, firms must not ignore the risks associated with these technologies. Primarily, firms must control their exposure regarding information technology security. While these technologies inherently connect individuals within the firm and may connect the firm to outsiders, firms must maintain tight security standards in order to prevent unauthorized access or the introduction and spread of harmful computer viruses.

Similarly, firms should be wary of potentially unreliable information available from external sources. The potential for bad information in online settings is always a concern and is particularly relevant regarding wikis (Priedhorksy, et al., 2007). Therefore, firms should seek to validate information available in public sources before making significant investments based on such information.

## CONCLUSION

Web 2.0 technologies are not only changing the landscape of the internet, but changing the competitive environment for many firms. Firms that aggressively pursue Web 2.0 technologies may successfully develop competencies that enable a competitive advantage. Furthermore, firms that leverage Web 2.0 technologies to engage customers in a positive, value-generating manner may be able to generate virtuous cycles. In such a virtuous cycle, the interaction continually increases in quality.

## REFERENCES

Bell, S. (2009). WIKIS for Reference, Enthusiasts, and Government Information. *Online*, *33*(1), 20–23.

Boyd, D. M., & Ellison, N. B. (2007). Social Network Sites: Definition, History, and Scholarship. *Journal of Computer-Mediated Communication*, *13*, 210–230. doi:10.1111/j.1083-6101.2007.00393.x

Brown, T. (2008). Design Thinking. *Harvard Business Review*, *86*, 84–92.

Bughin, J. R., Chui, M., & Johnson, B. (2008). The next step in open innovation. *McKinsey Quarterly,* (4), 112-122.

Cash, J. J. I., Earl, M. J., & Morison, R. (2008). Teaming Up to Crack Innovation & Enterprise Integration. *Harvard Business Review*, *86*, 90–100.

Cayzer, S. (2004). Semantic blogging and decentralized knowledge management. *Communications of the ACM*, *47*(12), 47–52. doi:10.1145/1035134.1035164

Employees Using Web 2.0 Tools (2008). *CU360, 34*(19), 4-5.

Hemp, P. (2006). Are You Ready for E-tailing 2.0? *Harvard Business Review*, *84*(10), 28–28.

Henricks, M. (2009). RECRUITING 2.0. *Entrepreneur*, *37*(2), 55–57.

Holloway, L. (2008). trend: web. *Entrepreneur*, *36*(12), 68–68.

Ives, B., & Watlington, A. (2005). Using Blogs for Personal KM and Community Building. *Knowledge Management Review*, *8*(3), 12–15.

Jarvis, J. (2007). Dell Learns to Listen. *BusinessWeek*.

Lange, P. G. (2007). Publicly Private and Privately Public: Social Networking on YouTube. *Journal of Computer-Mediated Communication*, *13*, 361–380. doi:10.1111/j.1083-6101.2007.00400.x

Lee, S., Hwan, T., & Lee, H. H. (2006). Corporate blogging strategies of the Fortune 500 companies. *Management Decision*, *44*(3), 316–334. doi:10.1108/00251740610656232

MacMillan, D. (2009). Facebook, Meet the Locals. *Business Week Online*, 21-21.

McAfee, A. P. (2006). Enterprise 2.0: The Dawn of Emergent Collaboration. *Sloan Management Review*, *47*(3), 20–28.

Middleton, C. (2008). The social side of business. *Computer Weekly*, 26-27.

Miller, D. I. (2006). Collaborating through wikis. *CNet*.

O'Reilly, T. (2005). *What Is Web 2.0: Design Patterns and Business Models for the Next Generation of Software*. Retrieved from http://www.oreillynet.com/pub/a/oreilly/tim/news/2005/09/30/what-is-web-20.html

Parise, S., Guinan, P. J., & Weinberg, B. D. (2008). The Secrets of Marketing In a Web 2.0 World. *Wall Street Journal - Eastern Edition, 252*(141), R4.

Priedhorksy, R., Chen, J., Lam, S. K., Panciera, K., Terveen, L., & Riedl, J. (2007). *Creating, destroying, and restoring value in wikipedia.* Paper presented at the Conference on Supporting Group Work, Sanibel Island, Florida, USA.

Schwartz, J. (2005). If You Want to Lead, Blog. *Harvard Business Review*, *83*(11), 30–30.

Singh, T., Veron-Jackson, L., & Cullinane, J. (2008). Blogging: A new play in your marketing game plan. *Business Horizons*, *51*(4), 281–292. doi:10.1016/j.bushor.2008.02.002

Stephen, A. T., & Toubia, O. (2009). (Forthcoming). Deriving Value from Social Commerce Networks. *JMR, Journal of Marketing Research*.

Tapscott, D., & Williams, A. D. (2007). *Wikinomics: How Mass Collaboration Changes Everything*. New York: Penguin.

Wagner, C. (2004). Wiki: A Technology for Conversational Knowledge Management and Group Collaboration. *CAIS, 2004*(13), 265-289.

## KEY TERMS AND DEFINITIONS

**Web 2.0:** An umbrella term that refers to an assortment of advances in internet technologies, marked by increases in rich media, dynamic content, social networking elements, and distributed contributions.

**Rich Media:** Media, particularly images, video and sound, conveyed via internet technologies that provides a deeper user experience than simple text.

**Dynamic Content:** Internet content that can be modified and uploaded quickly which keeps users 'up-to-the-minute.'

**Social Networking Elements:** Web 2.0 applications embedded in web sites that enable users to uniquely identify and form connections with one another.

**Distributed Contributions:** The practice of leveraging the willing participation of users.

**Blogs:** Short for 'weblogs,' blogs are simple, content-driven sites that are updated regularly.

**Wikis:** Content-driven sites which are editable by all participants and focus on harnessing the collective knowledge of all users.

**Social Networking Sites (SNS):** Web-based platforms which enable many individuals to create individual profiles, find and connect with other users.

# Chapter 118
# Web 2.0:
## The Era of User Generated Content on Web Sites

**Jos van Iwaarden**
*Erasmus University, The Netherlands*

**Ton van der Wiele**
*Erasmus University, The Netherlands*

**Roger Williams**
*Erasmus University, The Netherlands*

**Steve Eldridge**
*The University of Manchester, UK*

## INTRODUCTION

The Internet has come of age as a global source of information about every topic imaginable. A company like Google has become a household name in Western countries and making use of its internet search engine is so popular that "Googling" has even become a verb in many Western languages. Whether it is for business or private purposes, people worldwide rely on Google to present them relevant information. Even the scientific community is increasingly employing Google's search engine to find academic articles and other sources of information about the topics they are studying.

Yet, the vast amount of information that is available on the internet is gradually changing in nature. Initially, information would be uploaded by the administrators of the web site and would then be visible to all visitors of the site. This approach meant that web sites tended to be limited in the amount of content they provided, and that such content was strictly controlled by the administrators. Over time, web sites have granted their users the authority to add information to web pages, and sometimes even to alter existing information. Current examples of such web sites are eBay (auction), Wikipedia (encyclopedia), YouTube (video sharing), LinkedIn (social networking), Blogger (weblogs) and Delicious (social bookmarking).

This development has become known as "Web 2.0", a term coined by Tim O'Reilly in 2004 (O'Reilly, 2007). Web 2.0 is defined as "the design of systems that harness network effects to get better the more people use them" (O'Reilly, 2006). This

DOI: 10.4018/978-1-61520-611-7.ch118

definition emphasizes the need for the active participation of many users. When few people contribute to a Web 2.0 site like Wikipedia, it will be of little use to people who visit the site. The term Web 2.0 seems to suggest that it represents a new version of the internet, which is not the case. In fact, one of the major criticisms of Web 2.0 is that it is built on the same internet technologies as the earlier version of the web.

So, the most important contribution of Web 2.0 is not in the software but in the information provided on the web sites. The involvement of the internet users in the contents of these web sites has been dubbed "user generated content", or UGC for short (Williams et al., 2009). The tremendous increase in UGC on the internet has important consequences for users of the internet, as well as companies whose products and services are the object of certain types of UGC. In user generated product and service reviews, potential buyers can read about aspects of products and services that the seller carefully tried to conceal, which can be of tremendous value to these potential buyers. On the other hand, the companies that sell products and services may find that some critical reviewers may simply be mistaken about certain details. It is clear that leading companies are just getting to grips with UGC and its consequences for their business. In the academic community, some interesting and promising research about UGC is slowly emerging.

This chapter reviews the existing scant research by putting it into a framework that is meant to cover the supply and demand for UGC. By doing so, this paper sheds light on an emerging phenomenon that will impact many companies in years to come. The two key objectives of this paper are (i) to look into the role of UGC in purchasing decisions, and (ii) to explain the strategic implications of UGC for online management of service quality.

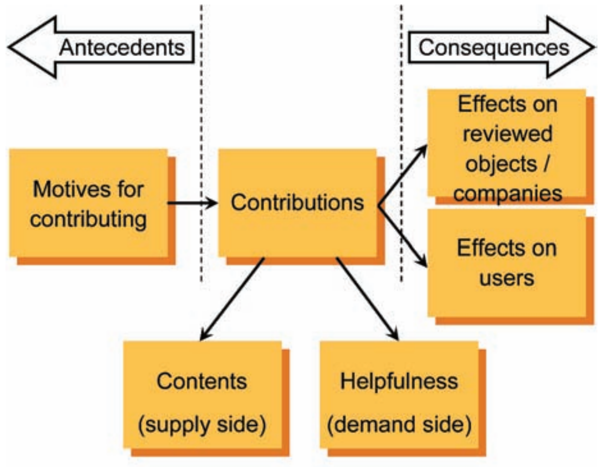
## BACKGROUND

There are currently many web sites that actively involve visitors in the provision of content. The success of these web sites even depends on UGC. A site like eBay is only useful to buyers if sellers offer a large variety of products. Similarly, YouTube can only entertain visitors if there are enough contributors who upload videos in all possible categories.

Yet, the nature of the content offered varies greatly, depending on the type of web site. Content on eBay is of a commercial nature, while content on YouTube is usually not. This issue is related to the motives that people have for putting UGC on a web site. Somebody uploading a video on YouTube may hope that he or she will one day become famous and therefore the video could potentially change the life of the uploader. However, of the millions of videos on YouTube, only very few actually become a real hit. When somebody offers a product for sale on eBay, he or she simply wants to exchange the product for money. There are however motives for contributing that are less tangible. Some people go to great lengths to solve computer problems that have been uploaded by less knowledgeable users. These people put in time and efforts while there is no monetary return of any kind. Apparently such people are driven by motives like a need to help other people, or the reward of public recognition of their IT skills. Borst and Van den Ende (2007) have undertaken research on motives for contributing to UGC web sites.

The differences between the various UGC web sites in terms of the content they offer and the motives contributors have, mean that the field of UGC is rather broad. For that reason, the remainder of this paper will zoom in on a specific type of UGC which consists of user generated product and service reviews. Web sites that provide this kind of UGC enable users to read reviews about products and services like hotels, restaurants, cars, books, DVDs etc. User generated product and

*Figure 1. Framework of the stages and elements in the development and use of UGC*




service reviews could potentially have a major impact on buyers and on the commercial success of the products and services involved.

## USER GENERATED PRODUCT AND SERVICE REVIEWS

This section will review the existing literature and discuss relevant findings. Based on the review of literature, a framework has been developed that contains the relevant stages and elements in the development and use of UGC.

This framework is presented in Figure 1.

The framework makes a distinction between the contributions (i.e. UGC) themselves, and their antecedents and consequences. These stages consist of one or more relevant elements. For each of the elements in the framework, some research findings are available. These will be reviewed, in order to explain the significance of these research findings in the broader context of UGC.

### Antecedents

The antecedents stage of the framework contains one element, i.e. the motives for contributing. The motives for contributing have been studied from a behavioral and psychological point of view, given that the vast majority of user contributions to web sites are not financially compensated (Borst & Van den Ende, 2007).

It appears that buyers of products and services tend to write on online review when they are either very satisfied or very dissatisfied with the experience they had. Authors disagree on which of the two extremes will more likely lead to a review. Research by Hu et al. (2007) has shown that in a sample of more than four million Amazon.com reviews (books, DVDs and videos) there was a clear bias towards both positive and negative reviews. However, the positive ones outnumbered the negative ones. Kelly (2009) argues that "clearly people feel more compelled to write when they have had a poor experience, probably to vent but also to warn others". His comments are based on a small scale study of hotel reviews on TripAdvisor.com.

So, it appears that only people with extreme experiences, both positive and negative, feel the urge to spend their time writing an online review. Kelly (2009) observed that reviewers also tend to react on each other's comments, which leads to a wave-like pattern in the reviews with a number of positive ones followed by a number of negative ones.

## Contributions

The contributions of users consist of the actual reviews that are available for everyone to read. Depending on the type of web site, these reviews can be quite extensive. In many cases they consist of a quantitative part in which certain aspects of a product or service are rated on predefined scales, as well as a qualitative part in which reviewers describe their experiences and perceptions. In addition to the information provided by the reviewer, sites like Amazon and TripAdvisor indicate how many people actually found the review helpful.

### Contents

When it comes to the contributions themselves, some research has been done on the supply side (the contents of a contribution), which is found to be biased to a rather large extent. The aforementioned research by Hu et al. (2006; 2007) concludes that there are two major problems with online product reviews. Firstly, there is a purchasing bias, which means that only consumers with a favorable disposition towards a product will actually buy the product and may then decide to write an online review. This increases the likelihood of positive reviews. Secondly, there is an under-reporting bias, which means that people with moderate views are much less likely to post a review than people with more extreme views. Hu et al. (2006; 2007) found that these biases lead to a J-shaped distribution curve, instead of the bell-shaped normal distribution that is generally found in an unbiased sample. Talwar et al. (2007) warn that "under these circumstances, using the arithmetic mean to predict quality (as most forums actually do) gives the typical user an estimator with high variance that is often false."

Combined with the conclusion of Kelly (2009) that positive reviews elicit a stream of negative reviews (and the other way around), it becomes clear that we should treat the reviews with care.

### Helpfulness

Surprisingly little attention has been paid to the helpfulness of the contributions (the demand side). Presumably, people upload reviews of products and services with the aim to inform prospective customers. Consequently, it would be interesting to find out to what extent users find the contributions useful in their decision making processes. When looking at an extremely popular review site like TripAdvisor (millions of visitors), it is striking to see how few people bother to say whether they found a review helpful or not (usually single digit numbers). This makes it difficult to tell whether the reviews rated as most helpful are really considered to be the most helpful (or even helpful at all) by the vast majority of visitors who do not rate the reviews.

According to data by Amazon (Economist, 2009) some reviewers do consistently score higher than others on the helpfulness scale. The most productive reviewer at Amazon.com has contributed more than 18,000 reviews, which were found to be helpful 71% of the time, while another productive reviewer managed to score 95% on the helpfulness scale with about 500 reviews (Economist, 2009).

The question remains if the helpfulness rating bears any relation with actual buying behavior of consumers.

## Consequences

The final stage in the framework concerns the consequences of UGC for both users of the information, as well as the products/services and companies that are being reviewed. With regards to the actual effects of UGC some evidence is available. Even if prospective customers find reviews of existing customers useful, they still may choose to act in a way that neglects these reviews.

The products, services and companies that are the object of the reviews also have various options in dealing with UGC. Consulting firms are offering companies services to deal with UGC.

## Effects on Users

Given the dramatic growth of web sites with user generated reviews, there apparently is a demand for such information. Several authors refer to online reviews as online word-of-mouth (Chevalier & Mayzlin, 2006; Forman et al., 2008; Williams et al., 2009). The power of word-of-mouth (WOM) promotion is generally acknowledged in the marketing literature. However, a major reason for the strength of WOM is in the fact that the communication is personal and between people who know each other. The online version of WOM lacks these major strengths since reviews are written by complete strangers.

A major problem for users of UGC is therefore to determine what to believe and what not. Some of the reviews may be written by people who have a (financial) interest in increased sales for a product or service. The most positive reviews may have been written by such people, which could lead users to consider such positive reviews as less credible (Chevalier & Mayzlin, 2006). Even when all reviews have been written by people who actually bought the product or service and who have no financial interest in writing a positive or negative review, it may still be very difficult to make sense of the reviews. Opinions on the exact same product or service often tend to vary greatly and because users have very little insight into who the reviewers are (in terms of lifestyle, interests, education, social status etc) it is difficult to decide who to believe. Forman et al. (2008) found that users prefer reviews that disclose the identity of the reviewer over reviews that do not.

Despite the difficulties in interpreting the reviews, they do seem to have influence on the buying behavior of customers. Research has shown that many people trust other people's reviews more than they trust expert opinion. Creamer (2007) reports that, in a study by industry research group Bazaarvoice, peer reviews are preferred over expert reviews by a margin of 6 to 1. Voight (2007) reports that the 2007 Edelman Trust Barometer which surveys nearly 2,000 opinion leaders in 11 countries indicated that for the second year in a row just over half the people in the USA said they trusted peers or "a person like me" for information about a company or product more than they trusted experts such as doctors and academics. In contrast, just four years ago, the same survey showed that only a fifth of respondents picked their peers as the most-trusted source.

One thing that UGC certainly achieves for the users is a reduction of the information asymmetry between buyers and sellers. Potential buyers are now much better than ever before able to judge products and services before the actual purchase. For the seller it has become much more difficult to conceal product flaws and poor performance.

## Effects on Companies

Given the effects that UGC has on users and therefore on consumers, it is important for companies to deal with this proactively. There are a growing number of consulting firms that focus specifically on building and maintaining online reputations. Services range from quick response to postings of dissatisfied customers, to suggesting the client's product to a reviewer who is dissatisfied with a competitor's product.

There is of course a thin line between such activities and deceit. Companies could post very positive anonymous reviews for their own products and very negative ones for competing products. It is obviously very difficult to find evidence of such activities, although a technical problem at Amazon once revealed the true identities of book reviewers which in some cases turned out to be the authors themselves (Chappell, 2004). The question is whether companies have higher moral standards than such authors.

Yet, research has pointed out that there is no need for companies to give in to such immoral behavior. In fact, a small number of bad reviews are worth having because any sensible consumer will understand that it is virtually impossible for all buyers to be happy with the product (Economist, 2009). It appears that having reviews is maybe even more important than the actual ratings being very high. Experiments by Bazaarvoice have found that having more than 10 reviews for a product significantly increases the sales level of that product compared to the ones that have none or very few reviews (Economist, 2009). Other studies add to this that the effects of online reviews diminish as the time since the product's release becomes longer (Hu et al., 2008), and that the presence of reviews on web sites increases satisfaction with both the site and the retailer (Freed, 2007).

So, even though companies may be reluctant to empower the general public by allowing them to put reviews on the companies' web sites, there are clear advantages to be had from UGC. Generally, a positive effect on both sales and customer satisfaction can result from UGC.

Moreover, companies can even use the online community to its benefit by starting up conversations with reviewers. Companies that react to online reviews can often freely obtain valuable suggestions for improvement, by simply asking reviewers for possible solutions to problems they have encountered with the company's products and services.

## CONCLUSION AND FUTURE RESEARCH DIRECTIONS

The review presented in this article has shown that UGC is an important development for both customers and companies. At the same time, it is clear that research into this area is still limited. Many of the currently available sources provide anecdotal evidence that lacks a clear research methodology.

This chapter has put the various aspects of UGC in perspective by building and discussing a framework that contains the relevant stages and elements in the development and use of UGC. For each of the framework's elements there is a need for sound research that generates answers to the many questions that remain. How do users make sense of user generated reviews? Why are some reviews considered more helpful than others? To what extent do reviews replace other means of information gathering about products and services that have traditionally been used for decision making by buyers? What strategic options do companies have in dealing with UGC?

## REFERENCES


Borst, I., & Van den Ende, J. (2007). *Financial rewards in open sourcing models: The case of multimedia services*. Erasmus University working paper.

Chappell, D. A. (2004). Anonymous Amazon critics revealed. *O'Reilly XML Blog*. February 15. Retrieved March 9, 2009, from http://www.oreillynet.com/xml/blog/2004/02/anonymous_amazon_critics_revea_1.html

Chevalier, J. A., & Mayzlin, D. (2006). The effect of word of mouth on sales: Online book reviews. *JMR, Journal of Marketing Research*, *43*(3), 345–354. doi:10.1509/jmkr.43.3.345

Creamer, M. (2007). At last, the reviews are in: Wal-Mart wakes up to the power of the people. *Advertising Age*, July 23. Retrieved March 9, 2009, from http://adage.com/article?article_id=119456

Forman, C., Ghose, A., & Wiesenfeld, B. (2008). Examining the relationship between reviews and sales: The role of reviewer identity disclosure in electronic markets. *Information Systems Research*, *19*(3), 291–313. doi:10.1287/isre.1080.0193

Freed, L. (2007, Spring). Customer reviews drive online satisfaction, recommendation and loyalty. *ForeSee Results Report*, 1-6. Retrieved March 12, 2009, from http://www.foreseeresults.com/_downloads/researchcommentary/Top-100-Customer-Reviews-Spring-07.pdf

Hu, N., Liu, L., & Zhang, J. (2008). Do online reviews affect product sales? The role of reviewer characteristics and temporal effects. *Information Technology and Management*, *9*(3), 201–214. doi:10.1007/s10799-008-0041-2

Hu, N., Pavlou, P. A., & Zhang, J. (2006). Can online reviews reveal a product's true quality? In *Proceedings of ACM Conference on Electronic Commerce (EC 06).*

Hu, N., Pavlou, P. A., & Zhang, J. (2007). Why do online product reviews have a J-shaped distribution? Overcoming biases in online word-of-mouth communication. *Communications of the ACM.*

Kelly, M. (2009). TripAdvisor, where truth is a matter of opinion. *Travel Trends*, January 19. Retrieved March 5, 2009, from http://www.traveltrends.biz/ttn448-tripadvisor-commentary-by-martin-kelly

O'Reilly, T. (2006). Web 2.0 compact definition: Trying again. *O'Reilly Radar*, December 10. Retrieved March 5, 2009, from http://radar.oreilly.com/2006/12/web-20-compact-definition-tryi.html

O'Reilly, T. (2007). What is Web 2.0: Design patterns and business models for the next generation of software. *Communications & Strategies*, *65*, 17–37.

Talwar, A., Jurca, R., & Faltings, B. (2007). Understanding user behavior in online feedback reporting. In *Proceedings of ACM Conference on Electronic Commerce (EC 07).*

The Economist. (2009, March 7). Fair comment. *The Economist Technology Quarterly*, 10-11.

Voight, J. (2007). Getting a handle on customer reviews. *Adweek*, July 2. Retrieved March 9, 2009, from http://www.adweek.com/aw/esearch/article_display.jsp

Williams, A. R. T., Van der Wiele, A., Van Iwaarden, J. D., & Eldridge, S. (2009). (forthcoming). The importance of user generated content: The case of hotels. *TQM Journal*.

## ADDITIONAL READING

Van Iwaarden, J. D., Van der Wiele, A., Ball, L., & Millen, R. (2004). Perceptions about the quality of web sites: A survey amongst students at Northeastern University and Erasmus University. *Information & Management*, *41*(8), 947–959. doi:10.1016/j.im.2003.10.002

## KEY TERMS AND DEFINITIONS

**Web 2.0:** The design of better systems that harness network effects the more people use them.

**UGC:** User generated content on web sites.

**UGC Site:** A web site that allows its users to upload content.

**Online Review:** A consumer's assessment of a product or service which he/she put on a web site.

**Motives for Contributing:** The reasons why people create UGC.

**Contributions:** The actual online reviews that are available for everyone to read.

**Effects of UGC:** The consequences of UGC for both users of the information, as well as the products/services and companies that are being reviewed.

# Chapter 119
# Web 2.0 Concepts, Social Software and Business Models

**Matthes Fleck**
*University of St. Gallen - mcminstitute, Switzerland*

**Andrea von Kaenel**
*University of St. Gallen - mcminstitute, Switzerland*

**Miriam Meckel**
*University of St. Gallen - mcminstitute, Switzerland*

## ABSTRACT

*This article provides an overview of the most prominent definitions, basic concepts and applications of the term Web 2.0. In addition to the seven principles outlined by O`Reilly, this article will investigate Anderson's long tail concept, issues of transparency and the effects of an interconnected user base on E-Business. Later, the focus will shift from the concepts of Web 2.0 towards the social software applications of this new Web era. Blogs, social network sites, wikis, folksonomies and virtual worlds will be explained and their (potential) relevance to e-business will be outlined. The article closes with a brief discussion about the future research directions of Web 2.0 for successful E-Business.*

## INTRODUCTION

The Internet has become a social catalyst of great importance. In particular, the term Web 2.0 represents a wide range of changes which are worth investigating, specifically with respect to their influence on E-Business. Although Web 2.0 has technical connotations, it describes, first and foremost, the social dynamics of the Internet (Hoegg, Meckel, Stanoevska-Slabeva, & Martignoni, 2006). In its essence, the term Web 2.0 describes the evolution from a read-only Web to a read-write Web (Warr, 2008).

DOI: 10.4018/978-1-61520-611-7.ch119

Coined by Tim O`Reilly (2005, 2006), the term Web 2.0 was used to describe developing forms of web-based co-operation and data exchange. Later, Web 2.0 became a generic expression for the fundamental changes of the Internet. The concepts and ideas of mass collaboration (Tapscott & Williams, 2006), collective intelligence (Albrycht, 2006; Surowiecki, 2004), knowledge exchange (Haythornthwaite, 2005a), boundless democracy (Rheingold, 2002) and the integration of niche offers and remote corners (Anderson, 2006) had been outlined previously by Web 1.0 visionaries. The development of Web 2.0 made possible the interaction and communication of users through the production and exchange of information based on platforms such as Weblogs (Blood, 2004; Schmidt, 2007), social networks (boyd & Ellison, 2007), social bookmarking sites (Golder & Huberman, 2005, 2006), wikis (Spinellis & Louridas, 2008) and virtual worlds (Louie, 2007). These new technologies allowed the creation, modification and distribution of almost every imaginable kind of digital content and led to new social and economic phenomena. The current article investigates the most relevant concepts and platforms of Web 2.0 as well as provides an overview of social software and its (potential) uses within E-Business.

## BACKGROUND

### The Concept of Web 2.0

After the collapse of the dot-com bubble, Tim O'Reilly compiled the following seven principles that exemplified the term "Web 2.0" (O'Reilly, 2005, 2006; Warr, 2008). These seven principles, could be subdivided into the primary drivers of Web 2.0 development and the primary design principles of Web 2.0.

- The Web as platform
- Harnessing collective intelligence
- Data as the next "Intel Inside"
- Perpetual Beta
- Lightweight software and business models with cost-effective scalability
- Software above the level of a single device
- Rich user experience

#### The Web as Platform

Web 2.0 must be understood as a Platform which is loosely tied together through its users and applications. The more users who participate, the stronger and better the Platform becomes. Small pieces of information and services are recombined by users leading to an immense variety of social software applications. In the language of relational view, "critical resources may span firm boundaries and may be embedded in inter-firm resources and routines" (Dyer & Singh, 1998, p. 660). Unique data and user participation are the primary resources of those platforms. Technical routines such as RSS (Really Simple Syndication) and API (Application Programming Interface) allow the simple exchange and recombination of these resources.

#### Harnessing Collective Intelligence

Web 2.0 is based on the strength of collective intelligence. Amazon.com, for example, uses the power of collective intelligence in product reviews by its users to influence the buying decisions of others. This information in these reviews enables more targeted search results for customers, increasing customer value and satisfaction as well as increasing site traffic. The online encyclopedia Wikipedia was founded on the idea that the more people who participate in generating and refining content, the more useful it becomes to its users. The effects of large-scale user collaboration in knowledge systems have been outlined by James Surowiecki (2004) and have been termed crowd wisdom. Collective intelligence is regarded as a core pattern of Web 2.0, relying upon positive network effects and permanent peer review (Warr, 2008) to increase transparency and credibility.

#### Data as the Next "Intel Inside"

Each Internet application is based on some type of specialized data. Those data might be products, sellers, maps, songs or user profiles. The control over exclusive databases can lead to market control and, consequently, outsized financial returns. Therefore, unique collections of data have become a strategic resource (Barney, 1991) for companies operating in the Web.

## Design Principles of Web 2.0

In addition to the drivers or elementary principles mentioned above, Web 2.0 follows some elementary design principles: perpetual Beta, lightweight software, business models with cost effective scalability, software above the level of a single device and a rich user experience.

*Perpetual Beta* is a new understanding of classic product lifecycle management introduced by Levitt (1965). Software in the Web 2.0 era must be understood as a service which has to be maintained daily with users as co-developers. Extensive co-development is only possible through *lightweight programming models (LPMs)* which have low barriers to modification using programming languages such as AJAX. Consistent with Lessig's definition of (2004) "Free culture," intellectual property has to be managed with only some rights reserved instead of all rights reserved. *Software* must also be *above the level of a single device* meaning that software can be accessed by computers, handhelds and other mobile devices using a set of diverse operating systems. *Rich user experiences* of Web applications will allow users to benefit from almost PC-equivalent interactivity.

## Long Tail

In addition to the principles outlined by O'Reilly, the idea of a long tailed Internet (Anderson, 2006) is of great importance in understanding the relevance of Web 2.0 for E-Business. With the long tail concept it is also possible to reflect the economic consequences resulting from the power law distribution of Internet sites (Albert, Jeong, & Barabasi, 1999). Anderson's work is based on the observations of Brynjolfsson, Yu and Smith (2003) who argued the following:

> *... limits on the number of titles Internet retailers can present and sell to consumers are substantially lower [than in conventional retail outlets]. As a result, Internet customers have easy access to millions of products that they could not easily locate or purchase through brick-and-mortar retailers.* (p. 1592)

Digital products can be developed at virtually no additional cost. It is a viable strategy for online retailers to "sell less of more" (Enders, Hungenberg, Denker, & Mauch, 2008, p. 201). Thus, it is possible and profitable to offer products that sell only in small quantities. In addition, the long tail does not only describe business strategies in Web 2.0 but it also explains why almost every blog finds a reader but only a few are popular (Shirky, 2004), why social networks sites have so many profiles, why Wikipedia has entries on the most irrelevant topics and how virtual shoe selling has become a business in Second Life.

# Social Software and Business Models

Social software summarizes a variety of services, platforms and applications within Web 2.0 including blogs, social network sites, folksonomies, wikis and virtual worlds.

## Blogs

Weblogs ("blogs" for short) are online publications that are characterized by short entries usually written in an expressive and authentic style, typically arranged in reverse chronological order. One of the most interesting features of blogs is the functionality that enables comments on each entry (Kolbitsch & Maurer, 2006; Rosenbloom, 2004). This enables an open discussion for every post that is made, fostering dialog among the blog's author and his/her readers (Zerfass & Boelter, 2005). Other definitions describe blogs as "a Web page where a Web logger 'logs' all the other Web pages she finds interesting" (Blood, 2004, p. 53) or they describe the act of blogging as "to blog is to continually post one's own ideas, opinions, Internet links (including those for other blogs), and so on about things on one's own Website, which is called a web log" (Smudde, 2005, p. 34). All of these definitions emphasize the fact that blogs are online publications that are regularly updated and are based on the personal opinions of the author. The collective comments and links on blogs form a clustered network termed the blogosphere (Schmidt, 2007). Due to the complexity and vitality of the blogosphere, it is almost impossible to accurately estimate the total number of blogs forming this collaborative network. Blog search engines such as technorati.com or blogpulse.com index more than 133 million blogs worldwide (Technorati, 2008). This is not an easy task, considering the vitality of the blogosphere: almost every second blog is abandoned after merely three months, but a new blog is set up every 1.4 seconds (Sifry, 2007). Although only a few bloggers generate significant income from ad sales (Technorati, 2008), blogging is of great importance for E-Business since bloggers report on the latest trends and review new products and services. In addition, corporate blogs can be a useful instrument to present a company or its products to customers (Fleck, Kirchhoff, Meckel, & Stanoevska-Slabeva, 2007).

## Social Network Sites

According to boyd [sic] and Ellison (2007):

*Social network sites ... [are] Web-based services that allow individuals to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection, and (3) view and traverse their list of connections and those made by others within the system.*

While every social network site requires its users to create a public profile, the scope of each site varies greatly. Facebook, for example, focused first on students' friend networks, while network sites like Linkedin or Xing offered to manage a user's business contacts. Myspace, in contrast, did not address a special audience instead focusing on special interest topics such as music and lifestyle. No matter which niche social network sites have addressed, they have become a widely accepted tool to manage the contacts and relationships of individuals, helping to discover latent ties, recast weak ties (Haythornthwaite, 2005b) and bridge structural holes (Burt, 1982, 1992). Business models of such sites are primarily ad-sales or subscription driven. However, the relevance of social networking sites for E-Business is not just in their innovative business models but also (and, perhaps, more importantly) in their function as aggregators of demographic information of their users.

## Collectively Arranged Metadata: Folksonomies and Tags

Within the Web 2.0 movement many applications become more useful as more users use them. One example is collaborative Tagging, a process that collectively creates and manages metadata about digital content (Golder & Huberman, 2006). The collections of individually assigned metadata about objects - URLs, for example - are called folksonomy. The term folksonomy is based on the idea of Thomas Vander Wal who combined the words folk and taxonomy (Mathes, 2004). The process of assigning tags or labels to Websites and URLs is also often referred to as social bookmarking. The primary idea behind these applications is that users will find content more easily. The tags help to classify digital content like pictures or videos. Such metadata may not be as accurate as that from a professional librarian, but it is more flexible, faster and cheaper than professional metadata assignment. Therefore, folksonomies have become an important user-administrated alternative to search engines or other instruments for navigating the Web. Within E-Business, such applications are powerful tools to index and describe new products in terms that customers understand best.

### Wikis

A wiki is Web-based software that allows all visitors of a Website to edit its content. Wikis are easy-to-use, browser-operated platforms that enable collaborative work on text and hypertexts on the Internet (Ebersbach & Glaser, 2005). The idea of fast changes to any document is also reflected by the term wiki itself which is Hawaiian for quick (Leuf & Cunningham, 2001). In contrast to blogs, the content of wikis tends to be more unbiased as the author allows the readers to re-edit the original contribution. Through multiple revisions of an article by a number of different authors, the article becomes more credible (Kolbitsch & Maurer, 2006). Wikis are an example of the wisdom of crowds - a concept introduced by Surowiecki (2004) which describes the aggregation of information in groups leading to much better results than those based on a single author (Warr, 2008). One of the most popular applications of wiki software is the online encyclopedia, Wikipedia, which contained nearly 2.78 million articles as of March 2008 (see Wikipedia.org). Wikis allow customer-centric Web sites. As Wagner and Majchrzak (2006) emphasize, wikis are a paradigm shift in the co-creation of knowledge between a company and its customers.

### Virtual Worlds

In recent years, online computer games have developed into complex online environments that allow multiple interactions among users from all over the world in 3D environments. These massive multiplayer online games (MMOG) have gained in popularity in the form of either massive multiplayer online role-play games (MMOPRG) such as the online-game "World of Warcraft" or as multi-user environments (MUVE) with unstructured worlds such as the virtual world, "Second Life." Classic MMOPRG business models are often based on user subscriptions and typically follow clearly defined rules (Mennecke et al., 2008). MUVEs have a more open approach and combine elements of chat-rooms, user-generated content and 3D browsing.

Currently populated with approximately 20 million users (Warr, 2008), Second Life is a MUVE that has rapidly gained in popularity among users worldwide. Second Life is a 3D online digital world inhabited, imagined and created by avatars representing the alter egos of real world people. It offers users the ability to create digital goods of almost every imaginable kind. Furthermore, these digital goods remain the intellectual property of the creator. Interestingly, the Second Life platform is bound to a virtual currency called the Linden dollar, which is convertible into US dollars (Wandt, 2007). Thus, Second Life offers a wide range of economic transactions and relations mostly based on micropayments. Virtual worlds have been used to explain complex products (Edery, 2006; Grigorovici & Constantin, 2004), as a place for customer services (Borremanns, 2007) and as a place for human resource management (Krell, 2007).

## FUTURE RESEARCH DIRECTIONS

One of the challenges for Web 2.0 applications is that business and revenue models are poorly developed. While various sites and services may have many (active) users, only a few of them earn revenue from their activities. This challenge becomes more critical given that Web 2.0 is eroding conventional media business models like newspapers, ad sales and encyclopedia printing without providing an alternative revenue stream.

In addition, questions of governance and transparency have to be clarified: who owns user generated data, how trustworthy is user generated data and who is allowed to benefit from it? With respect to social software as a marketing and communication instrument, the conditions under which users willingly invest time and knowledge in order to interact with a company must be better understood. Moreover, defining what conditions nurture viral effects of social software must be further explored. In terms of Web 2.0 as a collective knowledge management tool, quality standards must be set and incentive strategies adopted to encourage the participation of the most active contributors.

## CONCLUSION

Web 2.0 has become a relevant part of our daily lives. Weblogs offer information on almost any niche topic. Friends and colleagues meet and interact via social network sites. Folksonomies or social bookmarking sites have become the TV-Guide for the Internet. Wikis deliver a quick answer to many urgent questions and virtual worlds are places for our "second lives".

Web 2.0 embodies a network of services and people in which content, knowledge and social contacts are created, edited and managed with low technical and social barriers, fostering new kinds of social interaction, creativeness and economic activity. Undoubtedly, Web 2.0 will offer something even more exciting in the years to come.

## REFERENCES

Albert, R., Jeong, H., & Barabasi, A. L. (1999). Diameter of the World-Wide Web. *Nature*, *401*(9), 130–131. doi:10.1038/43601

Albrycht, E. (2006). From information overload to collective intelligence: Social bookmarking, tagging and folksonomy. *Public Relations Tactics*, *13*(1), 16–17.

Anderson, C. (2006). *The long tail*. London: Random House.

Barney, J. (1991). Firm Resources and Sustained Competitive Advantage. *Journal of Management*, *17*(1), 99. doi:10.1177/014920639101700108

Blood, R. (2004). How Blogging Software Reshapes the Online Communication. *Communications of the ACM*, *47*(12), 53–55. doi:10.1145/1035134.1035165

Borremanns, P. (2007). Clarifying IBM's strategic mission for social media. *Strategic Communication Management*, *11*, 24–27.

boyd, d.m., & Ellison, N. B. (2007). Social Network Sites: Definition, History, and Scholarship. *Journal of Computer-Mediated Communication, 13*(1), 210-230.

Brynjolfsson, E., Yu, H., & Smith, M. D. (2003). Consumer Surplus in the Digital Economy: Estimating the Value of Increased Product Variety at Online Booksellers. *Management Science*, *49*(11), 1580–1596. doi:10.1287/mnsc.49.11.1580.20580

Burt, R. S. (1982). *Toward a Structural Theory of Action: Network Models of Social Structure, Perception, and Action*. New York: Academic Press.

Burt, R. S. (1992). *Structural holes the social structure of competition*. Cambridge, MA: Harvard University Press.

Dyer, J. H., & Singh, H. (1998). The relational view: cooperative strategy and sources of interorganizational competitive advantage. *Academy of Management Review*, *23*(4), 660–679. doi:10.2307/259056

Ebersbach, A., & Glaser, M. (2005). Wiki. *Informatik-Spektrum*, *28*(2), 131–135. doi:10.1007/s00287-005-0480-7

Edery, D. (2006). Reverse Product Placement in Virtual Worlds. *Harvard Business Review*, *84*(12), 24–24.

Enders, A., Hungenberg, H., Denker, H.-P., & Mauch, S. (2008). The long tail of social networking.: Revenue models of social networking sites. *European Management Journal*, *26*(3), 199–211. doi:10.1016/j.emj.2008.02.002

Fleck, M., Kirchhoff, L., Meckel, M., & Stanoevska-Slabeva, K. (2007). Applications of Blogs in Corporate Communication. *Studies in Communication Sciences, 7*(2).

Golder, S. A., & Huberman, B. A. (2005). The structure of collaborative Tagging Systems. *Journal*.

Golder, S. A., & Huberman, B. A. (2006). Usage patterns of collaborative tagging systems. *Journal of Information Science*, *32*(2), 198–208. doi:10.1177/0165551506062337

Grigorovici, D. M., & Constantin, C. D. (2004). Experiencing Interactive Advertising beyond Rich Media:Impacts of Ad Type and Presence on Brand Effectiveness in 3DGaming Immersive Virtual Environments. *Journal of Interactive Advertising, 4*(3), N.PAG.

Haythornthwaite, C. (2005a). Introduction: Computer-mediated collaborative practices. *Journal of Computer-Mediated Communication*, *10*(4).

Haythornthwaite, C. (2005b). Social networks and Internet connectivity effects. *Information Communication and Society*, *8*(2), 125–147. doi:10.1080/13691180500146185

Kolbitsch, J., & Maurer, H. (2006). The Transformation of the Web: How Emerging Communities Shape the Information we Consume. *Journal of Universal Computer Science*, *12*(2), 187–213.

Krell, E. (2007). HR Challenges in Virtual Worlds. *HRMagazine*, *52*(11), 85–88.

Lessig, L. (2004). *Free culture: How big media uses technology and the law to lock down culture and control creativity*. New York: Penguin.

Leuf, B., & Cunningham, W. (2001). *The wiki way*. Upper Saddle River, NJ: Addison-Wesley.

Levitt, T. (1965). EXPLOIT the Product Life Cycle. *Harvard Business Review*, *43*(6), 81–94.

Louie, A. W. M. (2007). Designing Avatars In Virtual Worlds: How Free Are We To Play Superman? *Journal of Internet Law*, *11*(5), 3–12.

Mathes, A. (2004). *Folksonomies - Cooperative Classification and Communication Through Shared Metadata: Computer Mediated Communication - LIS590CMC*.

Mennecke, B. E., McNeill, D., Ganis, M., Roche, E. M., Bray, D. A., Konsynski, B., et al. (2008). Second Life and Other Virtual Worlds: A Roadmap for Research. *Communications of AIS, 2008*(22), 371-388.

O'Reilly, T. (2005). *What Is Web 2.0: Design Patterns and Business Models for the Next Generation of Software.* Retrieved March, 1st, 2007.

O'Reilly, T. (2006). Web 2.0 Compact Definition: Trying Again. *Sebastopol: O'Reilly Media.* Retrieved March 22, 2007, from http://radar. oreilly. com/archives/2006/12/Web_20_compact. html

Rheingold, H. (2002). *Smart mobs the next social revolution transforming cultures and communities in the age of instant access*. Cambridge, UK: Basic books.

Rosenbloom, A. (2004). THE Blogosphere. *Communications of the ACM*, *47*(12), 32–33. doi:10.1145/1035134.1035161

Schmidt, J. (2007). Blogging Practices: An Analytical Framework. *Journal of Computer-Mediated Communication*, *12*(4), 1409–1427. doi:10.1111/j.1083-6101.2007.00379.x

Shirky, C. (2004). *Power laws, weblogs, and inequality*. Retrieved May 12, 2009, from http://www.shirky.com/writings/powerlaw_weblog.html

Smudde, P. (2005). Blogging, Ethics and Public Relations: A Proactive and Dialogic Approach. *Public Relations Quarterly*, *50*(3), 34–38.

Spinellis, D., & Louridas, P. (2008). The Collaborative Organization of Knowledge. *Communications of the ACM*, *51*(8), 68–73. doi:10.1145/1378704.1378720

Surowiecki, J. (2004). *The Wisdom of Crowds: Why the Many Are Smarter Than the Few and How Collective Wisdom Shapes Business, Economies, Societies and Nations*. New York: Doubleday.

Tapscott, D., & Williams, A. D. (2006). *Wikinomics: How Mass Collaboration Changes Everything*. New York: Penguin.

Technorati. (2008). State of the Blogosphere / 2008. *Journal*. Retrieved December 16, 2008, from http://technorati.com/blogging/state-of-the-blogosphere/

Wagner, C., & Majchrzak, A. (2006). Enabling Customer-Centricity Using Wikis and the Wiki Way. *Journal of Management Information Systems*, *23*(3), 17–43. doi:10.2753/MIS0742-1222230302

Warr, W. A. (2008). Social software: fun and games, or business tools? *Journal of Information Science*, *34*(4), 591–604. doi:10.1177/0165551508092259

Zerfass, A., & Boelter, D. (2005). *Die neuen Meinungsmacher Weblogs als Herausforderung für Kampagnen, Marketing, PR und Medien*. Graz, Austria: Nausner & Nausner.

## ADDITIONAL READING

Bachnik, W., Szymczyk, S., & Leszczynski, P. R. E., R., & Kurylo, L. (2005). Quantitative Sociological Analysis of Blog Networks. *arXiv:physics, 1*.

Barabasi, A.-L. (2003). *Linked how everything is connected to everything else and what it means for business, science, and everyday life* (Reprinted ed.): Plume.

Bruns, A. (2007). Methodologies for mapping the blogosphere: An exploration using the issue crawler tool. *first monday, 12*(1).

Dearstyne, B. W. (2005). BLOGS The New Information Revolution? *Information Management Journal*, *39*(5), 38–44.

Dearstyne, B. W. (2007). Blogs, Mashups, & Wikis Oh, My! *Information Management Journal*, *41*(4), 24–33.

Dellarocas, C. (2003). The Digitization of Word of Mouth: Promise and Challenges of Online Feedback Mechanisms. *Management Science*, *49*(10), 1407–1424. doi:10.1287/mnsc.49.10.1407.17308

Ellison, N. B., Steinfield, C., & Lampe, C. (2007). The Benefits of Facebook HFriends:" Social Capital and College Students' Use of Online Social Network Sites. *Journal of Computer-Mediated Communication*, *12*(4), 1143–1168. doi:10.1111/j.1083-6101.2007.00367.x

Fieseler, C., Fleck, M., & Stanoevska-Slabeva, K. (2008). Corporate Blogs als Instrumente einer nachhaltigen Markenführung online. Kundendialog im Netz mt hohem Anspruch. *Marketing Review St. Gallen. Die neue Thexis – Fachzeitschrift für Marketing* (4).

Garton, L., Haythornthwaite, C., & Wellman, B. (1997). Studying Online Social Networks. *JCMC, 3*(1).

Halavais, A., & Lackaff, D. (2008). An Analysis of Topical Coverage of Wikipedia. *Journal of Computer-Mediated Communication*, *13*(2), 429–440. doi:10.1111/j.1083-6101.2008.00403.x

Hanneman, R. A., & Riddle, M. (2005). Introduction to social network methods, Available from http://faculty.ucr.edu/~hanneman/.

Herring, S. C., Kouper, I., Paolillo, J. C., Scheidt, A., Tyworth, M., Welsch, P., et al. (2005). *Conversations in the Blogosphere: An Analysis from "Bottum up"*. Paper presented at the HICSS-38, Los Alamitos.

Huberman, B. A. (2001). *The laws of the Web: Patterns in the ecology of information*. Cambridge: MIT Press.

Kumar, R., Novak, J., Raghavan, P., & Tomkins, A. (2004). Structure and Evolution of Blogspace. *Communications of the ACM*, *47*(12). doi:10.1145/1035134.1035162

Kumar, R., Novak, J., Raghavan, P., & Tomkins, A. (2005). On the Bursty Evolution of Blogspace. *World Wide Web (Bussum)*, *8*(2), 159–178. doi:10.1007/s11280-004-4872-4

Lee, D., Im, S., & Taylor, C. R. (2008). Voluntary self-disclosure of information on the Internet: A multimethod study of the motivations and consequences of disclosing information on blogs. *Psychology and Marketing*, *25*(7), 692–710. doi:10.1002/mar.20232

Lee, S., Hwang, T., & Lee, H. H. (2006). Corporate blogging strategies of the Fortune 500 companies. *Management Decision*, *44*(3), 316–334. doi:10.1108/00251740610656232

Mennecke, B. E., McNeill, D., Ganis, M., Roche, E. M., Bray, D. A., Konsynski, B., et al. (2008). Second Life and Other Virtual Worlds: A Roadmap for Research. *Communications of AIS, 2008*(22), 371-388.

Parameswaran, M., & Whinston, A. B. (2007). Research Issues in Social Computing. *Journal of the Association for Information Systems*, *8*(6), 336–350.

Park, H. W. (2003). Hyperlink Network Analysis: A new method for the study of social structure in the Web. *Connections*, *25*(1), 49–61.

Rice, R. E. (1994). Network analysis and computer-mediated communication systems. In S. Wasserman & J. Galaskiewicz (Eds.), *Advances in social network analysis* (pp. 167-203).

Schuster, M. (2004). *Applying Social Network Theory to a small Weblog Community. Hubs, Power Laws and the Community Core.* Paper presented at the Blogtalks 2.0 International conference on Weblogs.

Seltzer, T., & Mitrook, M. A. (2007). The dialogic potential of Weblogs in relationship building. *Public Relations Review*, *33*(2), 227–229. doi:10.1016/j.pubrev.2007.02.011

Spinellis, D., & Louridas, P. (2008). The Collaborative Organization of Knowledge. *Communications of the ACM*, *51*(8), 68–73. doi:10.1145/1378704.1378720

Sweetser, K. D., & Metzgar, E. (2007). Communicating during crisis: Use of blogs as a relationship management tool. *Public Relations Review*, *33*(3), 340–342. doi:10.1016/j.pubrev.2007.05.016

Tapscott, D., & Williams, A. D. (2006). *Wikinomics: How Mass Collaboration Changes Everything* (Vol. New York): Penguin.

Trammell, K. D., & Keshelashvili, A. (2005). Examining the New Influencers: A Self-Presentation Study of A-List Blogs. *Journalism & Mass Communication Quarterly*, *82*(4), 968.

Trammell, K. D., Williams, A. P., Postelnicu, M., & Landreville, K. D. (2006). Evolution of Online Campaigning: Increasing Interactivity in Candidate Web Sites and Blogs Through Text and Technical Features. *Mass Communication & Society*, *9*(1), 21–44. doi:10.1207/s15327825mcs0901_2

Trufelman, L. P. (2005). Consumer-generated media – challenges and opportunities for public relations. *Public Relations Tactics*, *12*(5), 17–27.

Wagner, C., & Majchrzak, A. (2006). Enabling Customer-Centricity Using Wikis and the Wiki Way. *Journal of Management Information Systems*, *23*(3), 17–43. doi:10.2753/MIS0742-1222230302

Wasserman, S., & Faust, K. (1994). *Social network analysis methods and applications* (paperback ed.). Cambridge: Cambridge University Press.

Xifra, J., & Huertas, A. (2008). Blogging PR: An exploratory analysis of public relations Weblogs. *Public Relations Review*, *34*(3), 269–275. doi:10.1016/j.pubrev.2008.03.022

## KEY TERMS AND DEFINITIONS

**Web 2.0:** Web 2.0 embodies a network of services and individuals in which content and knowledge, as well as social contacts, are created, edited and managed with low technical and social barriers fostering new kinds of social interaction, creativeness and economic activity.

**Long Tail:** The long tail concept developed by Chris Anderson describes the fact that products in the Internet can be offered with low marginal costs. This leads to a broad variety of niche offers and fulfillment of almost any user demand based on (Anderson, 2006), (Brynjolfsson et al., 2003), and (Enders et al., 2008).

**Crowd Wisdom:** Crowd wisdom is a concept popularized by James Surowiecki based on the assumption that the aggregation of information in groups results in much better results than those based on a single member of the crowd based on (Surowiecki, 2004), and (Warr, 2008).

**Blog:** Weblogs or blogs for short are online publications that are characterized by short entries which are usually written in an expressive and authentic style and are arranged in reverse chronological order. The comments and links on all blogs in existence on the Internet form a clustered network termed the blogosphere based on (Schmidt, 2007), and (Zerfass & Boelter, 2005).

**Social Network Sites:** Social network sites are Web-based services that allow individuals to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection, and (3) view and traverse their list of connections and those made by others within the system (boyd & Ellison, 2007).

**Folksonomy:** Folksonomies are collections of collectively created and managed metadata about digital content by a process called collaborative Tagging based on (Golder & Huberman, 2005), and (Golder & Huberman, 2006).

**Wiki:** A Wiki is Web-based software which allows all visitors of a Website to edit its content. This makes them easy-to-use, browser-operated platforms that enable collaborative work on text and hypertexts in the Internet based on (Ebersbach & Glaser, 2005).

**Virtual Worlds:** Virtual worlds are massive multiplayer online games (MMOG) which are either massive multiplayer online role-play games (MMORPG) or unstructured worlds called multi-user environments (MUVE) based on (Mennecke et al., 2008).

# Chapter 120
# Grounding Principles for Governing Web 2.0 Investments

**Steven De Hertogh**
*Vlerick Leuven Gent Management School, Belgium & Amsterdam Business School, The Netherlands*

**Stijn Viaene**
*Vlerick Leuven Gent Management School, Belgium & Katholieke Universiteit Leuven, Belgium*

## INTRODUCTION

During the early years of the World Wide Web, also commonly referred to as the internet, there was relatively little engagement between content providers and end-users, or between end-users. Although some specialized communities, such as newsgroups, approached the internet as an open, decentralized, participative platform, not many content providers really did. Communication occurred mainly in a top-down, one-to-many, centralized mode of content broadcasting. In many ways the internet remained similar to already existing media such as television or radio. This first era of development is now being referred to as web 1.0.

The advent of Web 2.0 has been about embracing the inherently open and social characteristics of the internet. It supports a profound change in communication toward a many-to-many, decentralized format. The latter favors the emergence of bottom-up trends rather than the design of top-down, paternalistically imposed strategies and structures. Web 2.0 applications aspire to make maximal use of the level playing field for engagement offered by the internet, both technologically and socially (O'Reilly, 2005, 2006). The World Wide Web has thereby entered "the realm of sociality" (Bouman et al., 2007), where software becomes fused with everyday social life. Social software applications such as Wikipedia, Facebook and MySpace have all but become household names.

Both practitioners and researchers are converging on the usefulness of Web 2.0 for professional organizations. Companies like Procter & Gamble, Amazon and many others have indeed started to garner a respectable amount of experience on their use of Web 2.0 technologies. What we have observed, and others with us (e.g. Bughin & Manyika, 2007;

DOI: 10.4018/978-1-61520-611-7.ch120

Koplowitz & Young, 2007; McAfee, 2006a), is that the way for organizations to capture benefits from Web 2.0 technology differs substantially from the way they attended to information technology (IT) projects in the past. It is still early days in terms of learning from enterprise 2.0 experiences. What stands out already, however, is that management will have to find new ways of governing to respect the freedom, openness, and sociality inherent to Web 2.0 technologies.

In this chapter we propose a set of grounding principles for governing Web 2.0 investments. These grounding principles refer to attention areas and key choices that management ought to pay heed to if it wants to successfully invest in Web 2.0 for the enterprise. The position presented in this chapter stems from a combination of literature review and case studies of Belgian companies with experience in introducing Web 2.0 into their enterprise. We are grateful to the Flemish government, more specifically the government agency Flanders District of Creativity, for having supported this research. A word of gratitude also goes out to Deloitte, Möbius Consulting, and SAS Institute.

The chapter is organized as follows. We first provide some background information on Web 2.0. We then move on to problematize the notion of governance and introduce the need for an appropriate type of governance. Finally, we outline our set of grounding principles for governing Web 2.0 investments.

## BACKGROUND

If anything, information systems (IS) researchers have established that there can be a wide gap between investing in an IT resource and realizing business value from its use. Consequently, any such investment comes with a certain degree of risk. From Peppard & Ward (2004), we borrow a general view on organizational benefits realization from IS. Their framework allows us to distinguish between three categories of concepts which co-determine the value created by an IS: the ends (organizational objectives), the means (IT artifacts), and the ways (new working practices). We use this framework to organize this background section on Web 2.0.

### Web 2.0: The Ends

McAfee (2006a) coined the term enterprise 2.0 to describe companies buying or building platforms with wikis and social networking software to support and enhance the continuously changing and emergent collaborative structures of knowledge work across the (extended) enterprise. Organizations that have chosen to embrace the next generation internet are using the technologies not least to provide users, inside and outside of the enterprise, with the operational means for achieving high-aimed objectives such as stimulating collective creativity and open innovation.

- ***Collective creativity***: "Collective creativity reflects a qualitative shift in the nature of the creative process, as the comprehension of a problematic situation and the generation of creative solutions draw from – and reframe – the past experiences of participants in ways that lead to new and valuable insights," (Hargadon & Bechky, 2006, p. 484). This concept forms a counterweight to a traditional approach to innovation as a chain of top-down initiated innovation projects executed by relatively fixed and closed teams.
- ***Open innovation***: "Open innovation is the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively. Open innovation is a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as they look to

advance their technology," (Chesbrough et al., 2006, p. 1).

## Web 2.0: The Means

Literature search and our own case study work led us to identify six structural capabilities embodying the promise of Web 2.0 technology (see e.g. O'Reilly, 2005, 2006; McAfee, 2006a, 2006b; Murugesan, 2007; Parameswaran & Whinston, 2007):

1) The software enables reuse and combination of different applications and data from different sources.
2) The software enables flexible design, quick updates, and adaptability.
3) The software enables collaborative content creation and modification.
4) The software does not impose predefined structure on the content.
5) The software provides a rich, responsive and personalized user interface.
6) The software enables gathering of collective intelligence.

Creating an awareness of the capabilities embodied by a type of technology not only serves to help people understand why the technology could be useful. Making people mindful about the capabilities of the technology is an absolute precondition to benefits generation with the technology. Some of the skepticism among businesses and IT professionals with respect to Web 2.0 has been attributed to this very lack of understanding (Murugesan, 2007).

## Web 2.0: The Ways

Technology alone will not guarantee an organizational success. Realizing the objectives of a software implementation depends heavily on how an organization and its constituents will interact with the given technological artifacts and sustain their use within the fabric of the enterprise. It is well established in the IS literature that the most ambiguous, yet critical part of realizing the aspired benefits from an IT investment is providing for the right organizational complements to the technology (McAfee, 2006a). The latter come in four flavors:

1) *Empowerment*: the attribution of decision rights and responsibilities
2) *Processes*: incrementally improved or radically re-engineered business processes
3) *Collaboration*: new ways of forming teams and collaborating in teams
4) *People and culture*: developing mindfulness and skills of stakeholders, including employees, customers, suppliers, and other partners

To serve as guidelines for organizations embarking on a Web 2.0 journey, we propose four grounding principles, one for governing the management of each of the above types of organizational complements. These principles are geared toward a maximal exploitation of the inherently open en social nature of the technology platform. Before we lay down this set of grounding principles, we elaborate on the need for a type of governance appropriate to realizing the benefits from a Web 2.0 investment.

# APPROPRIATE WEB 2.0 GOVERNANCE

Governance is an organizational design activity that serves to simultaneously restrict and enable management. In line with the encyclopedic entry on Wikipedia (2009), the activity of governing involves: a) defining expectations for the organization and its constituents, b) specifying allocation rules for the resources to help accomplish these expectations, and c) defining the framework to verify the organization's performance. IT governance according to Weill & Ross (2004) intends to encourage desirable behavior in using IT, in this case Web 2.0 technology.

Governing the way an IS investment is managed always implies striking a balance between two views on organizational benefits realization. On the one hand, encouraging desirable behavior in using a corporate resource ultimately relates back to the proper articulation of the enterprise's aspired strategic identity (Weill & Ross, 2004). This serves as an a-priori specified boundary or control mechanism for managing the realization of benefits. On the other hand, when engaging with an IT artifact, users also automatically set in to motion a process of structuration (Orlikowski, 2000). This process occurs regardless of any intent attributed to the investment by its initiators.

Structuration theory (Orlikowski, 2000) distinguishes between A) the capabilities of an IT artifact, and B) the meaning attribution by users that emerges from its ongoing use. By using the artifact and integrating the (non-)use into their work practices, users attribute a certain meaning to the technology. Users will begin to change or reinforce social patterns, i.e. structures embedded in the organization. From that point of view, the benefits realized by the technology become a function of the interaction between the users and the technology, and the ensuing social patterns of meaning attribution by the users.

Our problematization of governing Web 2.0 investments emphasizes the importance of structuration as a key process for realizing benefits with the technology. The nature of this technology's capabilities stimulates a particularly reciprocal relationship between the technology and its users. Also, the open-ended nature of lofty aspirations of collective creativity and open innovation clearly alludes to an environment that leaves certain degrees of freedom for meaning attribution by users. Therefore, in formulating our set of grounding principles for governing Web 2.0 investments, we have been especially mindful of the need for governing with reference to structuration. In other words, special attention is given to the importance of carefully balancing control and emancipation objectives in specifying the framework for encouraging desirable use of Web 2.0 technologies.

## GROUNDING PRINCIPLES FOR GOVERNANCE

On an organizational level, benefits can be protected and risks can be mitigated by paying the necessary attention to the appropriate type of IT governance. In what follows we have coined a set of four grounding principles for governing Web 2.0 investments toward optimal benefits realization. We have formulated these principles in a context-free way, that is, disregarding the specific circumstances and choices of particular enterprises and their leadership. We firmly believe that any particular enterprise's set of principles for governing Web 2.0 investments can benefit from inheriting the spirit embodied in the following four principles.

### Empowerment

**Principle:** *"We focus on empowering users to discover the desirable use of the technology, rather than having users comply with a pre-specified set of rules to counter a-priori notions of unwanted use."*

In a Web 2.0 context, it is important to acknowledge that the focus of governance, by way of principle, is to enable desirable use instead of merely drawing up barriers to unwanted use. Moreover, the notion of unwanted use itself, especially from an a-priori point of view, remains a controversial one. Users ought to be given enough freedom, even power, to let value emerge from their use of the technology. Users and managers will do well to focus relentlessly on whether the desired benefits are being realized, rather than on how the system might be abused.

This principle embodies a dynamic notion of governance. As the desirable use of the IS grows organically the governance of its use may have to adapt. Consequently, governing Web 2.0 investments becomes an evolving process rather than a one-off design activity. A pre-ordained attribution of decision rights and responsibilities may well deny the Web 2.0 investment the possibility to reach its full potential. Yet, guidance in view of this overarching plea for freedom will be needed, if only to increase the focus on desirable benefits and to decrease the possibility of negative results. People's (proven) competency is likely to emerge as an important, if not the most important, driver of what governance will emerge.

In 2008, travel agency Connections launched a social networking system enabling its employees to digitally share travel experiences. The company was convinced that sharing such stories would enrich employees' advice to shoppers. The management also firmly believed that governance was best left to emerge from the actual use of the system. Thus, it empowered employees to co-design the system and take up roles and responsibilities as they saw fit whilst making use of the system. So, much like in Wikipedia, employees were free to take up roles as content contributors or reviewers. What was more, it was left to the employees' to decide to spend time working on the platform during working hours. This was very different, for example, from how they had approached the governance for their transactional applications in the past. In those cases, governance was carefully specified up front. Compliance was the name of the game in that operational environment.

## Processes

**Principle:** *"We stimulate emergent content creation and collaboration developments as important value creating activities. Because of this, rather than just adhere to top-down institutionalized business processes, process workers and managers will be enabled to capture value by progressively synthesizing better patterns for processing."*

A business process is "a [coordinated] collection of activities that takes one or more kinds of input and creates an output that is of value to the customer," (Hammer & Champy, 1993). Many organizations have used the institutionalization of explicit business processes as a means to industrialize best practice ways of working. In a Web 2.0 setting, however, process governance ought to be mindful of the evolving nature of best practice. This implies that, by default, process governance needs to embrace a continuous improvement approach. Process workers and managers will actually be continuously designing and improving processes along the lines of the latest collective knowledge.

From a practical point of view, it is important that enough explicit attention is paid to learning from past successes and mistakes to complete the organizational learning loop. Web 2.0 technology is conceived to support this learning. The technology enables process workers to reflect, synthesize on and redesign the work while at the same time performing it. Process governance in a Web 2.0 environment serves to responsabilize workers and have them act as both value creators as well as value capturers.

High-tech manufacturer Bekaert launched its Innovation Portal in 2004. The objective was to reinvigorate the fuzzy front end of their innovation funnel, i.e. the early idea generation phase of the innovation process. Bekaert's management decided not to spend a lot of time pre-engineering this part of the process. Rather, Bekaert focused on promoting the use of several different functionalities embedded in the portal to loosely guide the processing of ideas. For example, peer-review functionalities enabled participants in the process to review and vote on each others' ideas and suggestions. By combining data on items such as the number of page views, review ratings, and attributed tags, the system periodically synthesized the outcomes of the continuously evolving idea generation processes by creating rankings on the portfolio of ideas discussed on the platform at any given moment. Also, by making past trails of ideas, suggestions and projects easily retrievable through intelligent search capabilities, the employees were encouraged to refrain from re-inventing the wheel, to learn from past mistakes and to pick-up on old ideas that might have been dismissed at first. Visionaries in the company believed that, over the long haul, advanced data mining could even be applied to the logs of the engagement patterns in the process to help boost the search for more efficient and effective patterns for processing ideas.

## Collaboration

**Principle:** *"We leave enough freedom to let (virtual) communities and teamwork emerges from a free-flow of collaborative engagements, rather than to pre-assign the bulk of roles, activities, and access rules."*

Collaboration is a central theme for investments in Web 2.0. The organization will only achieve its enterprise 2.0 objectives if the work performed by the individual members is incorporated into a greater whole of patterns of activities, interactions, and relationships. Successfully governing this constellation of engagement patterns in a Web 2.0 universe differs substantially from setting up a hierarchical or functional concept of team collaboration. The technology does not limit the way people collaborate. In the end, it is all about facilitating a self-sustaining ecosystem that emerges out the web of individual contributions. If knowledge sharing and collaboration halts, the system basically ceases to exist.

Management should be wary of limiting access, connections, and contributions only to specifically assigned team members. The mantra should rather be to encourage all possible constituents and contributions as being potentially useful until proven dysfunctional. Collaborative value is not derived from guarding individual compliance, but rather emerges from the freedom of individuals. Of course, for this to work properly each individual must be aware of his own responsibilities and be willing to take up some. Also, the community of users should be able to hold individuals accountable for their contributions and intervene when necessary. This assumes that management actively stimulates the use of the available features of the technology for supporting a kind of emergent, evolutionary auto-governance of the collaboration.

From our case research it seems that creating and respecting the necessary room for auto-governance remains rather tough within contemporary enterprises. As Web 2.0 systems grow, the likelihood increases that management raises security, privacy, or other concerns – some of which may actually be rooted in a perceived loss of power and control. This can have a potentially devastating effect on the level of collaboration. At Bekaert, for example, they placed few limits on the access rights to their Innovation Portal for employees. However, the company's management was convinced that because of possible intellectual property rights issues, access rights had to be seriously downgraded for their external partners. In the end, while the internal idea market flourished, the external contributions never reached the level that management originally had hoped for.

In 2008, Gaz De France (GDF) Suez Group's technical competence and research center for electricity, Laborelec, began to pilot Web 2.0 tools. Their goal was to enhance knowledge sharing and encourage the emergence of communities of practice. When asked about the most important lessons learned from the first set of pilots, participants highlighted the possibilities for autonomous knowledge accumulation and development without too much external control. Granted, not everything was allowed or possible. There were some strict ground rules and constraints governing the use of the Web 2.0 applications. However, these rules were never imposed in a top-down fashion. Rather, these principles were collaboratively developed and continuously challenged by trends and patterns emerging from evolving practices on the platform. Based on their experience, Laborelec believed strongly that if participants are not able to perceive the platform as being a natural knowledge sharing environment made for and, more importantly, by the participants, then the platform simply will not survive. As a result of their learning from the pilots, in early 2009, the company was able to draw up a "Charter for Knowledge Initiatives". As a guideline for making future cases for Web 2.0 projects, the Charter put the primacy of supporting a bottom-up drive at centre of its reasoning.

## People and Culture

**Principle:** *"People are invited to cooperate. They are stimulated, guided, and continuously convinced of the value of cooperation, rather than coerced into doing anything or working in particular ways."*

Ideally, a Web 2.0 system starts out as an open invitation for an individual to join a collective. The invitees have a free choice to either take part in the system or not and thus ultimately help shape the finality and value of the system. Of course, this implies that they understand and appreciate the why, the what, and the how of contributing to the collective. They need to see what could be in it for them. Growth of the system is fueled by the provision of attractive functionalities to potential users. Interestingly, functionalities do not have to be strictly limited to what is functional to the organization or the work. Offering entertainment functionalities, for example, can certainly entice some users to take part.

Management can definitely give a push; for example, by promoting awareness about the capabilities of Web 2.0, by incentivizing people to actively contribute to value creation and value capturing activities, by learning them to value peer feedback and how to make use of it, and by nurturing the role of advocates of Web 2.0, who actively pursue and exemplify the benefits of collaboration via the platform. At Tele Atlas, for example, management understood they had only one option to promote a move away from a bottom-up created, yet potentially unsecured open source wiki-system, Adoption of a secure, commercial Web 2.0 system, would only be possible through word to mouth advocacy of the extended functionalities of the new system. Even without having to take recourse to constricting employees' access to the open source system, one and a half years later the viral campaign appeared to have worked and the open source system is hardly mentioned any more.

For some people, participation in a Web 2.0 experience goes against a natural inclination to protect their own ideas, or a reluctance to put their ideas and opinions to the test of collective judgment. These people nevertheless ought to be stimulated to participate in an open knowledge and experience sharing culture. They need to understand that judgment as such is not the goal of sharing, but knowledge enrichment is. For example, a change in the bonus system could help to grow a Web 2.0 system. Why not reward people who share great ideas for further development, rather than people who simply submit them secretively to an idea box?

## CONCLUSION

The promise of Web 2.0 is enticing to many organizations. However, experience and research into managing such investments to effective benefits realization has not yet reached full maturity. Still, based on literature search and our own case research, we have argued in this position paper that due to the nature of the technological capabilities and organizational aspirations for achieving high-aimed ends like collective creativity and open innovation, organizations would do well to investigate the implications for governing Web 2.0 initiatives.

In an attempt to help out, we have synthesized four grounding principles for governing Web 2.0 investments that fit the ambition levels and the technological capabilities. We believe that these principles will be particularly useful for organizations that are investigating the potential of Web 2.0 investments for their enterprise. It can help them understand the implications for designing how they will manage benefits realization. It is now up to the leadership of organizations to take up the set of grounding principles presented in this chapter and cast them onto their own specific context.

## REFERENCES

Bouman, W., de Bruin, B., Hoogenboom, T., Huizing, A., Jansen, R., & Schoondorp, M. (2007). The realm of sociality: Notes on the design of social software. In *Proceedings of the Twenty Eighth International Conference on Information Systems,* Montréal, Quebec, Canada, December 9-12, 2007.

Bughin, J., & Manyika, J. (2007). *How businesses are using Web 2.0: A McKinsey global survey*. Retrieved March 18, 2009, from http://www.mckinsey.de/downloads/publikation/mck_on_bt/ 2007/mobt_12_How_Businesses_are_Using-Web_2_0.pdf

Carr, N. (2003). IT doesn't matter. *Harvard Business Review*, *81*(5), 41–49.

Chesbrough, H., Vanhaverbeke, W., & West, J. (Eds.). (2006). *Open innovation: Researching a new paradigm*. Oxford, UK: Oxford University Press.

Hammer, M., & Champy, J. (1993). *Reengineering the corporation: A manifesto for business revolution*. New York: Harper Business.

Hargadon, A., & Bechky, B. (2006). When collections of creatives become creative collectives: A field study of problem solving at work. *Organization Science*, *17*(4), 484–500. doi:10.1287/orsc.1060.0200

Koplowitz, R., & Young, G. (2007). *Web 2.0 social computing dresses up for business* (Enterprise Web 2.0 for I&KM Professionals Series Rep. No. 1). Cambridge, MA: Forrester Research.

McAfee, A. (2006a). Mastering the three worlds of information technology. *Harvard Business Review*, *84*(11), 141–149.

McAfee, A. (2006b). Enterprise 2.0: The dawn of emergent collaboration. *MIT Sloan Management Review*, *47*(3), 21–28.

Murugesan, S. (2007). Understanding Web 2.0. *IEEE IT Professional*, *9*(4), 34–41. doi:10.1109/MITP.2007.78

O'Reilly, T. (2005). *What is Web 2.0: Design patterns and business models for the next generation of software.* Retrieved March 18, 2009, from http://www.oreillynet.com/lpt/a/6228

O'Reilly, T. (2006). *Levels of the game: The hierarchy of Web 2.0 applications*. Retrieved March 18, 2009, from http://radar.oreilly.com/archives/2006/07/levels-of-the-game.html

Orlikowski, W. (2000). Using technology and constituting structures: A practice lens for studying technology in organizations. *Organization Science*, *11*(4), 404–428. doi:10.1287/orsc.11.4.404.14600

Parameswaran, M., & Whinston, A. (2007). Social computing: An overview. *Communications of the Association for Information Systems*, *19*(1), 762–780.

Peppard, J., & Ward, J. (2004). Beyond strategic IS: Towards an IS capability. *The Journal of Strategic Information Systems*, *13*(2), 167–194. doi:10.1016/j.jsis.2004.02.002

Weill, P., & Ross, J. (2004). *IT governance: How top performers manage IT decision rights for superior results*. Boston: Harvard Business School Press.

Wikipedia. (2009). *Governance*. Retrieved March 18, 2009, from http://en.wikipedia.org/wiki/Governance

## ADDITIONAL READING

Anderson, C. (2008). *The long tail: Why the future of business is selling less of more.* New York, NY: Hyperion.

Chesbrough, H. (2006). *Open business models: How to thrive in the new innovation landscape.* Watertown, MA: Harvard Business Press.

Giddens, A. (1986). *The constitution of society: Outline of the theory of structuration*. Berkley, CA: University of California Press.

Surowiecki, J. (2005). *The Wisdom of crowds: Why the many are smarter than the few and how collective wisdom shapes business, economies, societies and nations.* New York, NY: Random House.

Tapscott, D. (2008). *Grown up digital grown: How the net generation is changing your world*. Columbus, OH: McGraw-Hill.

Tapscott, D., & Williams, A. (2008). *Wikinomics: How mass collaboration changes everything*. New York, NY: Penguin.

Van Grembergen, W., & Dehaes, S. (2009). *Enterprise governance of information technology: Achieving strategic alignment and value*. New York, NY: Springer.

von Hippel, E. (2006). *Democratizing innovation*. Cambridge, MA: MIT Press.

## KEY TERMS AND DEFINITIONS

**Collective Creativity:** "Collective creativity reflects a qualitative shift in the nature of the creative process, as the comprehension of a problematic situation and the generation of creative solutions draw from – and reframe – the past experiences of participants in ways that lead to new and valuable insights," (Hargadon & Bechky, 2006, p. 484).

**Enterprise 2.0:** McAfee (2006a) coined the term enterprise 2.0 to describe companies buying or building platforms with wikis and social networking software to support and enhance the continuously changing and emergent collaborative structures of knowledge work across the (extended) enterprise.

**Governance:** Governance is an organizational design activity that serves to simultaneously restrict and enable management. The activity of governing involves: a) defining expectations for the organization and its constituents, b) specifying allocation rules for the resources to help accomplish these expectations, and c) defining the framework to verify the organization's performance.

**IS Benefits Realization:** A general view on creating organizational benefits from IS. It distinguishes between three categories of concepts which co-determine the value created by an IS: the ends (organizational objectives), the means (IT artifacts), and the ways (new working practices).

**Open Innovation:** "Open innovation is the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively. Open innovation is a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as they look to advance their technology," (Chesbrough et al., 2006, p. 1).

**Structuration Theory:** A sociological theory applied to the field of IS by, amongst others, Orlikowski (2000). The theory helps to describe how social structures, that is patterns of social interaction, are developed, changed or re-affirmed through a) users interacting with an IT artifact, and b) users attributing meaning to the technology by integrating the (non-)use into their work practices.

**Web 1.0:** Web 1.0 refers to the early years of the internet. It marks an era where the main mode of communication between content providers and users was predominantly top-down and centralized. In fact, during this era, the web was very much approached as a continuation of traditional broadcasting media such as television or radio.

**Web 2.0:** The introduction of the notion of Web 2.0 is all about embracing the inherently open and social characteristics of the internet. The transition from 1.0 to 2.0 represents a profound change in communication toward a many-to-many, decentralized format. Web 2.0 favors the emergence of bottom-up trends rather than the design of top-down, paternalistically imposed strategies and structures. Web 2.0 applications, often referred to as social software, aspire to make maximal use of the level playing field for engagement offered by the internet, both technologically and socially.

# Chapter 121
# Web 1.0, Web 2.0 and Web 3.0:
## The Development of E-Business

**Tobias Kollmann**
*University of Duisburg-Essen, Germany*

**Carina Lomberg**
*University of Duisburg-Essen, Germany*

## INTRODUCTION

Both, Web 1.0 and Web 2.0 were linked directly to new stages in the development of e-business. Whereas the distinction between Web 1.0 and Web 2.0 became widely accepted in literature and practice, we are merely at the beginning of the possibilities arising from current trends culminating in our information society. Information emerges increasingly as a major factor of production, allowing the activation of innovative business opportunities. However, over the past years, a sheer explosion of supplies has taken place. This development is both a blessing and a curse as it leads to an oversupply of information within the World Wide Web. Thus, the time needed for finding required information may take longer eventually. Therefore, a next generation technology is needed being capable to cope with these challenges. Due to the logic of this chain of ideas, Web 3.0 technologies are characterized particularly by demand-orientated systems, i.e. demand for objects and services are at the centre. Starting point are demand-driven registration and specification systems. The consumer is at the centre of these processes and will gain individual help, comparable to an information desk. Not only information but also individual products and services may be released (customized products).

Against the background of an increasing information overload, the question to be asked is how technological and market-oriented future developments will cope with these challenges. This paper aims at clarifying this overall development with the objective of giving impulses for the 3rd generation of e-business. For this purpose, the characteristics of each generation (Web 1.0, Web 2.0, and Web 3.0) are clearly highlighted.

DOI: 10.4018/978-1-61520-611-7.ch121

## BACKGROUND

### Web 1.0: E-Procurement, E-Shop and E-Marketplace Systems

Web 1.0 is particularly characterized by supply-orientated systems, i.e. supply of objects and services is vital. Consequently, private or commercial suppliers try to use the internet as an additional distribution channel in order to provide products to the market using supply-orientated database systems as a starting point, yielding in three potential business opportunities:

#### E-Procurement-Systems

E-procurement enables the electronic purchasing of products and services from a company via digital networks using the integration of innovative information and communication technologies to support and conclude both operative and strategic tasks in the area of procurement. (Kollmann, 2006). As a matter of principle, e-procurement represents a collective term for electronically supported procurement. The basic idea of electronic procurement refers to the procurement-relevant activities between an entrepreneur (procurement-manager) and a distributor (vender).

#### E-Shop Systems

An e-shop is a company's virtual salesroom, allowing the electronic selling of products and services using digital networks. Thus, innovative information and communication technologies may be used supporting and concluding operative and strategic tasks for the buying process. (Kollmann, 2006). The increasing acceptance of electronic media by customers goes along with a rising supply of products and services being partially or exclusively distributed by "virtual shops" via the internet. The basic idea of electronic sale refers to the relationship and the sale-relevant activities between entrepreneurs (suppliers) and consumers. Electronic sale consists of three fundamental aspects transferred from the actual sale (Choi et al., 1997): First, the shop owner himself aims at distributing products via the internet whereas traditionally, the seller is physically present in a shop. Second, contact merely takes place virtually, and selling from a customer's perspective is executed by the means of machine transactions. Finally, the product is either available in physical (e.g. computer) or in digital (e.g. software) form, which affects the buying process. If the product is available physically, the virtual sale will be combined with an actual distribution whereas digital products may be delivered electronically.

#### E-Marketplace Systems

An e-marketplace allows for electronic trade with products and/or services via digital networks (Pavlou & Gefen, 2005). Moreover, this represents the integration of innovative information and communication technologies to support and conclude, respectively, the matching process of supply and demand sides. (Kollmann, 2006). Whereas actual marketplaces are characterized by local circumstances (e.g. tradeshows or weekly farmers' markets), electronic marketplaces focus on the digital networking of their market participants (Kollmann, 2009b). Participants may electronically access any e-marketplace from any digital access point without actually being present at a particular place at a particular moment, since e-marketplaces are permanently accessible. Supplier and consumer do not meet personally to settle a transaction but conclude contracts via digital data paths. The e-marketplace concept refers to a digital meeting place in which suppliers and consumers are connected by the means of electronic data processing to close business transactions. The transaction itself is detached from actual restrictions such as location-based limitations and is facilitated by a higher market instance (market operator), who actively coordinates transaction requests (Kollmann, 2005).

## Web 2.0: E-Community Systems

As opposed to Web 1.0 technologies, Web 2.0 is characterized by networking systems being supposed to connect private or commercial users over the internet, setting up social networks. Web 2.0 emphasizes communication via the e-networking process, occurring on so-called e-community platforms. Therefore, contact between users is the utmost concern. Contact is easily conceivable for private as well as for commercial purposes. Correspondingly, the *community-thought* comes forward, providing the basis for various new business ideas that were unconceivable a few years ago. Accordingly, the economic potential of these business ideas illustrates the high-volume going public of YouTube (1.65 billion U.S. dollars). However, Web 2.0 technology offers even more than mere successful business ideas: By means of concepts like wikis, blogs, and mashups, companies are able to enter even closer into dialogue with their customers (O'Reilly, 2005). Social capital has a great impact on the latest e-business developments and since there are a lot of common goals and interests in connecting people, *the Web of companies* became a *Web of people* (Wahlster & Dengel, 2006).

An e-community may be considered as structure of organized communication within an electronic contact network. More specifically, an e-community accounts for the supply of a technical platform in order to enable interaction between individuals (Kollmann, 2009b). Relationships between individuals may be characterized thematically by communication contexts but also by the social or professional status of community members. Focusing on social interaction, the exchange of information is individually generated, i.e. user-generated content. Accordingly, individuals possess common ideas in terms of interests, goals, or activities, and attend at least occasionally common places in terms of electronic platforms. Via these platforms, individuals are able to communicate with each other for a longer period (O'Reilly, 2005), and mutual communication is particularly affected by the asynchronous and location-independent character of the electronic information exchange. Thereby, the e-community supports members in two directions: On the one hand by assuring information- and communication exchange between members and on the other hand by managing the emerging social network between the members. Thus, support is usually provided by common rules, values and standards (Farrell & Saloner, 1985), determining the conditions of participation.

Summing up, Web 2.0 technology offers the opportunity to provide and access information at any time and place for companies as well as private persons. However, without knowing about the availability of particular information, users cannot utilize them. Additionally, current search engines are no longer capable of solving information problems efficiently and effectively. The fact that information seekers are increasingly overburdened with information overloads leads to an increased time being required for discovering particular information. Therefore, further development of technology is necessary being capable of coping with these challenges primarily characterized by information efficiency issues.

## WEB 3.0: E-DESK SYSTEMS

Accordingly, Web 3.0 is characterized particularly by demand-orientated systems, i.e. demand for objects and services is vital. Starting point are demand-driven registration and specification systems. The consumer is central to these processes and may get individual help comparable to help from an information desk. Figure 1 illustrates the transition from Web 1.0 over Web 2.0 to Web 3.0. Not only information but also individual products and services may be released (customized products).

*Figure 1. Transition from Web 1.0 via Web 2.0 to Web 3.0 (Kollmann 2009a, p. 28)*

| | Web 1.0 | Web 2.0 | Web 3.0 |
|---|---|---|---|
| Plattforms | E-Procurement, E-Shop and E-Marketplace | E-Communities | E-Desk |
| Content generation | by supplier | by user ("user-generated content") | by all |
| Annotations | by supplier | by user ("Tagging") | by all ("Structured meta data") |
| Search | keyword search finds documents ("search result list") | | structered search finds data, generates documents |
| Implications | inference by consumer ("Information overload") | | inference by plattforms and software agents |

## E-Request Systems

Web 2.0 and semantic Web are growing together slowly. Thereby, potential methods of resolution for coping with information overloads advance. However, evolution processes require time. A variety of user information issues are yet to be resolved. Despite the increased spread of tags and metadata, software systems can hardly respond to further issues such as automatically generated answers to personalized requests. Customers, however, need a demand tailored (mobile) e-business solutions instead of searching for a matching object on several distinct platforms. Hence resulting, business opportunities will arise from the identification of costumers' information needs. New business concepts allow for the individualization of existing products and services. For recording customers' demand, demand-orientated platforms and e-request systems facilitated by intelligent and user-friendly (e.g. Ajax-based) interfaces are required. Consequently, objects matching particular user demand are not merely generated by the information overloaded Web but rather by the means of human references from a well-structured pool of a partner companies, charging commission for the mediation function (Kollmann, 2009a). One example of a demand-oriented platform is *askerus*, being a portal for holiday seekers.

The proverb '*seek, and ye shall find'* does not necessarily apply to the context of searching for trips and booking holidays over the internet anymore, due to the information overload that hinders consumers to find what they are actually looking for. Along with this, the information overload reduces the recognition value for travel businesses since overlooking particular companies becomes more and more likely. In contrast to this, *askerus* focuses on counseling services. Travelers may configure individually their vacation demands via a particular template and may then request associated travel agencies to send up to 15 matching offers. Thus, the focus is on the customer, who uses the Web of the future to actively communicate demands. Moreover, this is advantageous for travel businesses as well since clientele and customer frequency increase, while acquisition costs decrease (e.g. for paper catalogs, electronic supplier marketplaces, telephone sessions, costly field workers).

## E-Customization Systems

Product configuration attempts to provide individualization options for customers, allowing for customization in alignment with their product demands. For this purpose, particular product characteristics are selectable facilitated by option menus. Choosing particular options allows customers to generate own individual products out of predefined sets of product variations, whereas the provider additionally generates useful information about demanded product characteristics. An explicit personalization is the option for customers to configure products according to their own desires, based on product-specific parameters being defined by the supplier himself. For possible product configurations, individualization and personalization become essential components of electronic business ideas and an upward trend can be observed for so-called e-customization systems (Kollmann 2009a). *Dell* can be regarded as a pioneer for product configuration options where the customer gets the ability to individually arrange the components of his laptop (e.g. processor, RAM, video card). Moreover, as well within the sector "food", a variety of young start-up companies emerged recently based on the business idea of product configuration (e.g. mycornflakes.com). The product analysis includes three main issue areas:

- The main component: The number of individual components of the end product, being supposed to be sold in an e-shop, may vary depending on complexity. Many business models emphasize one particular main component. Contrastingly, components depend on customers' demands and can be adjusted. In contrast, other business models attempt to attain a new, individual end product by combination of several individual products, e.g. mycornflakes.com. Besides the basic product, customers may further select cereal ingredients (nuts, seeds, fruits) for their individual purchasable product.
- Alternatives: Nature and number of variations (such as diverse nuts- or fruit types) have to be taken into account for the analysis of product configuration business models. Merely one predominant ingredient allows for the focusing on offering as many variations and types as possible for covering a wide range of individual tastes. A different way is to offer a wide variety in single products. However, this has to be regarded bearing content and profitability in mind - the more variations the more effort and costs for the process of composition.
- Share volume and price: An important criterion for product analysis is the identification of proportions of several components as well as pricing. If customers are allowed the possibility to configure a product by themselves, the impact of each step (e.g. selection of a type) needs to be apparent, e.g. the customer needs to be immediately able to find out how the final price changes by adding or removing ingredients.

## FUTURE RESEARCH DIRECTIONS

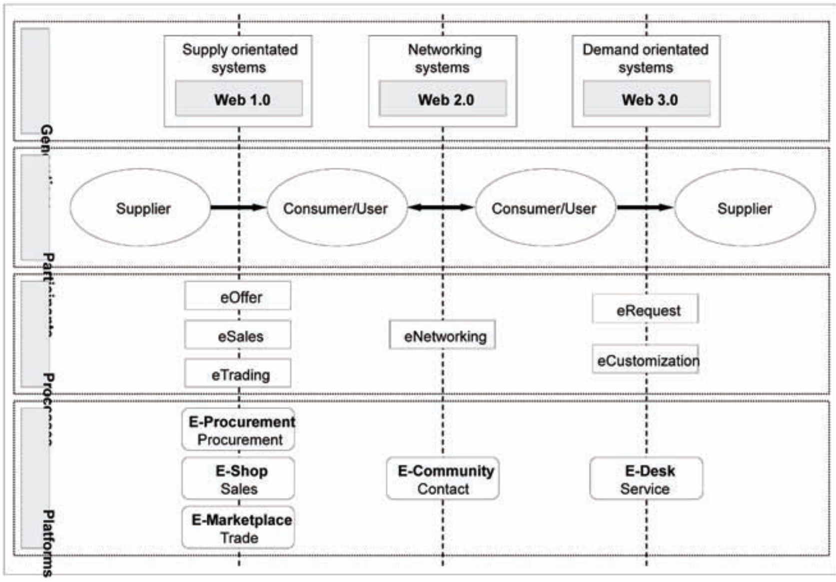
In this chapter we highlight the development from Web1.0 to Web 3.0, pointing out business opportunities for each phase. Future studies should consider this as a starting point for conducting further research regarding opportunities provided by all Web technologies.

## CONCLUSION

When information overloads will be reduced by the means of Web 3.0 technologies, new competitive advantages will open up (Figure 2).

Regardless of which technology is implemented to cope with those issues, taking advantage of current challenges, only one conclusion is possible: We are just at the beginning – the future of the World Wide Web holds lots of business opportunities ready.

*Figure 2. Characteristics of Web 1.0, Web 2.0 and Web 3.0 (Kollmann 2009a, p. 17)*




## REFERENCES

Choi, S.-Y., Stahl, D. O., & Whinston, A. B. (1997). *The economics of electronic commerce*. Indianapolis: Macmillan.

Farrell, J., & Saloner, G. (1985). Standardisation, compatibility and innovation. *The Rand Journal of Economics*, *16*(1), 70–83. doi:10.2307/2555589

Kollmann, T. (2005). The matching function for electronic market places – determining the probability of coordinating of supply and demand. *International Journal of Electronic Business*, *5*(3), 461–472. doi:10.1504/IJEB.2005.008520

Kollmann, T. (2006). What is e-entrepreneurship? –fundamentals of company founding in the net economy. *International Journal of Technology Management*, *33*(4), 322–340. doi:10.1504/IJTM.2006.009247

Kollmann, T. (2009a). *E-Entrepreneurship,* (3rd Ed.). Wiesbaden: Gabler.

Kollmann, T. (2009b). *E-Business,* (3rd Ed.). Wiesbaden: Gabler.

Kollmann, T., & Häsel, M. (2007). *Web 2.0*. Wiesbaden: Gabler.

O'Reilly, T. (2005). What Is Web 2.0. *Design patterns and business models for the next generation of software.* Retrieved March 30, 2009, from http://www.oreillynet.com/ pub/a/oreilly/tim/news/2005/09/30/what-is-Web-20.html

Pavlou, P. A., & Gefen, D. (2005). Psychological contract violation in online marketplaces: Antecedents, consequences, and moderating role. *Information Systems Research*, *16*(4), 372–399. doi:10.1287/isre.1050.0065

Wahlster, W., & Dengel, A. (2006). Web 3.0: Convergence of Web 2.0 and the semantic Web. *Technology Feature Paper Edition*, *II*, 2–22.

## ADDITIONAL READING

Adomavicius, G, Tuzhilin (2005). Toward the next generation of recommender systems: survey of the state–of–the–art and possible extensions. *IEEE transactions on Knowledge and Data Engineering, 17*(4), 734–748.

Berners-Lee, T., Hendler, J., & Lassila, O. (2001). The sematic Web. *Scientific American, 5*(5), Cayzer, S. (2004), Semantic blogging and decentralized knowledge management. *Communications of the ACM*, *49*(11), 40–45.

Daconta, M., Obrst, L., & Smith, K. (2003). *The semantic Web – A guide to the future of XML, Web services, and knowledge management*. Indianapolis: Wiley & Sons.

Duffy, G., & Dale, B. G. (2002). E-commerce processes: a study of criticality. *Industrial Management & Data Systems*, *102*(8), 432–441. doi:10.1108/02635570210445862

Farrell, J., & Saloner, G. (1986). Installed base and compatibility: Innovation, product, preannouncement and predation. *The American Economic Review*, *76*(5), 940–955.

Fensel, D., Hendler, J., Lieberman, H., & Wahlster, W. (2003). Introduction to the semantic Web. In D. Fensel, J. Hendler, H. Lieberman, & W. Wahlster (Eds.), *Spinning the sematic Web. Bringing the World Wide Web to its full potential* (pp. 1–25). Cambridge, MA: MIT Press.

Galanxhi-Janaqi, H., & Fui-Hoon Nah, F. (2004). U-commerce: Emerging trends and research issues. *Industrial Management & Data Systems*, *104*(9), 744–755. doi:10.1108/02635570410567739

Hagel, J., & Armstrong, A. G. (1997). *Net gain*. Boston, MA: Harvard Business School Press.

Hendler, J. (2001). Agents and the semantic Web. *IEEE Intelligent Systems*, *16*(2), 30–37. doi:10.1109/5254.920597

Ibeh, K. I. N., Luo, Y., & Dinnie, K. (2006). E-branding strategies of internet companies: Some preliminary insights from the UK. *Journal of Brand Management*, *12*(5), 355–373. doi:10.1057/palgrave.bm.2540231

Katz, M. L., & Shapiro, C. (1985). Network externalities, competition, and compatibility. *The American Economic Review*, *75*(3), 424–440.

Kollmann, T. (2000). Competitive strategies for electronic marketplaces. *Electronic Markets*, *10*(2), 102–109. doi:10.1080/10196780050138155

Kollmann, T. (2001). Measuring the acceptance of electronic marketplaces. *Journal of Computer Mediated Communication, 2*(6), n.p.

Kollmann, T. (2006). What is e-entrepreneurship? – Fundamentals of company founding in the net economy. *International Journal of Technology Management*, *33*(4), 322–340. doi:10.1504/IJTM.2006.009247

Kollmann, T., Stöckmann, C., & Schröer, C. (2009). The Diffusion of Web 2.0 Platforms: The Problem of Oscillating Degrees of Utilization. In J. Xu, M. Quaddus (Eds.), *E-business in the 21st Century: Realities, Challenges, and Outlook*, World Scientific Publishing: New Jersey, NJ.

Laudon, K. C., & Traver, C. (2002). *E-Commerce: Business, Technology, Society*, Addison Wesley, Boston, MA.

Lee, H. G., & Clark, T. H. (1996). Impacts of the electronic marketplace on transaction cost and market Structure. *International Journal of Electronic Commerce*, *1*(1), 127–149.

Lumpkin, G., & Dess, G. (2004). E-business strategies and internet business models: how the internet adds value. *Organizational Dynamics*, *33*, 161–173. doi:10.1016/j.orgdyn.2004.01.004

Pavlou, P. A., & Fygenson, M. (2006). Understanding and predicting electronic commerce adoption: An extension of the theory of planned behavior. *MIS Quarterly*, *30*(1), 115–143.

Powell, T. (2006). AJAX is the future of Web app development. *New World (New Orleans, La.)*, *23*(2), 35.

Rogers, E. M. (2003). *Diffusion of Innovations* (5th ed.). New York: Free Press.

Sheth, A., Verma, K., & Gomadam, K. (2003). Semantics to energize the full service spectrum – Using an ontological approach to better exploit services and the technical and business levels. *Communications of the ACM*, *49*(7), 55–61. doi:10.1145/1139922.1139949

Silver, M. (2006). Browser-based applications: Popular but flawed? *Information Systems and E-Business Management*, *4*(4), 361–393. doi:10.1007/s10257-005-0024-3

Soliman, F., & Youssef, M. A. (2003). Internet-based e-commerce and its impact on manufacturing and business operations. *Industrial Management & Data Systems*, *103*(8), 546–552. doi:10.1108/02635570310497594

## KEY TERMS AND DEFINITIONS

**E-Entrepreneurship:** E-entrepreneurship refers to establishing a new company with an innovative business idea within the Net Economy, which, using an electronic platform in data networks, offers its products and/or services based upon a purely electronic creation of value. Essentially, this value offer was only made possible through the development of information technology.

**Web 1.0:** Web 1.0 describes supply-orientated information-, communication- and transaction processes within the Net Economy. Due to these processes, the supplier and the supply via object-orientated databases constitutes the starting point for related e-offer-, e-sales-, and e-trading-processes predominantly carried out by means of e-procurement, e-shop, and e-marketplace platforms.

**Web 2.0:** Web 2.0 describes membership-orientated information-, communication-, and transaction processes within the Net Economy. Due to these processes, the network via profile-orientated databases represents the starting point for related e-networking-processes predominantly carried out by means of e-community platforms.

**Web 3.0:** Web 3.0 describes demand-orientated information-, communication-, and transaction processes within the Net Economy. Due to these processes, the consumer and the demand via individual registration-, and specification systems represent the starting point for related e-request-, and e-customization processes predominantly carried out by means of e-desk (request) or modified e-shop platforms.

**E-Procurement:** E-procurement enables the electronic purchasing of products and services from a company via digital networks. Using the integration of innovative information and communication technologies, e-procurement supports and concludes, respectively, both operative and strategic tasks in the area of procurement.

**E-Shop:** An e-shop allows for electronic sales of products and services by a company using digital networks. Using innovative information and communication technologies, e-shops support and conclude operative and strategic tasks for the area of sales.

**E-Marketplace:** An e-marketplace enables electronic trade with products and/or services via digital networks. This represents the integration of innovative information and communication technologies to support and conclude, respectively, the matching process of the supply and demand sides.

# Chapter 122
# The New Generation of Knowledge Management for the Web 2.0 Age: KM 2.0

**Imed Boughzala**
*TELECOM Business School, France*

**Moez Limayem**
*University of Arkansas, USA*

## INTRODUCTION

Today, due to spurred social (e.g. the "Millennials") and technological (e.g. Broadband Internet, Mobile Technology, GPS[1], Web 2.0), etc) changes, organizations are transformed in an economic environment that is more than ever competitive. In the context of the *Social Organization* in the Web 2.0 age, collaboration mediated by technology, social networking and virtual communities, culture of awareness and innovation have become new levers to put *Collective Intelligence* at the service of the organization. In such an organization, all employees can equally participate in creating, using and sharing information and knowledge. The "Individual"- knowledge worker, plays a central role in this case.

DOI: 10.4018/978-1-61520-611-7.ch122

Faced with these changes, strategies and management models must necessarily adapt and even sometimes be rethought. *Knowledge Management* (KM), which is range of practices, methods and techniques used in an organization to identify, analyze, organize, create, memorize, and share knowledge (Dieng et al., 1999), is in the forefront in this evolutionary organizational context as we are moving from the only information processing to human interactions management and interpersonal networking. With the advent of the Web 2.0, the concept of KM has been impacted and has evolved towards a vision based more on people participation and emergence and less on knowledge per say. This implies a new conception of KM that we propose to call "*KM 2.0*" rather than Andy McAfee (2006)'s term "*Enterprise 2.0*" which is a more technology-focused concept and is not yet well defined.

The purpose of this chapter is to introduce, define, and clarify the concept of KM 2.0 compared to the traditional KM in terms of scope, nature of knowledge, place of the individual, process, and technology. KM 2.0 opportunities and challenges will be discussed and implications to practitioners, managers and researchers will also be presented.

## TRADITIONAL KNOWLEDGE MANAGEMENT

The interest in KM dates back to the early 90s when companies realized the strategic value of knowledge as a competitive resource and a factor of stability for their survival (Spender, 1996). There is more than one definition of KM. Mentzas (2004 p.116) defines KM as the "*discipline of enabling individuals, teams and entire organizations to collectively and systematically create, share and apply knowledge, to better achieve the business objectives*". "*KM efforts can help individuals and groups to share valuable organizational insights, to reduce redundant work, to avoid reinventing the wheel per se, to reduce training time for new employees, to retain intellectual capital as employees turnover in an organization, and to adapt to changing environments and markets"* (McAdam and McCreedy, 2000 (as sited in Wikipedia).

According to Ikyjiro Nonaka (1994), *Knowledge Creation* is a spiralling and continuous process of interactions between explicit and tacit knowledge. Explicit knowledge which is codified and transmitted as information in formal and systematic language (e.g. rules, procedures) and tacit knowledge which is personal and deeply internalized, embodied in practice and action and so hard to be formalized and communicated (e.g. talent, hand-turn) (Polanyi, 1966). Spender (1996) has qualified a part of this tacit knowledge as implicit which is the only part that could be codified. The interactions between the explicit and tacit knowledge lead to the creation of new knowledge. The combination of the two categories makes it possible to conceptualize four conversion patterns: *Socialization*, *Externalization*, *Combination* and *Internalization* (Nonaka, 1994).

The Japanese culture inspired Ikyjiro Nonaka and and Noburo Konno to introduce the concept of *ba* in 1996 to represent a shared space for emerging relationships that serves as a foundation for *Knowledge Creation* (Nonaka, 1998). This space can be physical (e.g. office, dispersed business space), mental (e.g. shared experiences, ideas and ideals) or any combination of them. This concept which is difficult to be translated in Western languages, could be defined as the pooling context in which knowledge is shared, created and used through interaction.

Since its emergence, KM focused more on knowledge as such with its space of socialization (*ba*) and individuals (knowledge workers) who are holders of knowledge in their behavior, interactions and relationships. This discipline has for long time emphasized capturing, accumulating and disseminating knowledge through *Knoweldge Management Systems* (KMS). These systems are complex and expensive to implement and maintain.

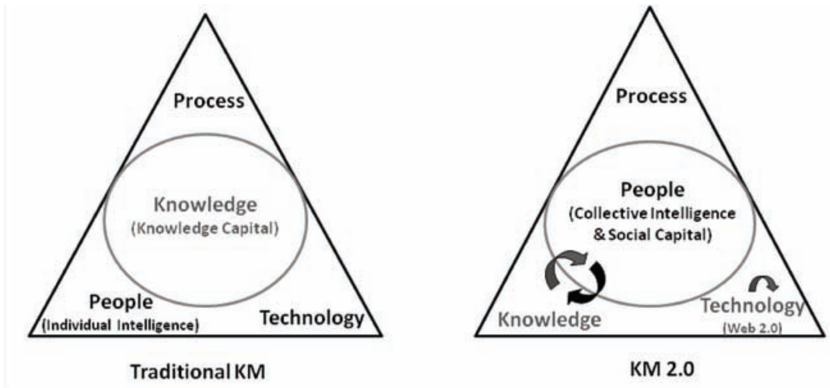
We argue that with the arrival of Web 2.0, KM has found a new youth and its study and scope should be redesigned.

## KNOWLEDGE MANAGEMENT 2.0

According to Stowe Boyd (Gandih, 2008), one of the prominent consultants and bloggers in the Web 2.0 industry, there are three types of knowledge:

- Impersonal knowledge which consists of ideas and information made explicit in documents and files (explicit knowledge).
- Personal knowledge which is tacit and stored in the brains (tacit knowledge).

*Figure 1. From traditional KM model to KM 2.0 model*




- Interpersonal knowledge which is communicated implicitly in the conversations and connections of people (implicit knowledge).

In traditional KM, we focus mainly on the two first types of knowledge. The study of Interpersonal Knowledge related to relationships and interactions of people (*Social Capital*, Nahapiet and Ghoshal, 1998) is specific to KM2.0. In the context of collaborative work, it is also called *Collaboration Knowledge* which includes work process and relational knowledge (Boughzala, 2007). Socialization is the most important mode of *Knowledge Creation* in the KM 2.0.

With the development of the concept of social organization, a human centered organization based on e-collaboration, social networks and communities with an intensive use of Web 2.0 technologies, it has involved a new concept of KM, the KM2.0. It describes the changing trends in managing knowledge in the knowledge-based society and economy built on the collective intelligence and social capital, mainly related to the interpersonal knowledge. We adopt Shimazu and Koike's definition of KM 2.0 as "*a model that places collective intelligence at its core and promotes its use by accelerating the distribution of information*" (Shimazu and Koike, 2007 p.52).

This new generation of KM, KM 2.0 aims to allow incorporated and pervasive management of knowledge for social and virtual organizations (teams, communities and enterprises). With the introduction of Web 2.0 - social and collaboration technologies, the bases of KM have been updated and in some ways metamorphosed. The Web 2.0 adoption in connecting people (social networks and virtual communities) and online collaborating will succeed where previous approaches of traditional KM had failed in term of socialization.

KM 2.0 affects *Enterprise Business Models*, organizational management and knowledge worker's skills and behavior and maybe visible at different dimensions: social, managerial, technical, economic, legal, ecological, etc.

## From KM to KM2.0: What is really new?

The main differences between KM and KM 2.0 are illustrated in Figure 1 below. The purpose of this section is to discuss all these differences based on several dimensions:

**KM Scope**: Traditional KM focuses mainly on knowledge (Knowledge capital: Impersonal and personal knowledge). KM2.0 on the other hand focuses not only on knowledge but also on its space of socialization and holders (Social capital: Interpersonal knowledge) through electronic open collaboration, social linking/networking and content sharing (thanks to Web2.0 technologies such as Wikis, blogs, RSS[2], Folksonomy, Mash-ups, Podcasting, Social ranking, etc) with a new culture of awareness (especially with both mixed and virtual reality) and innovation. For example, with *Facebook* or *LinkedIn* – famous social platforms, people could connect with others and build personal and professional relationships through groups of interest, communities of practice and collaborations.

At the level of the organization, while traditional KM focuses on Intra organizational knowledge, KM 2.0 also covers Inter organizational KM (IKM) such as in SCM[3] and e-business where many exchanges and sharing of knowledge are done between partners. These exchanges usually take place between experts of the same field or around the same value chain or network.

- **Nature of knowledge**: In the traditional KM, knowledge comes mostly from experts (*Individual Intelligence*). In the context of KM 2.0, knowledge originating from any individual could be interesting. Customer reviews on *amazon.com* for example could be decisive in the purchase of a product.

In the traditional KM, knowledge is mainly related to products (outcomes). In KM 2.0 however, knowledge is related to both products and processes. For example, in the case of a team working on the design of a new product, expertise around both the outcomes (individual domain knowledge and skills) and the work processes (collaboration knowledge, capabilities of members to work together and innovate) are important. The connection, interaction and collaboration of individuals and the nature of their relationships are a source of knowledge (*Collective Intelligence*).

- **Place of the individual**: In the traditional KM, knowledge workers are mostly users of knowledge. In KM 2.0, people play a more central role by consciously and unconsciously generating knowledge. Wikipedia which is the most viewed encyclopedia on the web was created and enriched spontaneously by internet users who are all editors-in-chief of this publication. The behavior of one user on a social platform like Facebook is carrier of knowledge (by profiling, tracing: people contacted, downloads, discussions in which (s)he participated, etc.).

The concept of *Collective Intelligence* plays a major role in KM 2.0. Consequently, performance and recognition of individuals is done according to their collaborative capabilities to get in touch (connect), to federate others and to work collaboratively. KM 2.0 is best suited to the new generation of individuals (the `Millennials') who are looking continuously for new technology, eager to find simply and quickly the good information/knowledge, at any-time and anywhere, and not intimidated by knowledge complexity and organizational hierarchy. Companies must undertake a relationship of seduction in terms of resources and rewards to be able to retain these Millennials (Dudezert et al. 2008).

- **Process**: KM is a structured process involving creating, storing, refining and sharing knowledge (*Knowledge Push*). KM 2.0 is less structured, more transparent to the user in all its behavior and interactions and evolves gradually over time ("on the fly"), using technologies to observe and to keep track such as Log files, RFID[4], GSM[5]/UMTS[6] or GPS, tagging and profiling (*Knowledge Pull*). Similarly, traditional KM is a *Top-Down* approach based on a corporate and normative strategy (centralization), KM 2.0 is a *Bottom-Up* approach based on individual initiatives and emergence (distribution). The development of

*Open Source Software* is the best example. Like many other Internet players, Google relies heavily on communities of practice to foster creativity and innovation.

- **Technology**: Compared to Web 2.0 technologies of today which are user centered, the traditional KMS - task oriented, seem incredibly primitive in terms of interpersonal knowledge. These offer only limited and formal information on experts and explicit knowledge in terms of collaboration. They suffer from their lack of tools of expression, social interaction and visualization of relationships. Traditional KM technologies are often passive with a static content and are generated by professionals. Web 2.0 technologies are participatory and personalized with a dynamic content and are generated by users themselves. Traditional KM technologies are overly complex and rigid. Web 2.0 technologies are flexible and easy to use and to install. For example, anyone can create a blog in few minutes and be able to share his/her ideas with others. Launching a wiki for sharing editions is an easy task for a project team.

KM requires significant investment in ICT[7] usually only large companies can afford. On the other hand, KM 2.0 takes advantage of Web 2.0 technologies that are more accessible even to SMEs[8]. Technologies such as ERP[9], SCM, CRM[10] and CAD[11] have started providing tools (features) that facilitate and enable KM 2.0 such as Wikis.

Table 1 summarizes the key differences between KM and KM 2.0 on the four dimensions discussed above of the two types of KM detailed above and according to the model we propose in Figure 1.

The paper of Shimazu and Koike (2007) introduces a KM model in the context of the Web 2.0 age that can expand to include collective intelligence in a positive spiral by closely linking it to knowledge extraction from various communication tools and job systems. The process of construction of collective intelligence can be divided into the four steps: *Disclosure, Linking, Selection and Evaluation*.

## IMPLICATIONS

### Implications to Companies

The introduction of KM 2.0 will affect companies on the following dimensions:

- **Social dimension**: Socialization is the most important mode of *Knowledge Creation* in the KM 2.0. Social networks, hubs, communities of practice and virtual communities are the main important instruments in which companies should invest to manage their knowledge and enhance their creativity and innovation; But how to manage/control these new organizational forms? Which means to adopt?

In addition, a new generation of hypermodern employees called the 'Millennials' are taking over. These individuals are familiar with Web 2.0 technologies; But how to integrate this generation in more traditional organizations? How to manage their behavior through the use of technologies? How to solve problems related to generation gaps, etc? All these are important questions that are yet to be answered.

- **Managerial dimension**: With the KM evolution, several modes of management should change. Specifically, methods of recruiting, monitoring and revaluating performance and career development must change. Not only are the technologies changing, but also the attitudes of employees, work methods and skills, distribution of teams, etc. So, which organizational structure should

*Table 1. Comparison of traditional KM and KM 2.0*

| | Traditional KM | KM 2.0 |
|---|---|---|
| **KM scope** | Knowledge | Knowledge, its space of socialization and holders |
| | Impersonal and personal Knowledge | Impersonal, personal and interpersonal Knowledge |
| | Knowledge mapping | Knowledge and social mapping |
| | Intra organizational knowledge | Intra and Inter organizational knowledge |
| **Nature of knowledge** | Expert knowledge | Any knowledge from any individual |
| | Product knowledge | Product and process knowledge |
| | Individual intelligence | Collective intelligence |
| **Place of the individual** | Non-central | Central |
| | User of knowledge | Generator of knowledge |
| | Domain competences | Collaborative competences |
| **Process** | More structured | Less structured |
| | Less transparent | More transparent |
| | Knowledge push | Knowledge pull |
| | Top-Down approach | Bottom-Up approach |
| | Centralization | Decentralization |
| **Technology** | Task oriented tools | User centered tools |
| | Overly complex tools | Easy to use and to install tools |
| | Rigid tools | Flexible tools |
| | Passive with a static content | Participatory and customizable with a dynamic content |
| | Generated by professionals | Generated by users themselves |
| | More significant investment in ICT – usually only for large companies | Less significant investment in ICT with Web 2.0 – even for SMEs |
| | Dedicated technologies for KM | Collaborative IT-based features embedded in technologies such as ERP |

companies adopt? What will be the impact on organizational performance? Which profile should the manager of tomorrow have? For that profile, some companies try to hire the leaders of MMORPG[12]' Guilds; which kind of skills could be transferred from virtual to real life?

- **Economic dimension**: KM 2.0 could affect *Business Models* because products and services could also change. Similarly, inter-organizational relationships could also evolve. For example, in the case of a travel agency, when a customer reserves a plane ticket, (s)he buys more than a place in the plane. The travel agency can provide feedbacks from previous customers such as things to do and things to avoid in certain destinations and packages with others partners.

The KM 2.0 could change customer / supplier and partners relationships. For example, through *sermo.com* - a virtual community of practice in the field of medicine, physicians could help each others, share best practices, etc. A patient could learn about his/her illness and after asks the private physician for a specific treatment, etc. In other words, we will become our own physician.

The investment in terms of acquisition of technologies may be less but much more in terms of data security, information privacy and confidentiality; But how to take a competitive advantage from these technologies? How to measure ROI?

- **Technological dimension**: The technologies should be more adequate for connecting people, online collaboration and network emergence. Compared to the previous generation of knowledge technologies (KMS), they have to be more customizable, flexible and more easily accessible to knowledge workers. They have to offer much more possibilities in terms of mobility, ubiquity and monitoring. A salesperson can inform the Marketing department about sales through his/her professional blog, a customer can track his/her package through the web thanks to RFID technology, etc.

Several questions related to technologies arise in this case: How to ensure their integrity, interoperability and scalability? How to adapt the training? How will other communication technologies, such as PDAs, GPS and Cell phones, integrate KM 2.0? What security problems need to be e taken in to account? What *Knowledge Extraction* models should be adopted?

- **Legal and ethical dimensions**: With the KM 2.0, some legal problems could be associated with information leakage, especially when people mix the private sphere with their professional activities. This could be revealing of strategic business information; But how to control the flow of information?

In KM 2.0, the *Knowledge Extraction* through ICT sometimes without informing the user may pose ethical problem in terms of trust and *Information Privacy.*

KM 2.0 involves much more informal and formal exchanges and *Knowledge Sharing* between people and partners. This raises the problem of *Intellectual Propriety* and *Value Creation Sharing*. This is a key issue in IKM in the context of partnerships where a partner with whom one shares knowledge today could become a competitor tomorrow. This sharing may help to increase the short-term value of a service/product which one creates, but may be in long terms a source of loss (to lose its position in the market, revealing of know-how to a competitor; etc). Then, how to take into account this problem? Who owns the value that is created? How to control this new KM which seems profitable but delicate?

- **Ecological dimension**: With a focus on the interaction of people, identity, knowledge, and environmental factors as a complex adaptive system akin to a natural ecosystem, how to manage this within organizations and inter organizations?
- **Cultural dimension**: Culture can be taken into account in the KM 2.0 study as in the choice of tools, specific modes of management, motivation, incitement, generational gap, etc; But how this new KM could take into account the culture of individuals?

## Implications to Research

From a research point of view, KM 2.0 will lead to several interesting research questions for researchers. Besides issues and challenges such as mastering the scope of the KM 2.0 domain and giving concrete answers to companies to take advantage of this new concept that researchers face.

Research interested in The KM 2.0 may investigate the following issues:

- Theory (conceptual frameworks, models, methods, etc.);
- Experimentation (field experiments, simulations, etc.);
- Observation (usage, best practices, field studies, etc.).

The KM 2.0 research could:

- Be pluri-, inter- and trans disciplinary covering *Management Science, Information Systems*, *Computer and Information Science*, *Geosciences*, *Sociology*, *Behavior Science*, *Education*, etc;
- Use several methods/methodologies: Qualitative and quantitative analysis, ground theory, design science, etc.
- Be tackled from different dimensions: Social (behaviouristic), managerial (organizational learning), economic, technological (techno-centric), ethical (intellectual propriety), ecological (ecosystem), etc.
- Open to many future avenues in *Information Systems* (usages) and *Computer Engineering* (new technologies).

### Implications to Technology Designers

Although KM 2.0 is based on the same traditional KM fundamentals, it requires significantly different technologies. Provided technologies are not defined by the richness of their features but by their ability to capture interpersonal knowledge and implicit connections between people, data and systems. These technologies enable collaboration and promote the emergence of community and social network. They are indifferent to organizational identities and go beyond the visible structures that are present in human interactions. From a technology design point of view, KM 2.0 will be based on areas such as *Social and Mobile Computing*, *Ubiquitous Computing*, *Ambient Technology*, *Virtual Reality*, *Grid Computing*, etc. In the future, it will benefit more from *Ontology Techniques*, *Semantic Web*, *Agent-based Intelligent Engines*, *3D Social Virtual Worlds* (SVW), *Cloud Technologies* and *Green Technologies*.

## CONCLUSION

It is our strong believe that the future is KM 2.0. According to Gartner Group, 80% of active Internet users will have a "Second Life" in the virtual world by the end of 2011 (www.gartner.com/it/page.jsp?id=503861). The use of SVW and future 3D Internet will grow. KM 2.0 will certainly benefit from this technological evolution and vice versa.

With the notion of *Smart World* (Ma et al., 2005) both real and virtual worlds become twin worlds. In ten years we all live in a smart world and use smart devices. Every object around us will have an identity and controlled from anywhere. Not only people but also objects can communicate with each other.

This concept of *Smart World* will in turn increasingly shape up, and is not possible without an effective KM. It goes without saying that this evolution will have direct and profound impacts on e-business strategies, processes and models.

In this chapter, we tried to introduce and define the concept of KM 2.0 as the new generation of KM for the Web 2.0 age in a vision more based on people within a *Social Organization* (which might be called also "*Organization 2.0*"). We compared KM to KM 2.0 on several important dimensions. We also discussed the implications of KM 2.0 to companies, managers, technology designers and researchers. It is apparent that this chapter led to more questions than answers. It is hoped that it will initiate a scientific debate about KM 2.0, its opportunities as well as the challenges that it causes.

## REFERENCES

Boughzala, I. (2007). *Ingénierie de la collaboration: Théories, technologies et pratiques*. Paris, France: Hermès.

Dieng, R., Corby, O., Giboin, A., & Ribière, M. (1999). Methods and tools for corporate Knowledge Management. *International Journal of Human-Computer Studies*, *51*, 567–598. doi:10.1006/ijhc.1999.0281

Dudezert, A., Boughzala, I., & Mounoud, E. (2008, October 17). *Comment intégrer la génération Millennials à l'entreprise?* Etats généraux du management workshop, Sénat/Paris, France.

Gandih, A. (2008). *L'entreprise sociale: Utiliser les applications "Entreprise 2.0" pour déculper la productivité des travailleurs du savoir*. Oracle White Paper, CA, USA.

Ma, J., Yang, L., Apduhan, B., Huang, R., Barolli, L., & Takizawa, M. (2005). Towards a smart world and ubiquitous intelligence: A walkthrough from smart things to smart hyperspaces and UbicKids. *International Journal of Pervasive Computing and Communications*, *1*(1), 53–68.

McAdam, R., & McCreedy, S. (2000). A critique of Knowledge Management: Using a Social Constructionist Model. *New Technology, Work and Employment*, *15*(2). doi:10.1111/1468-005X.00071

McAfee, A. P. (2006). Enterprise 2.0: The Dawn of Emergent Collaboration. *Sloan Management Review*, *47*(3), 21–28.

Mentzas, G. (2004). A strategic management framework for leveraging knowledge asset. *International Journal of Innovation and Learning*, *1*(2), 115–142. doi:10.1504/IJIL.2004.003715

Nahapiet, J., & Ghoshal, S. (1998). Social capital, intellectual capital, and the organizational advantage. *Academy of Management Review*, *23*(2), 242–266. doi:10.2307/259373

Nonaka, I. (1994). Dynamic Theory of Organizational Knowledge Creation. *Organization Science*, *5*(1), 14–37. doi:10.1287/orsc.5.1.14

Nonaka, I. (1998). The Concept of "Ba": Building a Foundation for Knowledge Creation. *California Management Review*, *40*(3).

Polanyi, M. (1966). *The tacit dimension*. London: Routledge & Kegan Paul Ltd.

Shimazu, H., & Koike, S. (2007). KM2.0: Business Knowledge Sharing in the Web 2.0 Age. *NEC Technical Journal*. Retrieved March 8, 2009, from http://www.nec.co.jp/techrep/en/journal/g07/n02/t070213.pdf

Spender, J. C. (1996). Competitive advantage from tacit knowledge? In B. Moingeon & A. Edmonson (Ed.), *Organizational learning and competitive advantage,* (pp. 56–73). London: Sage.

## KEY TERMS AND DEFINITIONS

**Collective Intelligence:** Refers to knowledge created from human interactions and interpersonal networking.

**Enterprise 2.0 or Enterprise Social Software:** The use of Web 2.0, emergent social software platforms within companies, or between companies and their partners or customers.

**KM 2.0:** The new generation of KM allowing incorporated and pervasive KM for social and virtual organizations.

**Knowledge Management Systems:** Refers to IT based systems for managing knowledge in organizations, supporting creation, capture, storage and dissemination of knowledge.

**Millennials:** A new generation of younger, college- and university-educated workers born between 1980 and 2000 and grown up with the Internet, also known as Generation Y or Digital Natives.

**Social Capital:** The set of resources embedded within the relationships among actors within a network.

**Socialization:** Enables the conversion of tacit knowledge through direct interaction between individuals through join activities by observation, imitation, practice and networking.

**Web 2.0:** The second generation of web development and design based on social software.

## ENDNOTES

[1] Global Positioning System
[2] Really Simple Syndication
[3] Supply Chain Management
[4] Radio Frequency IDentification
[51] Global System for Mobile communications
[6] Universal Mobile Telecommunications System
[7] Information and Communication Technologies
[8] Small and Medium Enterprise
[9] Enterprise Resource Planning
[10] Customer Relationship Management
[11] Computer-Aided Design
[12] Massively-Multiplayer Online Role-Playing Game

# Chapter 123
# Recommender Systems: An Overview

**Young Park**
*Bradley University, USA*

## ABSTRACT

*With the explosive growth of goods and services available on the Web through e-commerce, it is increasingly difficult for consumers to find the right products or services. Recommender systems provide consumers with personalized recommendations of goods or services and thus help them find relevant goods or services in the information overload. Since they were introduced a decade ago, recommendation technologies have made significant progress. This article presents a brief overview of recommender systems as an effective and powerful personalization tool in the e-commerce environment. Current major recommendation approaches are described and reviewed within a single unifying recommendation model and future directions are also discussed. Recommender systems and technologies will continue to have an essential role in future e-commerce and e-business.*

## INTRODUCTION

Electronic business (e-business) conducts many activities of a traditional business process by using information and communication technologies. E-business is usually done through the Internet and intranets. As a part of e-business, electronic commerce (e-commerce) handles the process of buying and selling goods and services between business and consumers (B2C e-commerce). E-commerce evolved to deal with all types of business interactions (e.g. B2B e-commerce and C2C e-commerce). E-commerce typically uses the World Wide Web (the Web) on the Internet and has grown exponentially. With the explosive growth of goods and services available on the Web through e-commerce, it is increasingly difficult for consumers to find and purchase the right products or services.

*Recommender Systems* are systems that provide consumers with personalized recommendations of goods or services and thus help consumers find relevant goods or services in the information overload

DOI: 10.4018/978-1-61520-611-7.ch123

(Resnick & Varian, 1997). Since its first introduction in the mid-1990s, a variety of recommender systems have been developed and used in a variety of e-commerce application domains including Amazon.com, BarnesandNoble.com, Netflix.com, mystrands.com and Yahoo.com (Konstan, Miller, Maltz, Herlocker, Gordon & Riedl, 1997; Sarwar, Karypis, Konstan & Riedl, 2000; Schafer, Konstan & Riedl, 2001). Over the last decade, recommender systems have been proven useful by sales increase and consumer retention, and are considered as an effective personalization tool in the E-commerce environment (Sarwar, Karypis, Konstan & Riedl, 2000; Schafer, Konstan & Riedl, 2001; Adomavicius & Tuzhilin, 2005; Goy, Ardissono & Petrone, 2007).

The concept of recommender systems is relatively new (just over ten years old) and interdisciplinary, based on various technologies. However, recommender technologies have made significant progress. In this article, we present a brief overview of the field of recommender systems in the context of e-commerce. First, we characterize the personalized recommendation problem and present a unifying model of recommender systems. We then examine current major approaches to personalized recommendations within this unifying model. We conclude with emerging and future research trends and additional readings in the area of recommender systems.

## BACKGROUND

The first major recommender systems emerged in the mid-1990s (Resnick & Varian, 1997). Since then, a variety of recommender systems have been developed and used in a range of e-commerce environments, and research has continued to improve them. Basically, a typical recommender system provides consumers with *personalized* recommendations of goods or services in order to help consumers find relevant goods or services. The recommendations are based on the past and present profiles of consumers with respect to the goods or services.

Figure 1 depicts a model of recommender systems. The personalized recommendation problem is described as follows: *Given a target consumer, produce personalized recommendations of goods or services for the target consumer.* To solve this recommendation problem, a recommender system generally uses three types of data – data about the consumers (called *C_data*), data about the items such as goods and services (called *I_data*) and data about the feedback (such as rating, evaluation, purchase or interest) relation between consumers and items (called *F_data*):

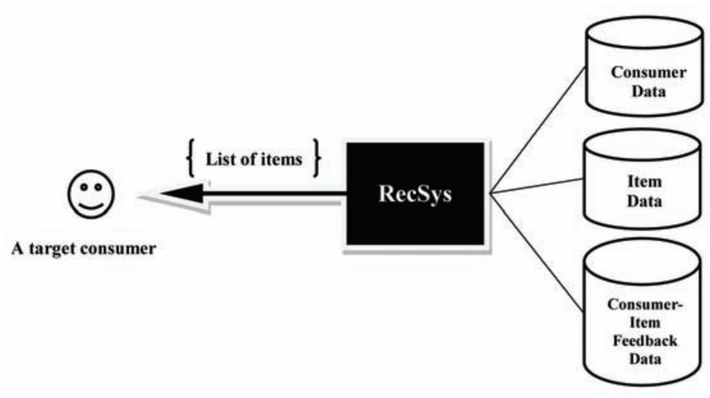
- *C_data* contains a set of all consumers and optionally some additional information about all consumers.
- *I_data* contains a set of all items and optionally some additional information about all items.
- *F_data* contains information about feedback (such as rating, evaluation, purchase or interest) of the consumers on the items (that can be viewed and represented as a partial function that maps a pair of consumer and item into a feedback value).

Thus, a recommender system can be modeled as follows: *Given a target consumer, a recommender system suggests a list of new items that are most relevant to the target consumer by using C_data, I_data and F_data.*

The consumer data and the item data are constructed for all existing consumers and items. The feedback relation data is constructed over time. It can be obtained explicitly from the consumers' participation (*explicit feedback*) or inferred implicitly from the consumers' behaviors (*implicit feedback*).

In order to find items relevant to the target consumer, recommender systems are based on the notion of *similarity* between consumers or between items. A number of similarity metrics

*Figure 1. A Recommender System (RecSys) model*




have been used to represent the degree of similarity between consumers or items. *Pearson Correlation* and *Cosine Similarity* are among most widely used metrics in recommender systems. The suggested list of most relevant and new items for the target consumer is determined by predicting the unknown feedback values of new items by the target consumer. The predicted feedback value of a new item is estimated from the feedback values of the item from some most similar consumers (i.e., nearest neighbors) or the feedback values of some most similar items (i.e., nearest neighbors) using some prediction algorithm such as the weighted sum.

Recommender systems have been evaluated in many ways (Herlocker, Konstan, Terveen & Riedl, 2004). The accuracy of the recommended items is most frequently evaluated. Various metrics for recommendation accuracy including popular metrics such as *mean absolute error* (MAE, i.e., the average of absolute differences between real feedback values and predicted feedback values), and *precision* (i.e., the number of relevant items recommended divided by the total number of items recommended) and *recall* (i.e., the number of relevant items recommended divided by the total number of existing relevant items) have been used.

## APPROACHES TO PERSONALIZED RECOMMENDATION

Many different approaches to personalized recommendation have been proposed for the development of more effective and efficient recommender systems in a variety of application domains (Adomavicius & Tuzhilin, 2005). The recommendation approaches can be classified as follows:

- Content-based recommendation approach
- Collaborative recommendation approach
- Knowledge-based recommendation approach and demographic approach
- Hybrid recommendation approach

Each of these approaches has strengths and weaknesses. We will describe major recommendation approaches within the single unifying recommender system model shown in Figure 1. Each approach uses three kinds of data – *C_data,* I*_data* and *F_data*. However, each approach differs in (1) what kind of information the data contains and (2) how the data is used to produce most relevant items.

### Content-Based Approach

The content-based recommendation approach is based on *content* of items. A variety of recommender systems using the content-based approach have been proposed (Pazzani & Billsus, 2007). The content-based approach basically recommends a list of items with similar content to that of the items that were given good feedback by the target consumer. The pure content-based method uses

- *C_data* = A set of all consumers.
- *I_data* = A set of all items & a partial function that maps a pair of item and feature, (i.e., item, feature), into a content description value. (This function contains information about items and features describing the content of the items.)
- *F_data* = A partial function that maps a pair of consumer and item, (i.e., consumer, item), into a feedback value.

The similarity between items with respect to content description features can be measured using various similarity metrics. The recommendation process of the content-based method consists of the following three main steps: Given a target consumer,

1. Find items which the target consumer provided good feedback using *F_data*.
2. Select items that have content similar to that of the items found in the step 1 using *I_data*.
3. Recommend a list of items from the items selected in the step 2 that are most relevant and new to the target consumer.

The content-based approach depends on how well the items are described by features, but it is often limited. The content-based method tends to recommend items that are similar to the already recommended ones (called *the item overspecialization problem*) and cannot recommend for new consumers until they provide enough feedback (called *the new user problem*). However, this content-based approach can recommend even new items.

## Collaborative Approach

The collaborative recommendation approach recommends items through *consumer collaborations*. Numerous recommender systems using the collaborative recommendation approach have been proposed and this approach is the most widely used and proven method of providing recommendations (Herlocker, Konstan, Terveen & Riedl, 2004; Schafer, Frankowski, Herlocker & Sen, 2007). There are two types of collaborative recommendation: *user-to-user collaborative filtering* based on user-to-user similarity and *item-to-item collaborative filtering* based on item-to-item similarity (Sarwar, Karypis, Konstan & Riedl, 2001; Linden, Smith & York, 2003).

### User-to-User Collaborative Filtering

The user-to-user collaborative filtering method is based on similar consumers. It recommends a list of items that other consumers gave feedback similar to that provided by the target consumer. The user-to-user collaborative filtering method uses

- *C_data* = A set of all consumers.
- *I_data* = A set of all items.
- *F_data* = A partial function that maps a pair of consumer and item, (i.e., consumer, item), into a feedback value.

Similarity between two consumers is based on feedback on all items both consumers provided. Different similarity metrics can be used for describing the similarity between consumers. The recommendation process of the user-to-user collaborative filtering method is done by the following three main steps: Given a target consumer,

1. Find consumers that are similar to the target consumer using *F_data*
2. Select items that have good feedback by the similar consumers found in the step 1 using *F_data*.

3. Recommend a list of items from the items selected in the step 2 that are most relevant and new to the target consumer.

### Item-to-Item Collaborative Filtering

The item-to-item collaborative filtering method is based on similar items and recommends a list of items that are similar to the items that were given good feedback by the target consumer. The item-to-item collaborative filtering method uses

- *C_data* = A set of all consumers.
- *I_data* = A set of all items & a partial function that maps a pair of item and item, (i.e., item, item), into a similarity value. (This function contains information about similarity between items.)
- *F_data* = A partial function that maps a pair of consumer and item, (i.e., consumer, item), into a feedback value.

Similarity between two items is based on feedback from all consumers both items received. Note, however, that the content-based approach uses similarity between items with respect to content description features. The similarity between items with respect to consumers can be measured using different similarity metrics. The partial function that maps a pair of item and item to a similarity value can be constructed using *F_data* in the offline stage in advance. The recommendation process of the item-to-item collaborative filtering method consists of three main steps as follows: Given a target consumer,

1. Find items that have good feedback by the target consumer using *F_data.*
2. Select items that are similar to the items found in the step 1 using *I_data*.
3. Recommend a list of items from the items selected in the step 2 that are most relevant and new to the target consumer.

While user-to-user collaborative filtering is based on similarity between consumers, item-to-item collaborative filtering is based on similarity between items. Item-to-item collaborative filtering is more algorithmically efficient and has shown better recommendation accuracy than user-to-user collaborative filtering. Item-to-item collaborative filtering is an example of the *model-based* method. The model-based method builds a model of the consumer-item feedback data offline and uses the model to generate items for recommendation. User-to-user collaborative filtering and the content-based method are called examples of the *memory-based* method. The memory-based method memorizes and then uses the entire consumer-item feedback data to find items for recommendation. The model-based method shows better scalability than the memory-based method.

The recommendation quality of both collaborative filtering-based methods depends on the feedback of consumers on items. But the available feedback is usually smaller compared with all possible feedback (called *the feedback sparsity problem*). Both collaborative filtering-based methods suffer from the new user problem and cannot recommend new items until they have enough feedback from consumers (called *the new item problem*).

## Knowledge-Based Approach & Demographic Approach

### Knowledge-Based Approach

The knowledge-based approach is based on *knowledge*. In order to generate personal recommendations, this approach uses deep domain knowledge about consumers and items instead of using *C_data, I_data* and *F_data*. Various knowledge-based recommender systems have been proposed (Burke, 2000). The knowledge-based method suggests items by reasoning about what items meet the target consumer's needs such as case-based reasoning using reasoning rules. Knowledge-based reasoning rules are constructed either manually or automatically. The main difficulty and limitation is the acquisition of knowledge. Compared to other approaches, the knowledge-based method is more suitable for recommending complex items rather than simple items.

### Demographic Approach

As an example of other approach, there is the demographic recommendation method that is based on *demographic* characteristics of consumers (Pazzani, 1999). The demographic approach is based on similar consumers (like the user-to-user collaborative filtering). However, similarity between two consumers is based on demographic characteristic features instead of feedback on all items both consumers provided. The demographic approach uses

- *C_data* = A set of all consumers & a partial function that maps a pair of consumer and feature, (i.e., consumer, feature), into a demographic description value. (This function contains information about consumers and features describing the demographic characteristics of the consumers.)
- *I_data* = A set of all items.
- *F_data* = A partial function that maps a pair of consumer and item, (i.e., consumer, item), into a feedback value.

The demographic approach recommends a list of items that have good feedback from the consumers that are demographically similar to the target consumer. The demographic recommendation process includes the following three main steps: Given a target consumer,

1. Find consumers that have demographic features similar to that of the target consumer using *C_data*.
2. Select items that received good feedback from the similar consumers found in the step 1 using *F_data*.
3. Recommend a list of items from the items selected in the step 2 that are most relevant and new to the target consumer.

This demographic approach can recommend even for a new consumer, but experiences the new item problem. The demographic method generally does not produce highly personalized recommendations and is a memory-based method.

### Hybrid Approach

In order to overcome the limitations of each approach and improve recommendation accuracy through synergy, the hybrid recommendation approach recommends items by combining two or more methods together, including the content-based method, the collaborative filtering-based method, the demographic method and the knowledge-based method (Burke, 2007). The combination can be done in many different ways. Several recommender systems adopt the hybrid method and tend to show better recommendations.

## FUTURE RESEARCH DIRECTIONS

Personalized recommendations can be viewed as part of personalization activity of e-commerce applications. Recommender technologies will become an important tool for e-commerce personalization. Future research will continue to focus on building more effective and efficient recommender systems for a wider range of application domains. A number of extensions to current recommender systems and future challenges have been proposed (Adomavicius & Tuzhilin, 2005; Felfernig, Friedrich & Schmidt-Thieme, 2007). Future trends in recommender systems and important research topics will include:

- Ubiquitous and mobile recommendations
- Context-aware recommendations
- Group recommendations
- Conversational and interactive recommendations
- Privacy, security and trust in recommendations
- New recommendation application domains

Some recent progress and leading researchers and companies in the field of recommender technologies can be found in the events including the premier series of Association for Computing Machinery (ACM) Conference on Recommender Systems (Pu, Bridge, Mobasher & Ricci, 2008) and ECAI workshop on Recommender Systems (Zanker, Felfernig & Burke, 2008) and the journals including ACM Transactions on the Web (TWEB).

## CONCLUSION

We present a brief overview on the field of recommender systems. The recommendation problem is formally described as a single unifying model of recommender systems. Current major approaches to personalized recommendations are then reviewed using this unifying model. Future trends and important research topics are presented along with additional readings in the area of recommender technologies. Recommender systems and technologies will continue to have an essential role in personalizing future e-commerce and e-business.

## REFERENCES

Adomavicius, G., & Tuzhilin, A. (2005). Toward the next generation of recommender systems: A survey of the state-of-the-art and possible extensions. *IEEE Transactions on Knowledge and Data Engineering*, *17*(6), 734–749. doi:10.1109/TKDE.2005.99

Burke, R. (2000) Knowledge-based recommender systems. In A. Kent (Ed.), *Encyclopedia of Library and Information Systems*. New York: Marcel Dekker.

Burke, R. (2007). Hybrid web recommender systems. In *The Adaptive Web* (pp. 377-408). Berlin: Springer.

Felfernig, A., Friedrich, G., & Schmidt-Thieme, L. (2007). Guest Editors' Introduction: Recommender Systems. *IEEE Intelligent Systems*, *22*(3), 18–21. doi:10.1109/MIS.2007.52

Goy, A., Ardissono, L., & Petrone, G. (2007). Personalization in e-commerce applications. In *The Adaptive Web,* (pp. 485-520). Berlin: Springer.

Herlocker, J. L., Konstan, J. A., Terveen, L. G., & Riedl, J. (2004). Evaluating collaborative filtering recommender systems. *ACM Transactions on Information Systems*, *22*(1), 5–53. doi:10.1145/963770.963772

Konstan, J. A., Miller, B. N., Maltz, D., Herlocker, J. L., Gordon, L. R., & Riedl, J. (1997). Grouplens: applying collaborative filtering to usenet news. *Communications of the ACM*, *40*(3), 77–87. doi:10.1145/245108.245126

Linden, G., Smith, B., & York, J. (2003). Amazon.com Recommendations: Item-to-Item Collaborative Filtering. *Internet Computing*, *7*(1), 76–80. doi:10.1109/MIC.2003.1167344

Pazzani, M. J. (1999). A framework for collaborative, content-based and demographic filtering. *Artificial Intelligence Review*, *13*, 393–408. doi:10.1023/A:1006544522159

Pazzani, M. J., & Billsus, D. (2007). Content-based recommendation systems. In *The Adaptive Web* (pp. 325-341). Berlin: Springer.

Pu, P., Bridge, D. G., Mobasher, B., & Ricci, F. (Eds.). (2008). In *Proceedings of the 2008 ACM Conference on Recommender Systems*. Lausanne, Switzerland: ACM Press.

Resnick, P., & Varian, H. R. (1997). Recommender systems. *Communications of the ACM*, *40*(3), 56–58. doi:10.1145/245108.245121

Sarwar, B. M., Karypis, G., Konstan, J., & Riedl, J. (2001). Item-based collaborative filtering recommendation algorithms. In *Proceedings of WWW10 Conference* (pp. 285-295). Hong Kong: ACM Press.

Sarwar, B. M., Karypis, G., Konstan, J. A., & Riedl, J. (2000) Analysis of recommendation algorithms for e-commerce. In *ACM Conference on Electronic Commerce,* (pp. 158-167). New York: ACM Press.

Schafer, J. B., Frankowski, D., Herlocker, J., & Sen, S. (2007). Collaborative filtering recommender systems. In *The Adaptive Web,* (pp. 291-324). Berlin: Springer.

Schafer, J. B., Konstan, J. A., & Riedl, J. (2001). E-commerce recommendation applications. *Data Mining and Knowledge Discovery*, *5*(1/2), 115–153. doi:10.1023/A:1009804230409

Zanker, M., Felfernig, A., & Burke, R. (Eds.). (2008). In *Proceedings of the Workshop on Recommender Systems – 18th European Conference on Artificial Intelligence*. Patras, Greece: University of Patras.

## ADDITIONAL READING

Adomavicius, G., Sankaranarayanan, R., Sen, S., & Tuzhilin, A. (2005). Incorporating contextual information in recommender systems using a multidimensional approach. *ACM Transactions on Information Systems*, *23*(1), 103–145. doi:10.1145/1055709.1055714

Adomavicius, G., & Tuzhilin, A. (2005). Personalization technologies: a process-oriented perspective. *Communications of the ACM*, *48*(10), 83–90. doi:10.1145/1089107.1089109

Adomavicius, G., & Tuzhilin, A. (2005). Toward the next generation of recommender systems: A survey of the state-of-the-art and possible extensions. *IEEE Transactions on Knowledge and Data Engineering*, *17*(6), 734–749. doi:10.1109/TKDE.2005.99

Anand, S. S., & Mobasher, B. (2005). Intelligent techniques for web personalization. In *Intelligent Techniques for Web Personalization* (pp. 1-36). Berlin / Heidelberg: Springer.

Balabanovic, M., & Shoham, Y. (1997). Content-based, collaborative recommendation. *Communications of the ACM*, *40*(3), 66–72. doi:10.1145/245108.245124

Bridge, D., Göker, M., McGinty, L., & Smyth, B. (2006). Case-based recommender systems. *The Knowledge Engineering Review*, *20*(3), 315–320. doi:10.1017/S0269888906000567

Burke, R. (2000) Knowledge-based recommender systems. In A. Kent (Ed.), *Encyclopedia of Library and Information Systems*. New York, NY: Marcel Dekker.

Burke, R. (2002). Hybrid recommender systems: Survey and experiments. *User Modeling and User-Adapted Interaction*, *12*(4), 331–370. doi:10.1023/A:1021240730564

Burke, R. (2007). Hybrid web recommender systems. In *The Adaptive Web* (pp. 377-408). Berlin / Heidelberg: Springer.

Canny, J. F. (2002). Collaborative filtering with privacy. In *IEEE Symposium on Security and Privacy* (pp. 45-57): IEEE Computer Society.

Felfernig, A., Friedrich, G., & Schmidt-Thieme, L. (2007). Guest Editors' Introduction: Recommender Systems. *IEEE Intelligent Systems*, *22*(3), 18–21. doi:10.1109/MIS.2007.52

Felfernig, A., & Zanker, M. (Eds.). (2006). Proceedings of the Workshop on Recommender Systems – 17th European Conference on Artificial Intelligence. Riva del Garda, Italy.

Goy, A., Ardissono, L., & Petrone, G. (2007). Personalization in e-commerce applications. In *The Adaptive Web* (pp. 485-520). Berlin / Heidelberg: Springer.

Herlocker, J., Konstan, J., & Riedl, J. (2000). Explaining collaborative filtering recommendations. In *proceedings of ACM 2000 Conference on Computer Supported Cooperative Work* (pp. 241-250): ACM Press.

Herlocker, J. L., Konstan, J. A., Terveen, L. G., & Riedl, J. (2004). Evaluating collaborative filtering recommender systems. *ACM Transactions on Information Systems*, *22*(1), 5–53. doi:10.1145/963770.963772

Jameson, A., & Smyth, B. (2007). Recommendation to groups. In *The Adaptive Web* (pp. 596-627). Berlin / Heidelberg: Springer.

Konstan, J. A., Miller, B. N., Maltz, D., Herlocker, J. L., Gordon, L. R., & Riedl, J. (1997). Grouplens: applying collaborative filtering to usenet news. *Communications of the ACM*, *40*(3), 77–87. doi:10.1145/245108.245126

Konstan, J. A., Riedl, J., & Smyth, B. (Eds.). (2007). Proceedings of the 2007 ACM Conference on Recommender Systems. Minneapolis, MN: ACM Press.

Linden, G., Smith, B., & York, J. (2003). Amazon.com Recommendations: Item-to-Item Collaborative Filtering. *Internet Computing.*, *7*(1), 76–80. doi:10.1109/MIC.2003.1167344

Lorenzi, F., & Ricci, F. (2005). Case-based recommender systems: A unifying view. In *Intelligent Techniques for Web Personalization* (pp. 89-113). Berlin / Heidelberg:Springer.

McNee, S. M., Riedl, J., & Konstan, J. A. (2006). Being accurate is not enough: how accuracy metrics have hurt recommender systems. In *CHI '06: CHI '06 extended abstracts on Human factors in computing systems* (pp. 1097-1101). New York, NY: ACM Press.

O'Donovan, J., & Smyth, B. (2005). Trust in recommender systems. In *IUI '05: Proceedings of the 10th international conference on Intelligent user interfaces* (pp. 167-174). New York, NY: ACM Press.

Pazzani, M. J. (1999). A framework for collaborative, content-based and demographic filtering. *Artificial Intelligence Review*, *13*, 393–408. doi:10.1023/A:1006544522159

Pazzani, M. J., & Billsus, D. (2007). Content-based recommendation systems. In *The Adaptive Web* (pp. 325-341). Berlin / Heidelberg: Springer.

Pu, P., Bridge, D. G., Mobasher, B., & Ricci, F. (Eds.). (2008). Proceedings of the 2008 ACM Conference on Recommender Systems. Lausanne, Switzerland: ACM Press.

Resnick, P., & Varian, H. R. (1997). Recommender systems. *Communications of the ACM*, *40*(3), 56–58. doi:10.1145/245108.245121

Sarwar, B. M., Karypis, G., Konstan, J., & Riedl, J. (2001). Item-based collaborative filtering recommendation algorithms. In *Proceedings of WWW10 Conference* (pp. 285-295). Hong Kong: ACM Press.

Sarwar, B. M., Karypis, G., Konstan, J. A., & Riedl, J. (2000) Analysis of recommendation algorithms for e-commerce. In *ACM Conference on Electronic Commerce* (pp. 158-167). ACM Press.

Schafer, J. B., Frankowski, D., Herlocker, J., & Sen, S. (2007). Collaborative filtering recommender systems. In *The Adaptive Web* (pp. 291-324). Berlin / Heidelberg: Springer.

Schafer, J. B., Konstan, J. A., & Riedl, J. (2001). E-commerce recommendation applications. *Data Mining and Knowledge Discovery*, *5*(1/2), 115–153. doi:10.1023/A:1009804230409

Smyth, B. (2007). Case-based recommendation. In *The Adaptive Web* (pp. 342-376). Berlin/Heidelberg: Springer.

Zanker, M., Felfernig, A., & Burke, R. (Eds.). (2008). Proceedings of the Workshop on Recommender Systems – 18th European Conference on Artificial Intelligence. Patras, Greece: University of Patras.

## KEY TERMS AND DEFINITIONS

**Electronic Business (E-Business):** Activities of a traditional business process by using information and communication technologies through the Internet and intranets.

**Recommender Systems:** Systems that provide consumers with personalized recommendations of goods or services and thus help consumers find relevant goods or services in the information overload.

**Content-Based Recommender Systems:** Recommender systems that are based on content of items and recommend a list of items with similar content to that of the items that were given good feedback by the target consumer.

**Collaborative Recommender Systems:** Recommender systems that recommend items through consumer collaborations and are the most widely used and proven method of providing recommendations. There are two types: user-to-user collaborative filtering based on user-to-user similarity and item-to-item collaborative filtering based on item-to-item similarity.

**User-to-User Collaborative Filtering:** Collaborative method that is based on similar consumers and recommends a list of items that other consumer gave feedback similar to that provided by the target consumer.

**Item-to-Item Collaborative Filtering:** Collaborative method that is based on similar items and recommends a list of items that are similar to the items that were given good feedback by the target consumer.

**Knowledge-Based Recommender Systems:** Recommender systems that are based on knowledge and suggest items by reasoning about what items meet the target consumer's needs.

**Demographic Recommender Systems:** Recommender systems that are based on demographic characteristics of consumers and recommend a list of items that have good feedback from the consumers that are demographically similar to the target consumer.

**Hybrid Recommender Systems:** Recommender systems that recommends items by combining two or more methods together, including the content-based method, the collaborative filtering-based method, the demographic method and the knowledge-based method.

# Chapter 124
# A Linguistic Recommender System for Academic Orientation

**E. J. Castellano**
*University of Jaén, Spain*

**L. Martínez**
*University of Jaén, Spain*

## INTRODUCTION

Students must face up to decision making situations since early ages, in order to keep on the chase of some professional competences. However, the suitability of people in jobs or studies is not only based on their preferences. Other factors are involved: capacities, skills, social attitudes, etc. that must be taken into account to successfully decide (Salgado, 1996).

Many countries have created a so-called advisor figure, whose role is to guide them in decisions regarding their academic future. Advisors consider different criteria and indicators in their task, the key one being the student's marks. Marks mean much more than a simple assessment: they indicate not only knowledge, but also skills, preferences about fields, attitudes, etc.

Advisors generally are required to guide support several hundreds of students and hence analyze large amounts of information. The aim of this contribution is to support them in their task of guiding students by means of Decision Support systems (DSS) that uses students' marks and provides linguistic information about the choices that students can make.

We found out that the analysis of huge amount of the data by advisors to make recommendations follows a similar scheme to personalized marketing in Internet accomplished by Recommender Systems (RS) (Adomavicius, 2005; Resnick, 1997). These systems offer recommendations to users according to their preference profiles, guiding them through search spaces to find the most suitable items for their needs.

DOI: 10.4018/978-1-61520-611-7.ch124

Due to the complementarity between the necessities of Academic Orientation and the facilities of RS, we have develop OrieB, a Web-DSS for Academic Orientation based on a Collaborative RS (CRS) for supporting advisors in their student guidance task. RS usually compute numerical degrees to rank the best items to be recommended. But in Academic Orientation we consider more appropriate the use of linguistic values (Martínez, 2007; Zadeh, 1975) for supporting advisor's tasks in order to manage the vagueness and uncertainty inherent to the problem, rather than precise numerical values that may mislead students, because predictions are just approximations.

## PRELIMINARIES

### Academic Orientation and Collaborative Filtering

The goal of this chapter is to establish the basis for a linguistic DSS based on a Collaborative Recommender System for Academic Orientation. Therefore, we review concepts about Educational Systems, Academic Orientation, Collaborative filtering and the Fuzzy Linguistic Approach in order to introduce a basic knowledge about them to understand our proposal.

### Educational Systems

The concept of Academic Orientation is related to the student curriculum guidance, i.e., students make decisions about their curriculum in order to obtain a degree. So the Academic Orientation consists of supporting students in such decisions by means of advices that facilitate their decisions in order to be successful in their academic choice.

To clarify the concept of Academic Orientation we have studied different educational systems to extract common features to show the generality of our proposal: although we focus in Baccalaureate orientation, by using a proper dataset the system could help students of any education level and/or area. In fact, we have observed two common features in most of educational systems: *Specialization and Evaluation*.

**Specialization**

Most educational systems allow students to choose among different specialization branches according to their skills, preferences and marks, building a personalized curriculum so-called *Academic Profile*. Each branch consists of a set of core and elective subjects.

Academic branches can group subjects in ***profiles*** or ***modules*** which allow students specialize in an area. Modules consist of *module* and *elective* subjects. The former are specific of the module although can be shared by several modules. The latter can be selected independently of the module.

Academic institutions offer at least core and elective subjects. Additionally they can offer modules to build an Academic Profile. The objective is that every student reaches an adequate level of specialization. Such a level is easier to achieve whenever, the students have adequate skills or feel affinity to the area of specialization, so that the more accurate they choose the better the development of their potential.

**Evaluation**

All academic institutions and educational systems have in common that they evaluate their students by means of different tools (tests, essays, tasks, etc.). The final result of this process is a *mark* that reflects not only the students' knowledge but also their skills, preferences about the subjects, etc.

### Advisors and Academic Orientation Tasks

Students must make hard decisions about the future since early ages despite they are not mature enough. Consequently, some educational systems have created a figure to guide the students, so-called *Advisor*.

Without loss of generality, we focus on the Spanish Educational System, its advisors, and in their Academic Orientation task. Usually, each advisor deals yearly with several hundreds of students; taking into account that each student has his/her own personality and skills, advisor's tasks are really hard to perform successfully with all students. The development of supporting tools for advisors can then improve the success of their tasks.

In order to support students' decisions, advisors take into account several variables in their analysis: skills, capacities, social attitudes, preferences, etc. Different types of data might be used to obtain valuable information about these variables, but the key one is the marks. So, marks should not be the only data to be considered. However, they fit quite well with Collaborative filtering requirements; hence they can be the starting point for implementing a simple and efficient system capable of helping advisors in the Academic Orientation task.

Of course once it have been proved the efficiency and usefulness of the marks for our aims, new variables might be used in order to improve the previous system, but the inclusion of new variables must analyze the complexity, effort and computational cost regarding to the possible improvement.

## Collaborative Recommender Systems

We have pointed out that the aim of this paper is to apply CF techniques used by CRS in order to start building a Web-DSS for Academic Orientation. Therefore, we need to review the main concepts and techniques related to them.

CRS gather ratings for items in a given domain and group customers with similar needs, preferences, etc. (Herlocker, 1999). In a CRS, customers share their judgments and opinions about items they have already experienced, such that, the system can support them in order to make right and better decisions about the items involved. The CRS provide customized recommendations for interesting items by using CF algorithms which try to predict user's satisfaction regarding an unrated item based on users with similar profile to the target user.

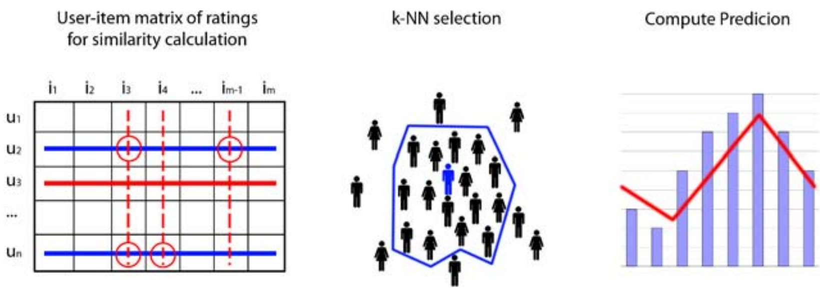
Following, we shall show the general working of CF in CRS with a scheme based on the k-NN algorithm (Breese, 1998; Herlocker, 1999) that will be used in our proposal.

### General Tasks for Providing CF Recommendations

Collaborative filtering methods fulfill three general tasks to elaborate the recommendations demanded by users:

- Selecting datasets: A dataset must be collected an optimized for the system (Herlocker, 2004).
- Grouping users: In order to elaborate recommendations, CF selects a group of users with similar profiles. There exist many methods to group users based on neighbor selection methods (Herlocker, 1999; Sarwar, 2000), but the most used scheme is based on Neighborhood Formation due to its robustness and accuracy. Previous work indicates that neighbors with a high degree of similarity to the target user are more valuable as predictors than those with lower similarity (Herlocker, 1999). This is the key idea about the use of CF in Academic Orientation, i.e., similar students will perform in a similar way.
- Generating predictions: CF algorithms use the previous groups to compute predictions for the target user. This can be done by

*Figure 1. Tasks concerning neighborhood-user-based methods*




aggregating ratings from groups of users in several manners (Adomavicius, 2005; Breese, 1998).

## CF Based on the K-NN Scheme

Due to the success of the k-NN scheme in CF (Herlocker, 1999; Sarwar, 2000; Schafer, 2001), and because we will use in our proposal, we make a brief review of its use in CRS. Figure 1 shows the three main tasks carried out by a CRS based on K-NN methods.

### Grouping Users

In this phase users are grouped by a k-NN algorithm according to their similarity. Therefore, a measure of similarity must be chosen. Breese refers two similarity measures as the most used in the CF field (Breese, 1998):

1. Pearson Correlation Coefficient (PCC): Being $v_{u,j}$, the rating assigned by user $u$ to item $j$ and $j$ the items that users $u$ and $i$ have co-rated, the correlation between them is computed as:

$$w(u,i) = \frac{\sum_j (v_{u,j} - \bar{v}_u)(v_{i,j} - \bar{v}_i)}{\sqrt{\sum_j (v_{u,j} - \bar{v}_u)^2 \sum_j (v_{i,j} - \bar{v}_i)^2}} \qquad (1)$$

2. Vector Similarity or Cosine Similarity (Breese, 1998). Here, $\vec{v}_u$ is the target user's profile and $\vec{v}_i$ is the other user's profile.

$$w(u,i) = \cos(\vec{v}_u, \vec{v}_i) = \frac{\vec{v}_u \vec{v}_i}{|| \vec{v}_u ||^2 \times \vec{v}_i^{\,2}} = \frac{\sum_j v_{u,j} v_{i,j}}{\sqrt{\sum_j (v_{u,j}^{\,2})}\sqrt{\sum_j (v_{i,j}^{\,2})}} \qquad (2)$$

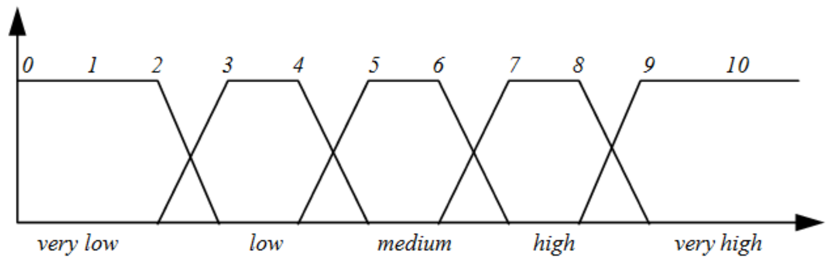
### Prediction Methods

Once users have been grouped, the CRS computes predictions of those items not rated yet by the target user, in order to choose those ones to be recommended. This can be made by simple aggregation, such as weighted average (Eq. 3) or by using similarity as weights (Adomavicius, 2005). However, the most common aggregation approach is the weighted sum (Eq. 4) (Breese, 1998).

$$v_{u,i} = \frac{\sum_j w_{u,j} v_{j,i}}{\sum_j w_{u,j}} \qquad (3)$$

$$v_{u,i} = \bar{v}_u + \frac{\sum_j w_{u,j}(v_{j,i} - \bar{v}_j)}{\sum_j w_{u,j}} \qquad (4)$$

*Figure 2. Semantic terms and membership functions*




## The k-NN Item-Based Collaborative Filtering

The use of CF in CRS based with a memory-based approach presents a drawback so-called *scalability problem*: the more data the less computing performance of the system. To avoid this, model-based algorithms generate a model from the dataset for computing the predictions. There exist different approaches (Breese, 1998).

## FUZZY LINGUISTIC APPROACH

Our aim is to develop a DSS to help advisors supporting students in their academic decisions based on their marks. We consider that the use of crisp and precise numbers can mislead the interpretation of the results by the advisors, because a number could be understood as the mark that will be obtained by the target student in the subject o module. However prediction should be interpreted as an approximation with some uncertainty rather than a precise value for the future student performance. Hence, we propose the use of linguistic information to express the recommendations obtained by the DSS.

The Fuzzy Linguistic Approach (Martínez, 2007; Zadeh, 1975) represents qualitative aspects as linguistic values by means of linguistic variables. We have to choose the appropriate linguistic descriptors for the term set and their semantics (Martínez et al., 2007). The universe of the discourse of the term set can be arbitrary, usually linguistic term sets are defined in the interval [0, 1], but in our case due to our framework will be [0, 10] the marks range (see Figure 2).

## A REAL CASE STUDY: THE SPANISH EDUCATIONAL SYSTEM

Before implementing a DSS based on a CRS for Academic Orientation first, we will show how can be used the CF in Academic Orientation. Second, we will accomplish a survey based on the Spanish educational system about its performance to prove the validity of our proposal.

### CF in Academic Orientation

The application of CF techniques used by CRS to Academic Orientation is based on its easy adaptation. A CRS deals with *customers, items and ratings*, Academic Orientation deals with *students, subjects and marks*. It is easy to adapt the dataset about Academic Orientation to apply CF techniques. Another key point is that we consider that students with similar marks share similar skills.

Therefore, the application of the ideas of CRS and CF to Academic Orientation consists of:

- **Dataset**: a dataset with students' marks is gathered.

- **Grouping students**: the students are grouped based on the marks because they indicate some kind of shared skills, preferences and attitudes.
- **Predictions**: the computed values will predict students' future performance. The advisors can then use such values to support student decisions.

In order to check the validity of the previous hypothesis, we have carried out a performance survey in the Spanish Baccalaureate.

## Spanish Baccalaureate

The Baccalaureate is a non-compulsory level in the Spanish education system; it comes after secondary school and lasts two years. It offers four different modules to students for further specialization in future academic stages:

a) Arts
b) Nature and Sanity Sciences
c) Human studies
d) Technologies

The structure of Baccalaureate is:

- **Core subjects**, common to all students.
- **Module subjects** depend on the chosen module.
- **Elective subjects** facilitate the access to other knowledge areas do not related to the chosen module.

Every student must choose a module with six module subjects and two elective subjects from a list of offered subjects.

## Survey

This survey studies the performance of CF in order to support students in their academic decisions.

Before starting the survey first we present our dataset and fix the metrics to measure quality of the results. We shall then describe the experimentation carried out and finally the experimental results and findings.

### Dataset

Our dataset consists of marks assessed in the interval, [0,10], gathered from anonymous students of different schools from 2000 to 2007. A detailed description is showed in Table 1.

The dataset contains students' marks with similar demographic characteristics, and from a concrete geographic area. Due to the fact that we think that schools, subjects and/or teachers are not static and they work in different manners, it should be convenient to accomplish a survey for each dataset in order to check the validity and best implementation of the support system.

Teachers and students' behavior changes along the time, therefore long term datasets cannot be useful, so short and midterm datasets can provide better and more accurate predictions.

**Metrics**

Metrics are used to check the performance of a system. There exist several types of metrics but we focus on metrics that evaluate recommender system's *accuracy*. Accuracy metrics measure how well a system predicts an exact rating value for a specific item (Herlocker, 2004).

Although accuracy metrics probably are not suitable for all domains or systems, our aim is to prove the validity of CF in order to support Academic Orientation tasks. The use of accuracy metrics is the best option, we have utilized the Mean Absolute Error (MAE) because the satisfaction in Academic Orientation is different from e-commerce and other metrics are not suitable, because we have certain lack of feedback due to the fact that students' satisfaction is not only based on the obtained marks. To complement this metric usually Coverage is also used:

*Table 1. Dataset (students' marks)*

| *Number of students* | **794** |
|---|---|
| Number of years observed: | from 2000 to 2007 |
| Total amount of marks: | 13421 |
| **Total number of subjects:**<br>**Core subjects**<br>**Module subjects**<br>**Elective subjects** | 74<br>11<br>32<br>31 |

- Mean absolute error (MAE, Eq. 5) measures the average absolute deviation between a predicted rating and the user's true rating (Herlocker, 2004):

$$MAE = |\overline{E}| = \frac{\sum_{i-1}^{n} |p_i - r_i|}{P} \qquad (5)$$

Being $p_i$ the prediction provided by the system for the subject $i$, $r_i$ the user's real mark, and $P$ the total number of predictions for which we obtain the real mark.

- Coverage is the percentage of items over all users for which a prediction was requested and the system was able to produce a prediction (Herlocker, 1999).

**Experimentation**

Our proposal of DSS based on a CRS will use a K-NN scheme for grouping students. In our survey we shall analyze both User-based collaborative filtering (UCF) and Item-based collaborative filtering (ICF) performances. The aim of our survey is to optimize the parameters of the k-NN algorithm to obtain the better predictions to support students' decisions. Such parameters are:

- k: neighborhood size.
- *N*: the *significance weighting* determines the number *N* of common ratings to compute similarity between neighbors (Herlocker, 1999). The more common-rated items, the more reliable will be similarity obtained.
- Prediction method.

This survey has been run 100 times for each configuration studied (see Table 2).

## Experimental Results

Initial tests performed with *k* varying from 10 to 30 showed that CF might be useful for Academic Orientation because of its good accuracy for UCF algorithms (see Table 3).

For a further study new configurations were analyzed such as PCC with fixed mean applying SW with WA, and WA with CA for predictions and a similar configuration but with mean in the PCC calculation. The best results obtained with the UCF method corresponds to PCC-F with SW as similarity measure, and predicting with WA using CA. Being the MAE = 0,9237 and the Coverage = 99,4072 with K = 30.

We then run experiments with ICF algorithms (Table 4) in order to compare accuracy and coverage.

ICF algorithms obtained high coverage values, consequently these algorithms should be used when they obtain better accuracy than UCF ones. In our study this happened with the configuration PCC with SW for similarity and WA with CA for predictions, being the MAE = 0,9026 and Coverage = 99,8852 with K = 15.

Analyzing both methods in depth by varying the K and N parameters, both UCF and UCF present similar values for accuracy (see Table 5), however

*Table 2. Different configurations used in survey for similarity computation*

| Method | User-CF (UCF) | | | | | | Item-CF (ICF) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Similarity measure | PCC | | PCC-F | | COS | | PCC | | PCC-F | | COS | |
| Improvements for similarity | SW | INV | SW | INV | SW | INV | SW | INV | SW | INV | SW | INV |
| Prediction Method | WA WS | | | | | | | | | | | |
| Improvement for prediction | CA | | | | | | | | | | | |
| Abbreviators | PCC: Pearson Correlation Coefficient with user relative average [1] (Breese, 1998).<br>PCC-F: Pearson Correlation Coefficient with fixed average<br>COS: Vector Similarity or Cosine Similarity (Breese, 1998).<br>SW: Significance Weighting (Herlocker, 1999) with variations of factor *N* for co-rated items<br>INV: Inverse Frequency (Breese, 1998).<br>WS: Weighted Sum (Adomavicius, 2005).<br>WA: Weighted Average (Adomavicius, 2005).<br>CA: Case Amplification (Breese, 1998).<br>For all configurations, parameter *k* of the *k-NN* method was varied widely from 5 to 50. | | | | | | | | | | | |

*Table 3. Experimental results*

| General Predictions for UCF | | | |
|---|---|---|---|
| Similarity measure | MAE WA | MAE WS | Coverage |
| cos | 1,3023 | 1,7383 | 79,9063 |
| cos + inv | 1,2054 | 1,5703 | 88,3686 |
| cos + inv + sw | 1,1913 | 1,8717 | 97,8888 |
| cos + sw | 1,3084 | 1,808 | 69,5259 |
| pcc-f | 1,1266 | 1,1322 | 82,9623 |
| pcc | 1,1792 | 1,6138 | 78,3836 |
| pcc-f + sw | **0,9523** | 1,0327 | **98,6686** |
| pcc + sw | 1,0286 | 1,4437 | 97,0385 |

it is remarkable that ICF algorithms perform better than UCF ones, because of its advantages related to online computation and scalability.

## Findings

Our survey has obtained that accuracy is always greater than 90% (MAE > 0,9), that means a predicting error less than 10% and the coverage is greater than 99% in ICF and around 97% in UCF.

These data confirm our intuition that marks means more than a crisp value, and they contain much valuable information concerning students. Hence, the survey shows that CF might be considered as a good predictive technique for Academic Orientation because the accuracy obtained to foresee the future performance of students (>90%), it is good enough to achieve our objective of helping advisors to support students' decisions.

The initial objective of our survey was to answer the question: *are CF methods good enough to provide useful information to support advisor in their task of guiding students about the election of module programs, module and elective subjects*? The survey shows that CF is suitable for these objectives and additionally for warnings about core subjects:

*Table 4. Experimental results*

| **General Predictions for ICF** | | | |
|---|---|---|---|
| Similarity measure | MAE WA | MAE WS | Coverage |
| cos | 1,1436 | 1,2897 | 63,0948 |
| cos + inv | 1,1331 | 1,3899 | 74,4365 |
| cos + inv + sw | 1,506 | 1,8135 | 31,8663 |
| cos + sw | 0,9525 | 1,1646 | **99,9932** |
| pcc-f | 0,9276 | 1,0955 | 89,2931 |
| pcc | 1,0507 | 1,1112 | 75,243 |
| pcc-f + sw | **0,9167** | 1,1112 | **99,8852** |
| pcc + sw | 0,9278 | 1,0902 | **99,9923** |

*Table 5. Comparison between UCF and ICF*

| **MAE for ICF with PCC and SW configuration** | | | | **MAE for UCF with PCC-F and SW configuration** | | | |
|---|---|---|---|---|---|---|---|
| | K=10 | **K=15** | K=20 | | K=25 | **K=30** | K=35 |
| N=20 | 0,9069 | 0,9053 | 0,9067 | N=35 | 0,9319 | 0,9300 | 0,9308 |
| N=25 | 0,9075 | 0,9036 | 0,9060 | N=40 | 0,9278 | 0,9261 | 0,9271 |
| **N=30** | 0,9097 | **0,9020** | 0,9072 | N=45 | 0,9278 | 0,9261 | 0,9272 |
| N=35 | 0,9094 | 0,9026 | 0,9095 | **N=50** | 0,9249 | **0,9234** | 0,9243 |
| N=40 | 0,9114 | 0,9045 | 0,9111 | N=55 | 0,9304 | 0,9297 | 0,9292 |

- **Module recommendations**: The better predictions for the subjects belonging to a module the better success expectations for the student in that area. The performance foresight for a student in a module is computed by aggregating the predictions for the subjects of such a module.
- **Module and Elective subject recommendations**: Both recommendations are similarly computed. The main issue is to decide when a predicted value is good enough to recommend that subject.
- **Reinforcement recommendations for core subjects**: By analyzing the survey results, we detected that CF provides information about which core subjects might cause difficulties to the student.

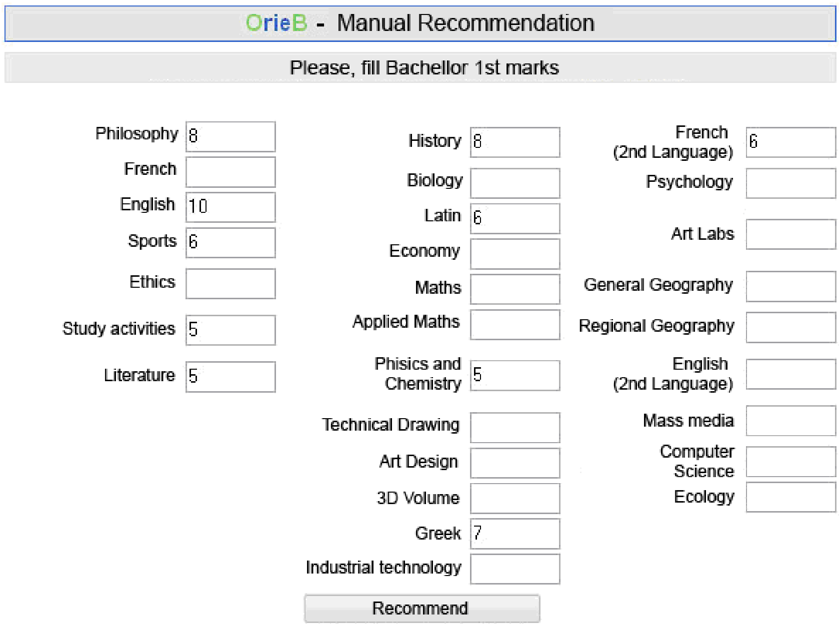
## ORIEB: A WEB-DSS FOR ACADEMIC ORIENTATION

Once we showed that CF is appropriate for our aim the next step was to implement a Web-DSS, so called OrieB, to support Spanish advisors in Academic Orientation. This system will provide information about recommendations by means of linguistic information, thus, the advisors can develop their duties quicker and with a greater reliability. When advisors want to use OrieB to support students, they just need to type a student's ID, or introduce student's marks (Figure 3).

### Linguistic Recommendations

As it was pointed out, it seems more natural the use of linguistic terms to make and explain recommendations than precise numerical values that can

*Figure 3. Manual filling of marks*




mislead the students in their decisions. So, OrieB will provide linguistic recommendations.

OrieB computes predictions for subjects and transforms them to linguistic labels belonging to the term set showed in Figure 2. This transformation is based on the greatest degree of membership (Herrera, 2005). An example of the conversion to linguistic recommendations is showed in Figure 5.

## Supporting Decisions

In order to help advisors in their tasks, OrieB offers three different types of support:

- Module recommendation
- Subject recommendation
- Warning difficulties in core subjects

They all are based on predictions computed by the method that better results obtained in our survey.

## Module or Vocational Program Recommendations

In order to aid advisors guiding students about the Module that better suits them according to their marks OrieB computes a Module recommendation based on a ordered list by interest (see Figure 6).

Each recommendation for a module incorporates an interest value and a trust value.

**Interest value** expresses the appropriateness of a module for the target student based on the predicted marks.

**Trust value** shows the confidence about the previous *interest value* based on the ratio between

*Figure 4. Subject recommendation in OrieB*

| Recommendation | Elective subject |
|---|---|
| Very high | Mass Media |
| High | Psichology |
| High | Computer science |
| Medium | French (2nd Language) |

*Figure 5. Example of linguistic labels assignment*

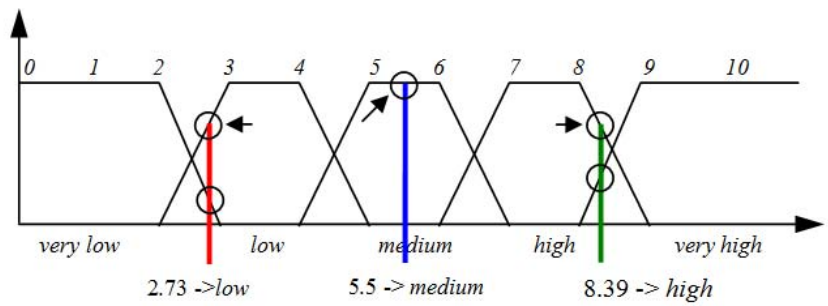



*Figure 6. Vocational Program Recommendation*

**Vocational Program Recommendation**

| Trust | Interest | Program |
|---|---|---|
| 57% | Very High | Arts |
| 60% | High | Humanities and Social sciences |
| 64.22% | Medium | Natural sciences and health |
| 54.5% | Very Low | Technology |

the number of subjects whose predictions were obtained and the total number of subjects for the module, and the variance of those predictions.

### Support for Choosing Elective and Module Subjects

Once students have chosen what module they prefer, they need to complete their curriculum with module and elective subjects. To support this decision OrieB offers separate recommendations for each group of subjects (see Figure 4).

### Warning Difficulties in Core Subjects

Finally, students also may need advices about what core subjects could be difficult for them. In this sense, the system offers a list with those core subjects with predictions lower than *medium*, it will warn the advisor which core subjects could cause difficulties to the student.

## CONCLUSION

In this chapter we have introduced the problem of Academic Orientation, and proposed the use of Collaborative filtering techniques in order to recommend students an academic path by using their marks. This method can be used not only for de case study presented, but all academic stages, having the appropriate dataset.

The accomplishment of a real case study to validate the use of CF in Academic Orientation has provided the necessary results to implement a linguistic Web-DSS based on a Collaborative Recommender System that helps the advisors in their task of supporting students. It is clear that these are only the basis for building a hybrid support system that will include additional data besides the student marks, such as qualitative indicators related to student's skills or preferences.

*Figure 7. Core subject difficulty advising*

Core subject difficulty advising

| Trust | Subject |
|---|---|
| 74.33% | English |
| 82% | Literature |
| 16.67% | French |

## REFERENCES


Adomavicius, G., & Tuzhilin, A. (2005). Toward the next generation of recommender systems: A survey of the state-of-the-art and possible extensions. *IEEE Transactions on Knowledge and Data Engineering*, *17*(6), 734–749. doi:10.1109/TKDE.2005.99

Breese, J. S., Hecherman, D., & Kadie, C. (1998). *Empirical Analysis of Predictive Algorithms for Collaborative filtering.* Paper presented at the Uncertainty in Artificial Intelligence. Proceedings of the Fourteenth Conference.

Herlocker, J. L., Konstan, J. A., Borchers, A., & Riedl, J. (1999). *An algorithmic framework for performing collaborative filtering.* Paper presented at the Sigir'99: Proceedings of 22nd International Conference on Research and Development in Information Retrieval, New York.

Herlocker, J. L., Konstan, J. A., Terveen, K., & Riedl, J. T. (2004). Evaluating collaborative filtering recommender systems. *ACM Transactions on Information Systems*, *22*(1), 5–53. doi:10.1145/963770.963772

Herrera, F., Martinez, L., & Sanchez, P. J. (2005). Managing non-homogeneous information in group decision making. *European Journal of Operational Research*, *166*(1), 115–132. doi:10.1016/j.ejor.2003.11.031

Martínez, L., Pérez, L. G., & Barranco, M. (2007). A Multi-granular Linguistic Content-Based Recommendation Model. *International Journal of Intelligent Systems*, *22*(5), 419–434. doi:10.1002/int.20207

Resnick, P., & Varian, H. R. (1997). *Recommender systems,* (Vol. 40). New York: ACM Press.

Salgado, J. F. (1996). Personality and job competences: A comment on the Robertson & Kinder (1993) study. *Journal of Occupational and Organizational Psychology*, *69*(4), 373–375.

Sarwar, B., Karypis, G., Konstan, J., & Riedl, J. (2000). *Analysis of recommendation algorithms for e-commerce*. Minneapolis, MN: ACM Press.

Schafer, J. B., Konstan, J. A., & Riedl, J. (2001). *E-Commerce Recommender Applications* (Vol. 5). Amsterdam: Kluwer Academic Publishers.

Zadeh, L. A. (1975). The concept of a linguistic variable and its application to aproximate reasoning. *Information Science, 8 and 9*.


## KEY TERMS AND DEFINITIONS

**Decision Support System:** Information system that supports users in decision-making activities.

**Collaborative Filtering:** Process of filtering for information using techniques involving collaboration among multiple users, data sources, etc.

**Subject:** An area of knowledge studied in school, college or university.

**Module:** Branch of knowledge which groups several *module* subjects in order to allow students specialize in an area.

**Academic Profile:** Set of subjects (core, module and/or elective) and modules chosen by a student.

**Academic Orientation:** Task that guides students to choose a suitable Academic Profile.

**Advisor:** Person who is in charge of performing the Academic Orientation task.

## ENDNOTE

1 As seen in Eq. 1 PCC uses two users' averages for its computation. This can be modified as we have done in PCC-F by fixing those averages to the average of the scale used. This can provide us absolute similarities more than relative similarities.

# Chapter 125
# Wireless Technologies:
## Shifting into the Next Gear?

**Simona Fabrizi**
*Massey University, New Zealand*

## ABSTRACT

*Mobile Operators (MOs) in several countries are constantly challenged with the urge to further enhance the quality of their existing wireless networks, often dictated by the need to meet the newest technological standards as progress in wireless technologies is made. While the pressure to upgrade wireless networks is constantly felt by MOs in this market, it is not uncommon to observe some MOs upgrading their networks earlier than others. This article provides a theoretical explanation for this apparent paradox of why some MOs postpone the upgrading while others do not. It is shown that in the presence of different types of users - conservative versus quality-seeking - MOs may find it more profitable to adopt asymmetric upgrading strategies. Furthermore, it is argued that the incentives by some MOs not to upgrade are the largest when the share of conservative users in the market is sufficiently high, relative to the additional cost that upgrading entails. In such a case the MOs that do not upgrade their networks enjoy higher profits than the ones that do so.*

## INTRODUCTION AND BACKGROUND

### Motivation

It is not uncommon nowadays to be confronted with various and continuous forms of advertising by MOs trying to persuade (prospective) customers of Mobile Internet services that their respective network is the fastest, the one with the broader coverage, or the one with the overall best performance, and so on. One such example is that of Telecom NZ with its only very recently proposed slogan to current and prospective customers of broadband Internet services: "*Testdrive, Faster in more places*".[1] Why would only some MOs engage in the upgrading of their networks? The answer to this question is far from obvious and the aim of this article is to

DOI: 10.4018/978-1-61520-611-7.ch125

fully characterize under which conditions such a behavior is perfectly rational.

The results of the analysis offer a way to reconcile the apparent contradiction of postponing the upgrading of their networks by some operators, but not others. By means of a theoretical model, the article first provides an explanation for the decision of MOs to engage in the upgrading of their networks. It is shown that those incentives to upgrade are the strongest, the tougher the competition between MOs for market shares, and the more alike the users with respect to their willingness to pay for the enhanced services. Further, it is analyzed and discussed that those incentives for MOs to all upgrade their networks change when the willingness to pay for enhanced services may vary considerably across potential users. In this case, it becomes relatively less attractive for MOs to align their networks to the highest technological standards, when others do so, and this could paradoxically guarantee the MOs that do not upgrade their network's higher profits than the ones of MOs that decided to do so.

These findings may provide a rationale for why MOs such as, for example, Telecom NZ, are at times more aggressive players than others in their upgrading decisions. For Telecom NZ, that decided to start upgrading its network before its rivals, there is at stake the prospect of being the provider capturing the share of the market formed by the New Zealanders seduced by the enhanced speed of accessing mobile broadband services.[2] Similar cases can be found, in which MOs have alternatively behaved as the leaders (pioneers), or the followers, in the adoption of several and subsequent standards.[3] A related example, is the case of Telecom NZ that itself took years before adopting the same 3G standards used by its rivals, such as Vodafone NZ, preventing over these years the possibility of international roaming for its subscribers. It is only recent the passage to the same standards as the ones used by its rivals, after Australian operators switched to this alternative standard.

## Description of the Main Features of the Model and Related Literature

A theoretical model is built to capture the main features needed to characterize the upgrading decision MOs make with respect to their respective networks' quality, as well as to allow for both scenarios in which (A) all users would equally value high quality services; and (B) users all value low quality services the same, however differ in their willingness to pay for the highest quality services; a distinction is made between *quality-seeking* and *conservative* users.

The model used is well suited to analyze at the same time different qualities of services offered in the market by MOs (e.g. different speeds of Internet access), as well as different varieties of services offered by MOs (e.g. that may depend on MOs' images, or their proposed bundles of services, etc.). The differences in quality are referred to in the economic literature as forms of vertical differentiation, while differences in varieties fall under the category of horizontal differentiation.

Many contributions in the economic literature have considered horizontal and vertical differentiation together, e.g. Economides (1989), or Neven and Thisse (1990). These rather classical studies have analyzed the way competing producers may select their offered *quality* and *variety* of services. In this article, the quality is endogenously determined by the upgrading decisions of horizontally differentiated MOs competing over prices. The novelty here is to allow for those decisions to be taken under alternative scenarios: the traditional one (scenario A) where users are considered to all have the same preferences for services of comparable quality; and the additional one (scenario B) where users might differ in the extent of their appreciation of high quality of services.

*Users' mobility* is often recognized as being a crucial feature of wireless Internet. To capture this important feature, in this article the upgrading decision of MOs is considered to be made within what is defined as a *closed system*. This is a system in which MOs are intended to have developed a network which extent covers all areas where users can potentially move when asking to access Internet services. As a result, within a closed system, given that each operator is autonomous in the provision of those services, interconnection to, or roaming into, rival networks can be neglected.[4]

Moreover, it is important to note that most Internet services are asymmetric in nature: e.g. downloading of movies, pictures, music, or simple access to websites. The theoretical model used in this article is well suited to focus on the asymmetric nature of Internet services, thus shifting its attention further away from the focus of previous studies, e.g. Crémer, Rey and Tirole (1999), or Laffont, Marcus, Rey and Tirole (2003), which dealt, respectively, with congestion, and interconnection issues in the Internet industry.

Finally, another important point of difference between the current analysis and previous ones, concerns the assumption of a usage-independent access fee to be incurred by users of Internet services, thus the abandonment of the more standard quantity-based pricing paradigm. The subscription fee used here reflects simply the quality and variety of services available within each network. Once more, issues such as congestion, i.e. potential quality degradation due to excessive use of an available network capacity, are left out. This is done under the implicit assumption that 3G technologies are characterized by a greater bandwidth capacity for the transmission of data than more traditional Internet technologies, leaving the cost MOs face to provide 3G services to basically be nothing else but the cost of providing direct access to those enhanced services.

The remainder of this article is organized as follows. The next section describes the model setup, where the timing of the game considered for the phenomenon of interest, i.e. the determinants of the upgrading decisions, is laid out; and the notation used in the rest of the analysis is also introduced. Different results are then summarized. A conclusion recapitulates those results and discusses them further in light of the original motivation for conducting the study.

## THE MODEL

### Networks

Two horizontally differentiated MOs,[5] network $j$ and network $(-j)$, decide simultaneously whether to upgrade their own network which would lead to an improvement in the quality of services provided from low to high. Define the quality of services as $\theta_i$, with $i = L, H$, standing for either high or low quality, so that $\Delta\theta = \theta_H - \theta_L \geq 0$. Assume further that the cost MOs face for the provision of services of quality $\theta_i$, $c(\theta_i) = \left\{c_L, c_H\right\}$ is such that $c_H \geq c_L$. Define the subscription fee users have to pay to network $j$ offering access to Internet services of quality $\theta_i$ as $p_{ij}$. Finally, assume that MOs fully cover the market, so that $\alpha_j$ and $\alpha_{(-j)} = (1 - \alpha_j)$ are defined as the market shares they respectively serve.

### Users

Users are normalized to have mass one. They are uniformly distributed along the unit line and derive utility as subscribers of a given network from accessing the Internet services. Users' gross utilities[6] depend both on the level of quality of services offered by the network they subscribe to, either high or low, as well as on how close the services offered by their chosen network are from their ideally preferred variety. A factor *t* reflects users' per-unit of distance cost of subscribing to a network which is far away from their ideal one. Users, after ascertaining the qualities, the varieties, and the subscription fees offered by each network, decide to which network they want to subscribe to.

Two alternative scenarios, A and B, are envisaged regarding the component of users' utilities which directly reflect their appreciation for the quality of Internet services offered by MOs:

(A) Users all derive the same level of utility from accessing Internet services which depends on the quality of service offered by MOs, $\theta_i$; and they value high quality services enough to compensate for the additional cost networks face to provide them, i.e. $\theta_i \geq c_i$;

(B) Users all derive the same level of utility from accessing low quality Internet services, $\theta_L$, but derive different utilities from accessing high quality ones instead. *Quality-seeking* users value them $\overline{\theta}_H$, while *conservative* users value them $\underline{\theta}_H$, with $\overline{\theta}_H \geq \underline{\theta}_H$. Furthermore, only users who are quality-seeking value high quality services enough to compensate for the additional cost networks face to provide them. This implies the following: $\Delta\overline{\theta}_H \geq \Delta c \geq \Delta\underline{\theta}_H$, with $\Delta\overline{\theta}_H = \overline{\theta}_H - \theta_L$, $\Delta\underline{\theta}_H = \underline{\theta}_H - \theta_L$, and $\Delta c = c_H - c_L$.

## Timing

The steps of the game are summarized as follows:

(a) MOs decide simultaneously to upgrade or not to upgrade their networks (which, in turn, determines both the quality of the Internet services offered, and the cost of providing them);

(b) MOs set the subscription fee to be charged to their respective subscribers, while incurring the cost of letting them access their Internet services;

(c) Users subscribe to one of the two networks and MOs' profits are realized.

In the next sections, the different results for the upgrading decisions are summarized by distinguishing all possible alternative cases of analysis stemming from the model as described above. The model is solved backwards. The distinction between scenarios A and B as described above is taken into account to characterize all possible solutions to the upgrading decisions by MOs.

## SCENARIO A

The MOs' profits are derived under the assumption that for all users $\theta_i \geq c_i$.

### Case A1: Both MOs Upgrade their Networks

If both MOs upgrade their network, users can access high quality of Internet services regardless of whether they join network $j$ or network $(-j)$. How users split between the networks is ultimately a function of (i) any differences in the subscription fees as charged by MOs; as well as of (ii) the distance between each user's and network's location (or, in an alternative interpretation, the discrepancy between each user's preferred variety and the variety offered by each of the networks).

The market share of network $j$ can be shown[7] to be:

$$\alpha_j = \frac{1}{2} - \frac{p_{H(-j)} - p_{Hj}}{2t}$$, or, written differently,

$$\alpha_j = \frac{1}{2} - \sigma\Delta p,$$

where $\Delta p$ stands for the difference, if any, between the subscription fees offered by network $(-j)$ as compared to network $j$, and $\sigma = \frac{1}{2t}$ is meant to capture the degree of substitutability, or differentiation, between MOs. If $\sigma$ is very high, small differences in prices charged by MOs are amplified in the eyes of users, making competition for market shares tougher; vice versa, if $\sigma$ is very low, at the limit if $\sigma \to 0$, the impact of any differences in the prices charged by MOs on the way users split among networks is reduced, thus softening competition for market shares.

Using the information about how market shares are determined, it is possible to derive the profit-maximizing level of the subscription fees for each MO.

For this case of analysis, case A1, the profit-maximizing level of the subscription fee for, let us say, network $j$ is obtained as follows: $p_{Hj}^{A1} = \arg\max\left[\pi_{Hj} = \alpha_j \left(p_{Hj} - c_H\right)\right]$, with $\pi_{Hj}$ standing for network $j$'s profit under case 1.

This leads to the following:

(A1.i) subscription fees $p_{Hj}^{A1} = p_{H(-j)}^{A1} = p^{A1} = c_H + t$;

(A1.ii) market shares $\alpha_j^{A1} = 1 - \alpha_j^{A1} = \alpha^{A1} = \frac{1}{2}$; and,

(A1.iii) profits $\pi_{Hj}^{A1} = \pi_{H(-j)}^{A1} = \pi^{A1} = \frac{t}{2}$.

### Case A2: Both MOs Do Not Upgrade their Networks

It can be shown that if both MOs decide not to upgrade their networks, both would offer the same low quality of service, and users would split across MOs according to a condition, similar to the one considered in the previous case, leading to:

(A2.i) subscription fees:

$p_{Lj}^{A2} = p_{L(-j)}^{A2} = p^{A2} = c_L + t < p^{A1}$;

(A2.ii) market shares:

$\alpha_j^{A2} = 1 - \alpha_j^{A2} = \alpha^{A2} = \frac{1}{2} \equiv \alpha^{A1}$; and,

(A2.iii) profits $\pi_{Lj}^{A2} = \pi_{L(-j)}^{A2} = \pi^{A2} = \frac{t}{2} \equiv \pi^{A1}$.

### Case A3: One MO Upgrades its Network while the Other Does Not

Let us say, MO $j$ upgrades its network, while the other does not. In this case, users will split across networks according to a slightly different condition than the one described above[8], leading to MO $j$ enjoying a market share as follows:

$$\alpha_j = \frac{1}{2} - \frac{\Delta\theta - \Delta p}{2t},$$

where as anticipated $\Delta\theta$ captures the difference in the high quality offered by upgrading network $j$ as compared to the low quality offered by the network that does not upgrade, and $\Delta p$ stands for any differences between the subscription fees charged by the non-upgrading and the upgrading network, respectively.

Repeating a similar analysis to the one described above, leads to:

(A3.i) subscription fees $p_{Hj}^{A3} > p_{L(-j)}^{A3}$;

(A3.ii) market shares $\alpha_j^{A3} > \alpha^{A2} = \frac{1}{2} > \alpha_{(-j)}^{A3}$; and,

(A3.iii) profits $\pi_{Hj}^{A3} > \pi^{A2} > \pi_{L(-j)}^{A3}$.

## RESULTS FOR SCENARIO A

Let us label the profit level enjoyed by the MO upgrading its network when its rival does not upgrade as $a$, and the profit of the non-upgrading rival as $b$. Under scenario A, those profit levels satisfy the condition $a > \frac{t}{2} > b$.

Using this labeling, it is possible to summarize the findings obtained so far using a matrix. The matrix below illustrates the profits achievable by each MO for each possible combination of their respective upgrading decisions. By convention, the first profit of each of the pairs of profits as

*Table 1.*

| SCENARIO A | $(upgrade)_{(-j)}$ | $(not-upgrade)_{(-j)}$ |
|---|---|---|
| $(upgrade)_{(j)}$ | $\left(\frac{t}{2},\frac{t}{2}\right)$ | $\left(b<\frac{t}{2},a>\frac{t}{2}\right)$ |
| $(not-upgrade)_{(j)}$ | $\left(a>\frac{t}{2},b<\frac{t}{2}\right)$ | $\left(\frac{t}{2},\frac{t}{2}\right)$ |

indicated in the matrix refers to the profit of network $j$, while the second profit level refers to that of network $(-j)$.

Upgrading is a dominant strategy for both MOs, as irrespective of the rival network's decision, it is profit-maximizing for each MO to upgrade. The fact that MOs' incentives to upgrade are symmetric, ultimately leads both of them to upgrade their networks. These findings are summarized below.

**Proposition 1.** *If all users value equally the access to Internet services of a given quality,* $\theta_i$, *and, if the value users attach to those services satisfies* $\theta_i \geq c_i$, *there exists a unique Nash equilibrium where both MOs decide to upgrade their networks.*

Finally, note that even though both MOs upgrade under scenario A, MOs' profits are not superior to the ones associated with no upgrading by both.

## SCENARIO B

The MOs' profits are derived under the assumption that for all users $\theta_L \geq c_L$; but $\Delta\bar{\theta}_H \geq \Delta c \geq \Delta\underline{\theta}_H$.

A similar analysis as under scenario A is replicated here.

However, in the analysis in scenario B it is important to examine all sets of restrictions needed for the different types of users to have an incentive to subscribe to either network, under each of the cases to be considered. The incentive for users to subscribe to either network is called *individual rationality constraint*.

Furthermore, it is important to also consider explicitly the different proportion of *quality-seeking* users, defined as $q \in (0,1)$, and of *conservative* ones, defined as $(1-q)$, respectively. Assume those proportions to be known to MOs. However, also assume that MOs cannot price discriminate users depending on whether they are quality-seeking or conservative, either because users' types are not observable, or because any form of price discrimination is banned. Either ways, it is not possible for MOs to offer different contracts to different users for similar services in order to sort their types.

### Case B1: Both MOs Upgrade their Networks

If both MOs upgrade their networks, they both offer high quality services.

Below are discussed the situations where: (Case B1.a) the findings in B1 are the same as in A1, which is possible as long as the individual rationality constraints for both types of users are still satisfied;[9] and where (Case B1.b) this does not happen anymore.

**Case B1.a:** Assume that the individual rationality constraint for the 'most remotely located' conservative user is non-negative for $p^{A1} = c_H + t$, i.e. $\underline{\theta}_H - p^{A1} - t\frac{1}{2} \geq 0$. This assumption is satisfied as long as $\underline{\theta}_H \geq \underline{\theta}_H^{\min} = \frac{3}{2}t + c_H$, that is as long as the lowest level for the utility conservative users derive from accessing upgraded services is above the minimum threshold of $\underline{\theta}_H^{\min}$.

**Remark 1.** *If all users value the access to Internet services of a given quality,* $\theta_i$, *such that* $\theta_i \geq c_i$ *and* $\underline{\theta}_H \geq \underline{\theta}_H^{\min} = \frac{3}{2}t + c_H$, and if both MOs upgrade their networks their profits are the same as under case A1, i.e. $\frac{t}{2}$.

**Case B1.b:** Assume that the value that conservative users attach to accessing high quality services, $\underline{\theta}_H$, is such that $c_H \leq \underline{\theta}_H \leq \underline{\theta}_H^{\min} = \frac{3}{2}t + c_H$, i.e. below the minimum threshold identified above, but still superior to the cost of providing high quality services themselves.

In this alternative case, MOs face a trade-off between lowering their subscription fee as compared to the one set in case A1 in order to attract all users and keeping the higher subscription fee at the expense of losing some users among the conservative ones. The MOs' profits can range between $q\frac{t}{2}$ and $\frac{t}{2}$. Define these profits achievable under case B1.b as $\underline{\pi}$, with $\underline{\pi} \in \left[q\frac{t}{2}, \frac{t}{2}\right]$.

**Remark 2.** *If all users value the access to Internet services of a given quality,* $\theta_i$, *such that* $\theta_i \geq c_i$ *and* $c_H \leq \underline{\theta}_H \leq \underline{\theta}_H^{\min} = \frac{3}{2}t + c_H$, and if both MOs upgrade their networks their profits are lower than under case A1.

## Case B2: Both MOs Do Not Upgrade Their Networks

If neither MO upgrades its network, only the low quality services are offered to users, and the distinction between quality-seeking and conservative users does not play any role. Thus, the same findings as under A2 apply for this case as well.

**Remark 3.** *If all users value the access to Internet services of a given quality,* $\theta_i$, *such that* $\theta_i \geq c_i$ *and* $\overline{\theta}_H - \theta_L \geq c_H - c_L \geq \underline{\theta}_H - \theta_L$, and if both MOs do not upgrade their networks their profits are the same as under case A2, i.e. $\frac{t}{2}$.

## Case B3: One MO Upgrades its Network while the Other Does Not

Suppose that all quality-seeking users prefer to subscribe to the high quality services, i.e. that their willingness to pay for those services is high enough to never let them turn toward the non-upgrading network. However, while some conservative users might find it worthwhile to join the upgraded network, some others 'more remotely located' with respect to it might choose to join the low quality network instead.

Assume that $\underline{\alpha}_j$ and $\underline{\alpha}_{(-j)} = (1 - \underline{\alpha}_j)$ are the market shares of conservative users respectively served by the upgrading network $j$ and the non-upgrading network $(-j)$. How the component of the market formed by conservative users splits between the two networks, once again, is obtained as follows:

$$\underline{\alpha}_j = \frac{1}{2} - \frac{\Delta\underline{\theta} - \Delta p}{2t}$$

where $\Delta\underline{\theta}$ accounts for the difference between the high quality offered by upgrading network $j$ as compared to the low quality offered by the network that does not upgrade in the eyes of the conservative users, and $\Delta p$ stands, as before, for any differences between the subscription fees charged by the non-upgrading and the upgrading network, respectively.

The profit-maximizing subscription fee for the upgrading network *j* can be found as follows:

$$p_{Hj}^{B3} = \arg\max\left[\pi_{Hj} = q\left(p_{Hj} - c_H\right) + (1-q)\underline{\alpha}_j\left(p_{Hj} - c_H\right)\right].$$

while the profit-maximizing subscription fee for the non-upgrading network (–*j*) can be found as follows:

$$p_{L(-j)}^{B3} = \arg\max\left[\pi_{L(-j)} = (1-q)(1-\underline{\alpha}_j)\left(p_{L(-j)} - c_L\right)\right].$$

Solving for both these profit-maximizing subscription fees, it can be shown that the following always holds:

(B3.i) $p_{Hj}^{B3} > p_{L(-j)}^{B3}$.

Then, if and only if $\frac{q}{1-q} > \frac{\Delta c - \Delta\underline{\theta}}{t}$:

(B3a.ii) market shares $\alpha_j^{B3} > \alpha_{(-j)}^{B3}$; and,

(B3a.iii) profits $\pi_{Hj}^{B3} > \pi_{L(-j)}^{B3} > \frac{t}{2}$ or $\pi_{Hj}^{B3} > \frac{t}{2} > \pi_{L(-j)}^{B3}$.

Otherwise, i.e. if and only if $\frac{q}{1-q} < \frac{\Delta c - \Delta\underline{\theta}}{t}$:

(B3b.ii) market shares $\alpha_j^{B3} < \alpha_{(-j)}^{B3}$; and,

(B3b.iii) profits $\pi_{L(-j)}^{B3} > \pi_{Hj}^{B3} > \frac{t}{2}$ or $\pi_{L(-j)}^{B3} > \frac{t}{2} > \pi_{Hj}^{B3}$.

Unlike in case A3, the comparisons between market shares, margins and profits now depend on the different possible combinations of the specific values of the parameters $q, \Delta c, \Delta\underline{\theta},$ and $t$.

In other to highlight how these findings impact on MOs' profit, it is useful to label the profit level enjoyed by the MO upgrading its network when its rival does not upgrade as $c$, and the profit of the non-upgrading rival as $d$.

Findings have shown that if $\frac{q}{1-q} > \frac{\Delta c - \Delta\underline{\theta}}{t}$, the ranking of MOs' profits is such that $c > d > \frac{t}{2}$ or $c > \frac{t}{2} > d$. However, depending on the several possible combinations of the parameters of the model, such a ranking does not rule out the possibility for MOs' profits to be such that $c > d > \frac{t}{2} > \underline{\pi}$, or $c > \frac{t}{2} > d > \underline{\pi}$, or, finally, $c > \frac{t}{2} > \underline{\pi} > d$.

Findings have also shown that if the opposite case occurs, that is if $\frac{q}{1-q} < \frac{\Delta c - \Delta\underline{\theta}}{t}$, the ranking of MOs' profits changes such that $d > c > \frac{t}{2}$ or $d > \frac{t}{2} > c$. Once again, depending on the different possible combinations of the parameters of the model, this ranking does not exclude MOs' profits to be such that $d > c > \frac{t}{2} > \underline{\pi}$, or $d > \frac{t}{2} > c > \underline{\pi}$, or, finally, $d > \frac{t}{2} > \underline{\pi} > c$.

In other words, the findings under scenario B3 show that in order for the MO who upgrades its network to have higher profits than its rival that does not upgrade its own network, the ratio between quality-seeking over conservative users has to be sufficiently high to compensate for the weighted loss associated with the upgrading itself. If this condition is met, the non-upgrading network might still gain or lose as compared to the profits achievable under case A3, i.e. with respect to $\frac{t}{2}$.

If the ratio between quality-seeking over conservative users is instead low enough not to compensate for the weighted loss associated with the upgrading itself, the non-upgrading network obtains higher profits than the upgrading one. The upgrading network might gain or lose in terms of profit as compared to the profits achievable under case A3, i.e. with respect to $\frac{t}{2}$.

## RESULTS FOR SCENARIO B

Given these findings, and their implied relationships for MOs' profits, the results for scenario B can be summarized as follows.

**Proposition 2.** *If* $\Delta\bar{\theta}_H \geq \Delta c \geq \Delta\underline{\theta}_H$, with $\underline{\theta}_H \geq \underline{\theta}_H^{\min} = \frac{3}{2}t + c_H$, and if $\frac{q}{1-q} > \frac{\Delta c - \Delta\theta}{t}$ there exist two mutually exclusive Nash equilibria:

i). *One MO upgrades while the other one does not, as long as* $c > d > \frac{t}{2}$;

ii). *Both MOs upgrade their network, as long as* $c > \frac{t}{2} > d$.

**Proposition 3.** *If* $\Delta\bar{\theta}_H \geq \Delta c \geq \Delta\underline{\theta}_H$, with $\underline{\theta}_H \geq \underline{\theta}_H^{\min} = \frac{3}{2}t + c_H$, and if $\frac{q}{1-q} < \frac{\Delta c - \Delta\theta}{t}$ there exist two mutually exclusive Nash equilibria:

i). *One MO upgrades while the other one does not, as long as* $d > c > \frac{t}{2}$;

ii). *Both MOs upgrade their networks, as long as* $d > \frac{t}{2} > c$.

**Proposition 4.** *If* $\Delta\bar{\theta}_H \geq \Delta c \geq \Delta\underline{\theta}_H$, with $c_H \leq \underline{\theta}_H \leq \underline{\theta}_H^{\min} = \frac{3}{2}t + c_H$, and if $\frac{q}{1-q} > \frac{\Delta c - \Delta\theta}{t}$ there exist two mutually exclusive Nash equilibria:

i). *One MO upgrades while the other one does not, as long as* $c > d > \frac{t}{2} > \underline{\pi}$, or $c > \frac{t}{2} > d > \underline{\pi}$;

ii). *Both MOs upgrade their network, as long as* $c > \frac{t}{2} > \underline{\pi} > d$.

**Proposition 5.** *If* $\Delta\bar{\theta}_H \geq \Delta c \geq \Delta\underline{\theta}_H$, with $c_H \leq \underline{\theta}_H \leq \underline{\theta}_H^{\min} = \frac{3}{2}t + c_H$, and if $\frac{q}{1-q} < \frac{\Delta c - \Delta\theta}{t}$ there exist two mutually exclusive Nash equilibria:

i). *One MO upgrades while the other one does not, as long as* $d > \frac{t}{2} > c > \underline{\pi}$, or, $d > \frac{t}{2} > \underline{\pi} > c$;

ii). *Both MOs upgrade their network, as long as* $d > c > \frac{t}{2} > \underline{\pi}$.

## CONCLUSION

By means of a theoretical economic model, this article has given a complete characterization of which conditions are needed for MOs to either decide not to upgrade their networks, while rival MOs decide to do so; or to both decide to upgrade their networks instead.

The asymmetry in the upgrading decision is more likely to be observed the higher the ratio of conservative versus quality-seeking users in the market for upgraded services, as compared to the weighted loss associated with the upgrading itself. In fact, it has been shown that when users vary with respect to their appreciation for high quality services and for the variety offered, not all MOs find it profitable to upgrade their network regardless of what their rivals' decisions on upgrading are. MOs not upgrading their networks might even derive higher profits than their rivals who decided to upgrade their networks.

Conversely, this article has proven that the incentives for MOs to all upgrade their networks are the stronger, the tougher the competition for market shares, that is the more alike users perceive competing networks. In other words, in the presence of sustained final demand for upgraded service, all MOs would fight more vigorously for market shares, thus putting more pressure on each other to upgrade their networks at the same time.

These insights can explain situations like the one for the mobile broadband market in countries such as New Zealand. This country is characterized by a final market for users of mobile Internet service which has only recently taken off. As a consequence of the recent passage from a less to a more mature market for mobile broadband, MOs such as Telecom NZ, with its XT network, have started upgrading their network in what promises to be just the beginning of a race toward further upgrading of mobile broadband networks.[10]

## REFERENCES


Crémer, J., Rey, P., & Tirole, J. (2000, December). Connectivity in the Commercial Internet. *The Journal of Industrial Economics*, *48*(4), 433–472.

Economides, N. (1989). Quality Variations and Maximal Variety Differentiation. *Regional Science and Urban Economics*, *19*(1), 21–29. doi:10.1016/0166-0462(89)90031-8

Fabrizi, S., & Wertlen, B. (2008). Roaming in the Mobile Internet. *Telecommunications Policy*, *32*(1), 50–61. doi:10.1016/j.telpol.2007.11.003

Laffont, J. J., Marcus, S., Rey, P., & Tirole, J. (2003). Internet Interconnection and the Off-Net-Cost Pricing Principle. *The Rand Journal of Economics*, *34*(2), 370–390. doi:10.2307/1593723

Neven, D., & Thisse, J. F. (1990). *On Quality and Variety Competition, Contributions in Honour of J.H. Drèze.* In J.J. Gabszewics, J.F. Richard and L.A. Wolsey, (Ed.), *Economic Decision-Making: Games, Econometrics and Optimisation*. Amsterdam: North-Holland.


## KEY TERMS AND DEFINITIONS

**Mobile Operators (MOs):** Operators offering mobile Internet services.

**Upgrading:** Improvement of the quality of mobile Internet services.

**Quality-Seeking Users:** Users whose additional valuation for upgraded services exceeds the additional costs for providing them.

**Conservative Users:** Users whose additional valuation for upgraded services *does not* exceed the additional costs for providing them.

**Vertical Differentiation:** Different qualities of products or services are offered in the market.

**Horizontal Differentiation:** Different varieties of products or services are offered in the market.

**Strategic Game:** A game in which each player's payoff is affected by the combination of actions chosen by this player and every other player – in this article, MOs are players in the strategic upgrading game, where actions are 'to upgrade' and 'not to upgrade', and payoffs are the profits achievable as a function of all possible combinations of these upgrading decisions.

**Dominant Strategy:** A strategy which is preferred over any other available strategy by one player regardless of what other players' strategies are.

**Nash Equilibrium:** A Nash equilibrium of a strategic game is a profile of strategies $(s_1^*, \dots, s_n^*)$, where $s_1^* \in S_j$ ($S_j$ is the strategy set of player $j$), such that for each player $j$, and for every $s_1^* \in S_j$, $u_j(s_j^*, s_{-j}^*) \geq u_j(s_j, s_{-j}^*)$, where $s_{-j}^* \in S_{-j}$ with

$S_{-j}$ being the strategies set of any other player but $j$, and where $u$ stands for the utility (or payoff, or profits) each player derives as a function of his or her own chosen strategy and the strategy chosen by any other player. Another way to state the Nash equilibrium condition is that $s_j^*$ solves $\max_{s_j \in S_j} u_j(s_j, s_{-j}^*)$, for each $j$. In other words, in a Nash equilibrium, no player has an incentive to deviate from the strategy chosen, since no player can choose a better strategy given the choices of the other players.

**Individual Rationality Constraint:** The incentive an individual economic agent has to participate in a given game. In this article, when this incentive is satisfied a user is ready to accept to subscribe to a network given the subscription fee, the quality and the variety offered by that network.

## ENDNOTES

1. Telecom NZ is currently investing in the roll-out of a network (XT Network) following the new Evolved High-Speed Packet Access standard, a wireless broadband standard also known as *HSPA Evolution*, *HSPA+*, *I-HSPA* or *Internet HSPA*. This standard allows for wireless Internet access at speeds of three times the ones available so far with Telecom NZ, as well as its competitors in New Zealand.
2. Vodafone NZ had promised to adopt similar enhanced standards.
3. Examples, which share similar features with the wireless technologies, could be found in the wired Internet services. Following the unbundling of the local loop, Telecom NZ had to provide rivals with access to its wired lines which made operators such as Orcon Internet Ltd invest in the roll-out of ADSL2+, which extends ADSL (Asymmetric Digital Subscriber Line) by doubling the number of downstream bits, far before Telecom NZ.
4. Networks overlap completely over the territory so that a *full overlapping* also characterizes the environment in which operators compete. This is an alternative case to the one explored in Fabrizi and Wertlen (2008), where cross-access is made possible between MOs to allow their respective subscribers to access Internet services in areas where the network they might have subscribed to is not available instead. This cross-access is made possible thanks to roaming agreements MOs can sign. The focus of that work is on incentives to enter into such agreements, for MOs' to decide the extent of their coverage, as well as their pricing strategies.
5. For the sake of simplicity the analysis is conducted with two MOs only. However, the results illustrated and discussed in this article can be generalized to many MOs. As in any Hotelling horizontal differentiation model, these assumptions are made in order to capture the idea that consumers of a given product or service perceive them differently, depending on their personal taste, or preferences. In standard Hotelling models, the differences in perceived – horizontally differentiated – qualities are modelled by assuming consumers are differently located with respect to where the products or services are available for purchase. Consumers' distance from the purchase point amplifies the cost associated with potentially buying a quality, or variety, different from their ideal one. This cost, of disutility in consumption, depends on a factor *t*, often referred to as the psychological cost, or transportation cost, of getting a product or service far away from the ideal one.
6. Gross of the subscription fee they need to pay to subscribe to either MOs to access Internet services.
7. This expression can be obtained by rearranging the following expression,

which states the condition for a user to be just indifferent between subscribing to network $j$ and network $(-j)$: $\bar{\theta}_H - p_{Hj} - t\alpha_j = \bar{\theta}_H - p_{H(-j)}t(1-\alpha_j)$.

8 This expression can be obtained by rearranging the following expression, which states the condition for a user to be just indifferent between subscribing to network $j$ and network $(-j)$, given that network $j$ now offers higher quality of Internet services than network $(-j)$: $\bar{\theta}_H - p_{Hj} - t\alpha_j = \bar{\theta}_L - p_{L(-j)}t(1-\alpha_j)$.

9 The implicit assumption here is that either type of users distribute equally across the two networks, so that no asymmetries in serving one type of users by one network, but not the other, can be envisaged. This is not a restrictive assumption, but a very natural one to make, as a priori, given that for this case both networks are of same quality, there is no reason why for any given location of each type of users, that user should prefer to subscribe to one network instead of the other as a function of anything else but the quality and variety offered by that network.

10 More on the New Zealand mobile broadband market can be read in an article appeared in the *National Business Review*: Special Report, "*The sheer of magic of mobile broadband*", July 5, 2009.

# Chapter 126
# Search Engines:
## Past, Present and Future

**Patrick Reid**
*AstraZeneca, UK*

**Des Laffey**
*University of Kent, UK*

## ABSTRACT

*This chapter covers key issues in the area of search engines. It shows the importance of search by explaining what search engines are and their significance to business and society. The mechanics of search are outlined which includes developments to the current age. The search market is then covered which stresses Google's dominance of most national markets. Search engine optimization is then analysed looking at the key factors which determine position. The chapter also looks at the key funding mechanism for search, paid search advertisements. Finally, the article looks at emerging issues in search, including rich media and mobile, and privacy issues.*

## INTRODUCTION

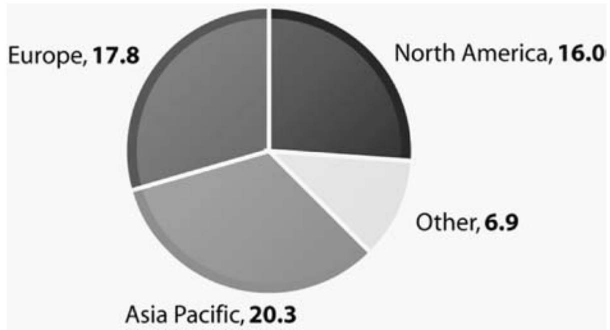
Search engines are fundamental to modern life, with Figure 1 illustrating the number of global searches in August 2007.

The use of the term Google as a verb is perhaps the strongest evidence of the impact of search and of Google's status as the dominant provider. Search has a key role in modern society and as Rangaswamy et al. (2009, p49) write "*search results can influence important decisions about someone's life, health, or a major purchase, or an entrepreneur's quest for an acquisition target*."

This chapter makes a contribution to the Encyclopedia by outlining the key issues regarding search. It does this by integrating ideas from academic and practitioner audiences to offer an integrated perspective on this important topic. The article firstly covers the key definitions, explains how search engines work and discusses the challenges of Web search. The competitive environment of search is then outlined which stresses Google's dominance but notes markets where national champions are dominant. The essential topic of search engine

DOI: 10.4018/978-1-61520-611-7.ch126

*Figure 1. Volume of searches globally (Billions), August 2007*




optimization (SEO) is then analysed. The article then covers the evolution of paid search, the use of text based advertisements which are triggered by the terms in a search. Finally before it concludes emerging issues in the search engine field are considered in the areas of the semantic Web, rich media, location based search, mobile search and the challenges of privacy.

## BACKGROUND

**What is Search?** Search capabilities are required for any information system, and the need grows in importance as the volume of data grows (Frana, 2004). There are key differences in the methods of how the search challenge is addressed:

- A directory is a human generated index (database) of websites, with the most well known examples being Yahoo and the Open Directory.
- Organic search refers to computer generated search results which appear based on how relevant the pages are to the user's search, an early example being Excite with Google the obvious current example.
- Meta-search in turn describes search engines which present aggregated results they have taken from search engines.
- Paid search, also known as sponsored search, refers to payment on a per click basis for text advertisements which are triggered by a search term (Laffey, 2007). Paid search provides the revenue model for organic search and Jansen (2007) estimates that 30% of organic searches lead to one or more clicks on a paid search link.

**The Mechanics of Organic Search:** The key reference for how search engines work is the seminal paper by Brin and Page (1998). Other authors such as Tassabehji (2003) or Schneider (2007) also cover the mechanics of organic search. A search engine has three essential aspects: the *crawler or spider*, which retrieves information from webpages, and other documents, it finds as it follows the link structure of the Web; the *index*, which stores relevant information about the document; and finally, the *search engine software* which contains algorithms, or rules, which decide how relevant a document is to a user search.

**The Surface Web and the Deep Web:** The Surface Web refers to pages that can be indexed by search engines. Google stated in 2008 that their systems were aware of 1 trillion unique pages (Google 2008). To place this in context when Google's prototype search engine was available in 1998, it indexed 24 million pages (Brin and Page, 1998). Estimating the size of the Web is very difficult as crawlers only become aware of new URLs either when they are informed by a webmaster or when they come across a link.

The Deep Web describes pages that cannot be accessed by crawlers, for example, pages which require password access or have been made inaccessible to crawlers. The Deep Web is believed to be many times greater than the surface Web (He et al, 2007).

**Challenges of Search:** Being able to present relevant results to users from a vast pool of possible results on the basis of unstructured queries presents a major challenge. Google's key software innovation was seen as its PageRank™ system which ranked pages on the basis of the volume and nature of websites which linked to them, with higher quality websites being seen as of greater importance (Rangaswamy et al., 2009). The size of the Web and the volume of searches present further challenges, with Google using over 1 million customised computers to deliver results in fractions of a second.

**The Search Market:** In most markets organic search is dominated by Google. In the United States in November 2008 Google had 63.5% share of searches with Yahoo having 20.4% (ComScore, 2008b). Greater dominance was reported in Europe in March 2008, with an 80% share for Google, whilst some countries, for example the UK and Germany, saw over 90% of searches generated through Google (ComScore, 2008a). A further search engine is MSN Live, which although a marginal player at present is seen as important because of its ownership by Microsoft, who is prepared to invest heavily in search for strategic reasons (Sharp and Laffey, 2008). Such investment led to a replacement for MSN Live called Bing in 2009.

Such dominance is by no means universal with Eastern European nations having major national search engines, the most prominent being Yandex, short for Yet Another Indexer, which is the market leader in Russia. Examples of other nations where Google is not the market leader are Japan (Yahoo), China (Baidu, which Google previously held a stake in) and South Korea (Naver owned by NHN) (Sharp and Laffey, 2008). Localisation issues in terms of dealing with language issues and content have been seen as important in the Yandex and Naver cases. Ioffe (2009) describes how the unusual nature of the Russian language, in which words can have up to 20 separate endings to show their meaning to other words, makes searching in Russian highly complex.

## Search Engine Optimization

As the web continues to grow both in volume and user base the need to effectively find information is critical to its future development. Search engines are the applications of choice of many web users to navigate these vast volumes of unstructured information (Rangaswamy et al., 2009).

Search Engine Optimization can be defined as the process undertaken to ensure greater search engine visibility for a given website (Zhang and Dimitroff, 2005). It requires a holistic approach taking into account many factors some of which may conflict with the design aspirations of the web site owner. As the levels of online commerce have increased there have been clear financial drivers to develop tools and expertise in this area.

The most cost effective method of search engine promotion is achieved by optimization. This is ideally started early in the development phase of a given website and will take into account factors involving coding, design, architecture, content and opportunities to utilize linkages between websites and social networking tools.

In the early days of search engine spiders there was a greater dependence on text based analysis, which was open to abuse in a variety of ways including key word stuffing, a practice where keywords or phrases might be hidden on a page. Methodologies have been developed to detect and mitigate for such manipulations, however, as the complexity of web sites has increased so has the ability to use different methods in attempt to manipulate search engine results with such techniques as a Blog-ping, Bowling or door-way pages (Malaga, 2008).

## Modern Approaches to Search Engine Optimization

**Link Building:** The number of websites linking to a website and their relative importance can be a major determinant of search engine ranking and has been utilized in the Google PageRank™ tool (Brin and Page, 1998: Evans, 2007). Likewise the number of links out going from any website will play a role in such an analysis and subsequent position in search results. Linking is becoming the mechanism of choice of many search engines to gauge the peer rating of a site.

**Title Tag and Page Content:** The title tag that appears in the bar of a browser when a user navigates to a web page can be important to set the relevancy of the page to a given search (Zhang and Dimitroff, 2005). Important keywords should appear here and the number of less impactful words such as 'and' and 'the' should be minimized. The impact of this particular tag has lessened over time and now relevant and quality page content is seen as the best determinant along with appropriate use of descriptors, meta tags and alt tags, which can in part assist with usability and accessibility.

**Keyword Density:** Zhang and Dimitroff (2005) make the point that relevant keywords need to be both in the title and the full text. Typically search engines have been reported to prefer maximum keyword densities in the range of between 2 and 8 percent. Higher densities may be considered by some to be spamming and may result in the search engine dropping the page from the index.

**Sitemaps:** Google first introduced sitemaps in 2005 and a year later other search engines announced joint support for the initiative. By 2007 a number of search engines agreed automatic discovery of the requisite robots.txt file on web sites that chose to follow the defined protocol.

The presence of a sitemap enabled web developers to inform search engines about the web pages on their web sites available for crawling. This is now an established way to ensure that the search engine knows where to find content and will result in greater visibility of that content. Whilst it is recognised by practitioners as important, academic research is yet to consider the topic which is common in an emerging field.

**Design Considerations and Social Networking:** Search engine spiders may only handle text and its various format, which appear on a web page, including the source code. Graphical elements, pictures and videos will play little part in the ranking of a given page and will impact the ranking of a page if they appear above the textual elements. Developers must consider the impact of different design elements and even the website architecture.

Social networking and user content generation have enabled web site owners to promote themselves much more effectively and in a targeted manner enabling their web site to be linked to certain groups or clusters of relevance to their area of interest (Enge, 2007).

## Paid Search

Paid search, the text advertisements triggered by the content of organic searches, provides the funding required for organic search to be available. It represented 99% of Google's revenue in 2008 and is a market worth nearly $12 Billion in the US alone (eMarketer 2009).

Paid search was an innovation introduced by Overture, originally known as GoTo, in 1998. It enabled organizations to avoid the long and complex process of search engine optimization and simply bid for position in the search results (Laffey, 2007).

Paid search grew in significance from 2001 when these results were syndicated to the major portals with results appearing alongside organic search on Yahoo, MSN and AOL. This led Google to introduce their own version of paid search, Google AdWords in 2002. This differed from the Overture model in that position was determined not solely by amount bid but also by a quality measure, to ensure adverts were relevant to the user. Google dominate the paid search market, with Yahoo (which purchased Overture in 2003) and MSN Live attempting to compete in Western markets. The national champions referred to in the section Search around the World also offer their own versions of paid search.

**Auctions and Payment:** Initially position was determined on the basis of a first price auction meaning the bidder would pay the amount they bid each time a user clicked on their link. So if an organization bid $10 to be in first place for the term auto-insurance they would appear first in the search results and pay this amount each time a user clicked on the link. However, this form of auction was unstable and was later changed to a second price auction whereby the bidder paid the amount bid by the next position (Edelman et al, 2007).

**The Appeal of Paid Search:** The appeal of paid search was that it attracted relevant traffic, as it was triggered by search terms, and the bidding organisation would only pay when their adverts were clicked on. Moreover, they could withdraw or enter the auction at particular times meaning that paid search was a flexible and low risk tool. Click throughs could also be measured offering the opportunity to monitor the return on investment. This led to terms such as paid search or pay per click (PPC), or the industry preferred term, sponsored search, being used to describe this innovation. The success of paid search led to contextual search whereby paid search links appear alongside relevant content, for example air travel links on a travel page (Laffey, 2007).

**Click Fraud and Ethical Issues of Paid Search:** Click fraud, the clicking on a paid search advert for the sole purpose of making the advertiser pay, has emerged as a major problem in this field (Jansen, 2007). Click fraud is an inherent problem caused by the payment method as individuals and organizations have the ability to increase advertisers' costs simply by clicking on their adverts. Click fraud can be committed by employees who wish to harm their organization, competitor firms aiming to waste the budgets of rivals and, for contextual search, by website owners. Contextual search has been identified as a particular problem as the website owner directly benefits as they obtain a revenue share from the clicks generated. Click fraud is estimated to account for anything between 5% and 20% of total revenues generated through paid search, with the majority of this in the contextual search area (Olsen, 2004).

Paid search introduces ethical aspects as shown by research in 2005 which found that only 38% of users were aware of the distinction between paid and organic search (Fallows, 2005). Even it can be assumed that greater awareness has developed over time this presents a challenge to this sector, as this research also showed users were uneasy when the nature of paid search was revealed.

A further ethical aspect to paid search was the decision by Google to allow firms to bid for the names of other organizations. After one example of such bidding, in 2008 Interflora sued Marks and Spencer, alleging abuse of its trademark.

## FUTURE RESEARCH DIRECTIONS

### Semantic Web

The vast volume of unstructured data being added to the web on a daily basis is continuing to drive the evolution of search techniques aimed at accurately retrieving the most relevant information to a given searcher. The term semantic web was defined by Berners-Lee (Berners-Lee, 2001) and describes the ability of a search tool to understand the subtlety of meaning and linkages between descriptive words, phrases and information sources and their quality. Much effort is being expended in this area by researchers to derive maximum value from the information available.

### Rich Media and Location Based Search

The amount of rich media on the web in terms of video and audio is continuing to increase dramatically as available bandwidth, storage and processing power increase. There is a need to be able to search such files for content and a number of initiatives are underway to improve the searchability of some formats, such as Adobe Flash etc. Much has yet to be done and many existing search techniques are dependant on text coding (Brooks, 2008).

The ability to access data services and global positioning technologies on mobile handsets is enabling the development of location based services (Weinman, 2007). Such services can include the provision of traffic flow information, location based advertising, local news update, tracking and differential pricing for services based on location data.

### Privacy and Legal Issues

Battelle (2005) uses the term “The Database of Intentions” to describe how search can reveal people’s desires, hopes and fears. Clearly such information is of interest to organisations and Google Trends offers insights into aggregated search behaviour. Search records are also now examined to find evidence of a suspect’s intentions in criminal investigations.

As users of the web store more personal information online via social networking sites, blogs and other mechanisms so the ability to profile an individual, their interests and personal details becomes much easier. Search Engines are able to retrieve and aggregate much of this information and make it widely available to those that request it. The increasing trend to bundle services also means that companies such as Google are able to profile users, their interests, the keywords they search for and what their web behavior is like via some of the applications such as the Google Toolbar. Privacy experts continue to voice concerns over the level of profiling which may be possible by such companies. A plethora of legal issues have been reviewed by Grimmelmann (2007) and includes, censorship, trademarks usage, ownership, privacy and search manipulation.

## CONCLUSION

This chapter has made a contribution to the E-Business field by outlining the key areas in the field of search engines. It has integrated materials from academics and practitioners to offer an integrated overview. Search is an essential part of Business and with the ever growing volume of material available on the Web will become of even greater importance in the future. This makes it essential that students, academics and practitioners have a good understanding of the evolution of search, its key issues and possible areas for future development.

## REFERENCES

Battelle, J. (2005). *The Search: How Google and its Rivals Rewrote the Rules of Business and Transformed Our Culture*. Boston, MA: Nicholas Brealey Publishing.

Berners-Lee, T., Hendler, J., & Lassila, O. (2001). The Semantic Web. *Scientific American*, (May): 29–37.

Brin S., & Page, L. (1998). The anatomy of a large-scale hypertextual web search engine. *Computer Networks and ISDN Systems, 30*(1–7), 107–117.

Brooks, G., (2008, September). *NMA Report, Search Marketing*.

ComScore. (2007). *61 Billion Searches Conducted Worldwide in August*. Retrieved June 6, 2009 from http://www.comscore.com/press/release.asp?press=1802

ComScore. (2008a). *comScore Releases March 2008 European Search Rankings*. Retrieved June 6, 2009 from http://www.comscore.com/press/release.asp?press=2208

ComScore. (2008b). *comScore Releases November 2008 U.S. Search Engine Rankings.* Retrieved March 30, 2009 from http://www.comscore.com/press/release.asp?press=2652

Dye, K. (2008). Website abuse for search engine optimization. *Network Security*, *3*, 4–6. doi:10.1016/S1353-4858(08)70028-X

Edelman, B., Ostrovsky, M., & Schwarz, M. (2005). Internet advertising and the generalized second-price auction: selling billions of dollars worth of keywords. *The American Economic Review*, *97*(1), 242–259. doi:10.1257/aer.97.1.242

eMarketer. (2009). *Search Marketing Spending and Trends*. Retrieved June 6, 2009 from http://www.emarketer.com/Article.aspx?id=1007002

Enge, E. (2007). *SEO for Blogs and Feeds*. Retrieved June 6, 2009 from http://searchenginewatch.com/3625832

Evans, M. P. (2007). Analysing Google rankings through search engine optimization data. *Internet Research*, *17*(1), 21–37. doi:10.1108/10662240710730470

Fallows, D. (2005). *Search Engine Users, Pew Internet and American Life Project*. Retrieved June 6, 2009 from http://www.pewinternet.org/reports/2005/search-engine-users.aspx

Frana, P. L. (2004). Before the Web There Was Gopher. *IEEE Annals of the History of Computing*, *26*(1), 20–41. doi:10.1109/MAHC.2004.1278848

Google. (2008). *We knew the web was big..., Google Official Blog*. Retrieved June 6, 2009 from http://googleblog.blogspot.com/2008/07/we-knew-web-was-big.html

Grimmelmann, J. (2007). The Structure of Search Engine Law. *93 Iowa Law Review*. Retrieved March 26, 2009, from http://james.grimmelmann.net/publications

He, B., Patel, M., Zhang, Z., & Chang, K.,C-C. (2007). Accessing the deep web. *Communications of the ACM*, *50*(5), 94–101. doi:10.1145/1230819.1241670

Ioffe, J. (2009). *Google's Russian threat*. Retrieved June 6, 2009 from http://money.cnn.com/2009/02/10/technology/ioffe_russians.fortune/index.htm

Jansen, B. J. (2007). Click Fraud. *Computer*, *40*(7), 85–86. doi:10.1109/MC.2007.232

Laffey, D. (2007). Paid search: the innovation that changed the Web. *Business Horizons*, *50*(3), 211–218. doi:10.1016/j.bushor.2006.09.003

Malaga, R. A. (2008). Worst practices in Search Engine Optimization. *Communications of the ACM*, *51*(12), 147–150. doi:10.1145/1409360.1409388

Olsen, S. (2004). *Google gets gruff over click fraud*. Retrieved June 6, 2009 from http://news.cnet.com/Google-gets-gruff-over-click-fraud/2100-1024_3-5463243.html

Rangaswamy, A., Giles, C. L., & Seres, S. (2009). A Strategic Perspective on Search Engines: Thought Candies for Practitioners and Researchers. *Journal of Interactive Marketing*, *23*, 49–60. doi:10.1016/j.intmar.2008.10.006

Schneider, G. (2007). *Electronic Commerce*, ($7^{th}$ Annual Ed.). Boston, MA: Thomson Course Technology.

Tassabehji, R. (2003). *Applying E-Commerce in Business*. London: Sage.

Weinman, J. (2007, October). A New Approach To Search. *Business Communications Review,* (pp. 19-29).

Zhang, J., & Dimitroff, A. (2005). The impact of webpage content characteristics on webpage visibility in search engine results (Part I). *Information Processing & Management*, *41*(3), 665–690. doi:10.1016/j.ipm.2003.12.001

## ADDITIONAL READING

Cambazoglu, B. B., Karaca, E., Kucukyilmaz, T., Turk, A., & Aykanat, C. (2007). Architecture of a grid-enabled Web search engine. *Information Processing & Management*, *43*(3), 609–623. doi:10.1016/j.ipm.2006.10.011

Chaffey, D., Lake, C., & Friedlein, A. (2007). *Search Engine Optimization Best Practice Guide*. London: E-Consultancy.com.

Fruchter, G. E., & Dou, W. (2005). Optimal budget allocation over time for keyword ads in web portals. *Journal of Optimization Theory and Applications*, *124*, 157–174. doi:10.1007/s10957-004-6470-0

Grappone, J., & Couzin, G. (2006). *Search Engine Optimization an hour a day*. Indianapolis, Indiana: Wiley Publishing.

Gudivada, V., Raghavan, V., Grosky, W., & Kasaanagottu, R. (1997). Information retrieval on the World Wide Web. *IEEE Internet Computing*, *1*(1), 58–68. doi:10.1109/4236.623969

Jones, K. B. (2008). *Search Engine Optimization*. Indianapolis, Indiana: Wiley Publishing.

Kitts, B., & Leblanc, B. (2004). Optimal bidding on keyword auctions. *Electronic Markets*, *14*(3), 186–201. doi:10.1080/1019678042000245119

Laffey, D., Hunka, C., Sharp, J. A., & Zheng, Z. (2009). Estimating advertisers' values for paid search clickthroughs. *The Journal of the Operational Research Society*, *60*(3), 411–418. doi:10.1057/palgrave.jors.2602570

Lempel, R., & Moran, S. (2000). The stochastic approach for link-structure analysis (SALSA) and the TKC effect. *Computer Networks*, 33(1–6), 387−401.

Marchiori, M. (1998) The limits of Web metadata, and beyond. *Computer Networks and ISDN Systems*, 30(1-7), 1-9.

Marckini, F. (2001). *Search Engine Positioning*. Plano, Texas: Wordware Publishing Inc.

Michael, A., & Salter, B. (2008) *Marketing Through Search Optimization: How people search and how to be found on the web*. Oxford, UK: Elsevier Butterworth Heinemann.

Moran, M., & Hunt, B. (2008). *Search Engine Marketing, Inc. Driving Search Traffic to Your Company's Web Site* Upper Saddle River, New Jersey: IBM Press.

Nobles, R., & O'Neil, S. (2000). *Maximize Web Site Traffic: Build Web Site Traffic Fast and Free by Optimizing Search Engine Placement*. Cincinnati, OH: Adams Media Publishing.

Noruzi, A. (2007). A Study of HTML Title Tag Creation Behavior of Academic Web Sites. *Journal of Academic Librarianship*, *33*(4), 501–506. doi:10.1016/j.acalib.2007.03.008

Seda, C. (2004). *Search Engine Advertising*. Indianapolis, Indiana: New Riders.

Sharp, J. A., & Laffey, D. (2008). Paid search wars. *Communications of the Association for Information Systems*, *22*(32).

Thurow, S. (2007). Search Engine Visibility. Indianapolis, Indiana: New Riders.

Varian, H. R. (2007). Position auctions. *International Journal of Industrial Organization*, *25*(6), 1163–1178. doi:10.1016/j.ijindorg.2006.10.002

Viney, D. (2008). *Get to the top on Google*. Boston, MA: Nicholas Brealey Publishing

Zhao, L. (2004). Jump higher: Analyzing website rank in Google. *Information technology and libraries*, 23(3), 108-118.

## KEY TERMS AND DEFINITIONS

**Click Fraud:** This refers to the clicking on a paid search link for the sole purpose of making the advertiser pay, rather than because of interest in their website.

**Crawler:** An essential part of a search engine which "crawls" the Web, using its linked structure to find web pages which can be analyzed and stored in a search engine's index.

**Index:** This is the term used to describe the database of searchable content stored by a search engine.

**Organic Search:** Search which involves the matching of web pages in a search engine's index with a user's search term(s) through a ranking algorithm and does not involve any payment.

**PageRank™:** Google's trademarked method of ranking web pages. This is done by looking at the web pages which link to the page in question, in terms of quantity and also quality – links from web pages which are highly ranked themselves, carry a higher weighting.

**Paid Search:** Text based advertisements which are triggered by keyword searches and involve payment on a per click basis.

**Search Engine Optimization:** Refers to the process of maximizing the position of a website's pages in search engine results. This is be achieved by a mix of code, design, architecture, a link strategy, relevant content creation and manual submission of websites to search engines. All these factors are in the direct control of the web site owner and their developer.

**Semantic Web:** An evolving area of web related science allowing the meaning of various forms of communication to be defined and thoroughly understood, enabling the web to be used effectively as a universal store for data, information and knowledge. This allows the effective linkage and prioritization of themes, words, pictures and other data elements in a meaningful way.

## WEBSITES

Interactive Advertising Bureau. Retrieved June 6, 2009 from http://www.iab.net
Search Engine Colossus. Retrieved June 6, 2009 from http://www.searchenginecolossus.com
Search Engine Marketing Professional Organization. Retrieved June 6, 2009 from http://www.sempo.org
Search Engine Watch. Retrieved June 6, 2009 from http://searchenginewatch.com
SEO Chat. Retrieved June 6, 2009 from http://www.seochat.com
Sitemaps. Retrieved June 6, 2009 from http://www.sitemaps.org

# Chapter 127
# E-Government:
## Status Quo and Future Trends

**Tobias Kollmann**
*University of Duisburg-Essen, Germany*

**Ina Kayser**
*University of Duisburg-Essen, Germany*

## INTRODUCTION

According to the recent worldwide UN e-government survey, a rising trend towards the electronic reform of the public sector around the world becomes apparent (UNPAN 2008). Hence, the mere processing of detached transactions in government e-services is increasingly replaced by a complex process framework to develop an integrative approach for unidirectional as well as for bidirectional government and citizen (G2C, C2G), government and business (G2B, B2G), and government and government (G2G) communication and services. This article provides an overview of current findings in the realm of e-government and presents future directions of research. Therefore, we perform a keyword analysis of current high-quality research in the field of e-government.

## BACKGROUND

The rising scope and possibilities of information technology (IT) during the past century accounts for the increasing diffusion of IT in our every-day life (Kollmann & Häsel 2006). Consequently, the modernization of public administration, i.e., the facilitation and processing of government-related tasks by the means of information and communication technology was merely a matter of time. Accordingly, the term e-government refers to electronically (predominantly online) offered services regarding information, communication, and transaction in support of government-related processes.

Among other things, the announcement of Denmark's integrated state information systems was one of the important milestones towards the emergence of e-government research in the early 1990s (Costake 2008). Subsequently, the G7 special meeting in 1995 gave direction to e-government research when the term 'online government' ap-

DOI: 10.4018/978-1-61520-611-7.ch127

peared within a project (Leitner 2003). Since the late 1990s, e-government projects and research were put in place in all major institutions, e.g. the OECD, the World Bank, and the UN. Nowadays, e-government projects face various challenges, primarily with respect to trust and privacy issues. This goes along with the emergence of considerable e-government projects in research in the early and mid 2000s, the launch of academic journals focusing on e-government (e.g., Electronic Journal of E-Government, launched in 2005), and the initiation of important conferences (e.g., International Conference of E-Government, first meeting in 2002). To narrow the focus, the trade-off between confidence and trust in e-government as opposed to increasing government accountability facilitated by e-government services is in the focus of attention (Carter & Belanger 2004). Additionally, overcoming the digital divide is still a current topic of discussion in both research and practice. What is more, government applications need to fulfill particular demands deriving from public administration and law requirements. In spite of all criticisms, e-government applications allow for a considerable simplification of public services. Accordingly, the location-independent and time efficient handling of government processes is facilitated, which is not only desirable and valuable for citizens but can for example also be a factor of success in the fast moving realm of e-entrepreneurship (Kollmann 2006).

## METHOD

The presented research is based on a review of recent work in the field of e-government. Our analysis aims at e-government research in general, not at sub-disciplines in particular, such as e-democracy and e-administration. Therefore, we exclusively used the search term ‘e-government’ and synonyms such as ‘electronic government’ and ‘digital government’ to allow for a wide but relevant range of articles as foundation of our work. To identify relevant articles, our first step was to search EconLit and Social Science Citation Index via Web of Science databases for the past four and a half years (2005-2009), which is consistent with other literature reviews. This time span refers to the previously described emergence of considerable and widespread e-government research in the mid 2000s. To ensure focus on high-quality research, we reduced the extensive list of articles by those journals not being ranked 3 or 4 in the ABS Academic Journal Quality Guide for the Information Management and Public Sector subject groups. However, those two large research areas need to be amended by the niche of e-government-specific publications to allow for articles from different angles, i.e., the broader IT and public administration perspectives, as well as the narrow e-government viewpoint. Consequently, we included all relevant (i.e. those that included the keyword ‘e-government’ and its synonyms) articles from the Electronic Journal of E-Government (EJEG), which is one of the leading e-government journals. Additionally, the EJEG is closely linked with the two large conferences on e-government (European Conference on E-Government, International Conference on E-Government), which underlines its up-to-date orientation. Thus, we paid attention to current research from the three most relevant directions, i.e. information technology (40 articles), public administration (20 articles), and e-government itself (90 articles) with publications specific to each field, resulting in a sample of 150 articles from the past four and a half years. Following from this list of studies, we deduced current research trends in the field of e-government by performing a keyword analysis. To ensure a concise analysis, keywords with the same meaning were combined in the underlying concept, e.g., the term ‘Quality’ subsumes the two keywords ‘IT Quality’ and ‘System Quality’. Subsequently, we arranged a correlation matrix, which covers correlations of keywords between the different articles using Ucinet 6 (Borgatti & Everett, 1997).

To enhance data evaluation, we established keyword cliques (Mokken 1979). The cliques approach is an established method of social network analysis indentifying configurations of sub-sets of keywords (i.e., cliques) within the network (Mokken 1979). We formed cliques with a minimum set size of two keywords (nodes) and a maximum distance of one, i.e., we examined only adjacent nodes since adjacency is the criterion for being mentioned in the same article. If two (or more) keywords are used within the same article, this is an indication for relevant research in a particular (keyword-related) field. However, cliques may consist of more than two nodes and thus not all keywords of a particular clique were necessarily mentioned in a single article. Nevertheless, cliques reveal patterns of research bringing particular topics and issue areas into focus. Consequently, we obtained 39 cliques (i.e., sets of keywords), most of them being trivial relations such as IT/IS, E-Government, and Government. In the results section, we will consequently discuss the five non-trivial and clearly distinguishable cliques (i.e., sets of keywords).

## RESULTS: CURRENT ISSUES OF E-GOVERNMENT

Generally, results of our performed keyword analysis indicate three major issue areas framing the current status quo in e-government research. Firstly, the government-to-citizen field is strongly affected by analyzes of trust, risk, and adoption. Additionally, studies dealing with government-to-government processes focus on integration and interoperability of e-services, emphasizing framework and knowledge management implications. Thirdly, government-to-business services are analyzed with respect to current public e-procurement research. In the following part of this article, we will further elaborate on particular issue areas being object of currently ongoing discussions in the literature.

Figure 1 shows keywords being named five or more times in the different articles of our sample and their interrelations. This figure is deduced from our correlation matrix. Furthermore, the strength of correlations between keywords and the absolute number of mentions are visualized by the line strength of ties and node size, respectively. Accordingly, larger nodes represent keywords, which were mentioned more often than keywords represented by smaller nodes, and thickness of a tie indicates the frequency of two nodes being mentioned in the same article. Thus, the figure represents the network itself, and nodes linked by ties (with a maximum distance of one tie between two nodes) represent cliques. We will now discuss the five non-trivial and clearly distinguishable sets of keywords deriving from the formation of cliques to elaborate further on our general results.

### Clique 1: Government, Innovation, Trust, E-Government, E-Voting, IT/IS

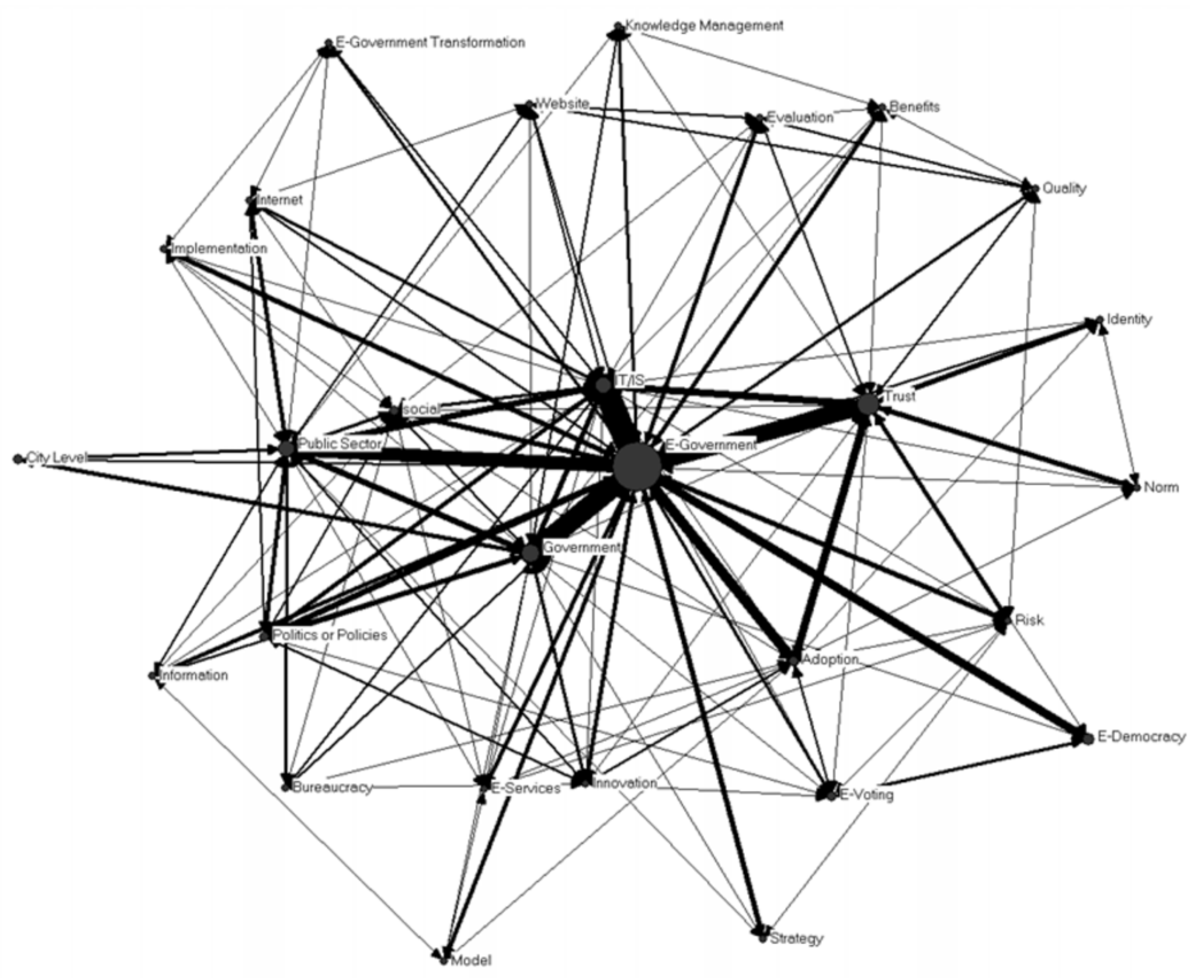
Innovation is the catalyst for change in e-government research. E-voting as a particular innovative application is already in place for many non-government related purposes. Correspondingly, due to the rising technological advances, its role in government related contexts increases (Cetinkaya & Cetinkaya 2007).

However, emphasizing the trust discussion, the innovation process in electronic government services such as e-voting needs to meet particular security and law-related demands. Therefore, research in this area focuses on trust and the design of secure e-voting systems.

### Clique 2: Evaluation, Trust, Benefits, E-Government, IT/IS

Research is conducted around the issue of evaluation of government e-services. Thereby, the perceived benefits as an outcome of electronic service offers as well as trust in e-government are two important measures of service quality

*Figure 1. Current e-government research correlations*




for citizens (Grimsley & Meehan 2008). Both, perceived benefits and trust in e-government are intimately connected with each other; therefore models for evaluation of government e-services gain importance not only in government-to-citizen and vice versa applications but also in government-to-business and business-to-government processes.

## Clique 3: Adoption, Risk, Trust, E-Government, E-Voting, IT/IS

Adoption and acceptance of e-government services, in particular with respect to e-voting applications are essential for the e-government approach. However, one popular criticism is a lack of transparency regarding e-services (Riera & Brown 2003). Research in this field emphasizes the importance of transparency and accountability mechanisms, which need to be put in place to gain citizens' acceptance and to ultimately enhance adoption of e-government.

## Clique 4: Adoption, Innovation, Trust, E-Government, E-Voting, IT/IS

Furthermore, adoption of e-voting applications and other innovative e-services are in the center of attention. Focusing on diffusion of innovations, factors to encourage adoption of e- government services are examined (e.g. Tung & Rieck 2005). Hereby, trust is a crucial factor for citizens' willingness to adopt innovative government e-services (Carter & Belanger 2004). Along with this, trust consists of several diverse aspects, e.g. trust in the government itself, and trust of the internet (Belanger & Carter 2008).

### Clique 5: Government, Trust, Benefits, E-Government, Knowledge Management

Knowledge Management is utilized for e-government enhancement, thereby focusing on ensuring greater quality and efficiency regarding e-services. A more knowledge-based approach to e-government is helpful to increase the perceived public value (Centeno, van Bavel, & Burgelman, 2005).

## FUTURE RESEARCH DIRECTIONS

This section focuses on issues in e-government research that may be already identified but lack sufficient analysis and testing. To identify relevant research issues, figure 1 is quite revealing. If two keywords are not adjacent (i.e. are not mentioned in the same article) and are not member of the same clique (i.e. there is no concentration of research around those terms), this is an indication for a possible research gap. Correspondingly, we will now discuss five non-trivial and evident gaps.

Further implications of innovations and risk need to be studied, e.g., regarding the question which preventive risk management measures can be put in place to decrease perceived risks of innovative e-government services.

Innovations may entail risk. While trust as an influence factor on acceptance and adoption of e-government services is tackled well, risk management for innovations in e-government services is partially neglected as a preventive measure to gain trust in G2C, C2G, G2B, B2G, and G2G transactions. Though trust in e-government services is essential, preventive risk management measures need to be adjusted to governmental requirements and circumstances, for example, to avoid fraud regarding e-voting applications or data theft concerning e-administration services.

Additionally, further research needs to be conducted in the field of identity management with respect to e-services, for example, in relation to the question how an interoperable cross-agency identity management can be developed, implemented, and managed properly.

Identity management in e-government services goes along with the discussion concerning risk and trust. Hence, individualization of e-services, particularly with respect to web 2.0/web 3.0 applications requires a common identity management, especially concerning the desirable interoperability of electronic services and the prevention of identity theft.

What is more, research needs to focus on implications of strategy in knowledge management, for example, concerning the question to what extend a long-term strategy for proper knowledge management can increase the perceived public value of e-government services.

There is a definite need for a long-term knowledge management strategy in e-government applications. This goes along with the need for increasing the public value of e-government, which goes beyond the aspects of efficiency and effectiveness. Since e-government applications serve the demands of the public as a whole, they outreach classic commercial IT requirements and thus a government-aligned strategy for knowledge management is essential. Though this aspect gained already importance in e-government research, it is yet to be conceived in an integrated and all-encompassing manner.

In addition, the effects of strategy and strategic orientation in e-democracy applications need to be investigated, for example regarding the issue of which strategic measures can encourage citizens' adoption of e-democracy services.

Analogously, a long-term strategy is necessary for a substantiated development of e-democracy processes. This goes along with the digital divide discussion, emphasizing the need for an all-encompassing strategy to allow for the involvement of the total population, not only particular target groups.

Implications of norms regarding e-voting applications are yet to be explored, for example, the question whether norms can enhance the diffusion of innovative e-voting systems needs to be addressed.

Since trust is a prerequisite for the adoption of e-voting applications, the definition and implementation of norms need to be considered. In doing so, norms can contribute to a proper basis for e-services risk management as well as to a confidence base, because they allow for clear and concise requirements.

## CONCLUSION

Research on electronic government comes of age. However, the increasing importance of digital government around the world requires an integrated cross-agency approach of electronic government. The performed keyword analysis identified current research issues in e-government, predominantly concerning trust and adoption of e-services. This does apply for all three directions of research, i.e., G2G, G2B, and G2C. Furthermore, we derived research needs with respect to a proactive, integrative risk management and long-term strategic measures for electronic government.

## REFERENCES

Belanger, F., & Carter, L. (2008). Trust and Risk in E-Government Adoption. *The Journal of Strategic Information Systems*, *17*(2), 165–176. doi:10.1016/j.jsis.2007.12.002

Borgatti, S. P., & Everett, M. G. (1997). Network analysis of 2-mode data. *Social Networks*, *19*, 243–269. doi:10.1016/S0378-8733(96)00301-2

Carter, L., & Belanger, F. (2004). The Influence of Perceived Characteristics of Innovating on E-Government Adoption. *Electronic Journal of E-Government*, *2*(1), 11–20.

Centeno, C., van Bavel, R., & Burgelman, J. C. (2005). A Prospective View of E-Government in the European Union. *Electronic Journal of E-Government*, *3*(2), 59–66.

Cetinkaya, O., & Cetinkaya, D. (2007). Verification and Validation Issues in Electronic Voting. *Electronic Journal of E-Government*, *5*(2), 117–126.

Costake, N. (2008). General Requirements for Digital Government. In A. Anttiroiko, M. Malkia (Eds.), *Encyclopedia of Digital Government* (pp. 98-109). Hershey, PA: Idea Group.

Grimsley, M., & Meehan, A. (2008). Attaining Social Value from Electronic Government. *Electronic Journal of E-Government*, *6*(1), 31–42.

Kollmann, T. (2006). What is e-entrepreneurship? - Fundamentals of company founding in the net economy. *International Journal of Technology Management*, *33*(4), 322–340. doi:10.1504/IJTM.2006.009247

Kollmann, T., & Häsel, M. (2006). Cross-channel cooperation: a collaborative approach of integrating online and offline business models. *International Journal of Entrepreneurship and Small Business*, *6*(2), 212–229. doi:10.1504/IJESB.2008.018629

Leitner, C. (2003, July). *E-Government in Europe: The State of Affairs.* Presented at the E-Government 2003 Conference Como, Italy.

Mokken, R. J. (1979). Cliques, Clubs and Clans. *Quality & Quantity*, *13*, 161–173. doi:10.1007/BF00139635

Riera, A., & Brown, P. (2003). Bringing Confidence to Electronic Voting. *Electronic Journal of E-Government*, *1*(1), 43–50.

Tung, L. L., & Rieck, O. (2005). Adoption of Electronic Government Services Among Business Organizations in Singapore. *The Journal of Strategic Information Systems*, *14*(4), 417–440. doi:10.1016/j.jsis.2005.06.001

UNPAN. (2008). *UN Global E-Government Survey 2008: From E-Government to Connected Governance*. New York: United Nations Department of Economic and Social Affairs, Division of Public Administration and Development Management.

## ADDITIONAL READING

Aldrich, D., Bertot, J. C., & McClure, C. R. (2002). E-Government: Initiatives, Developments, and Issues. *Government Information Quarterly*, *19*, 349–355. doi:10.1016/S0740-624X(02)00130-2

Barquin, R. C., Bennet, A., & Remez, S. G. (Eds.). (2001). Knowledge Management: The Catalyst for Electronic Government. Leesberg, Virginia: Management Concepts.

Bertot, J. C., Jaeger, P. T., & McClure, C. R. (2008). Citizen-Centered E-Government Services: Benefits, Costs, and Research Needs. In *Proceedings of the 2008 International Conference on Digital Government Research* (Montreal, Canada, May 18 - 21, 2008). ACM International Conference Proceeding Series, vol. 289. Digital Government Society of North America, 137-142.

Chen, Y. C., & Thurmaier, K. (2008). Advancing E-Government: Financing Challenges and Opportunities. *Public Administration Review*, *68*(3), 537–548. doi:10.1111/j.1540-6210.2008.00889.x

Dawes, S. (in press). Governance in the Digital Age: A Research and Action Framework for an Uncertain Future. *Government Information Quarterly*.

De Meo, P., Quattrone, G., & Ursino, D. (2008). A Decision Support System for Designing New Services Tailored to Citizen Profiles in a Complex and Distributed E-Government Scenario. *Data & Knowledge Engineering*, *67*(1), 161–184. doi:10.1016/j.datak.2008.06.005

Elsas, A. (2003). E-Government: Integration with Web Services. *Journal of European Economy*, *2*(3), 340–353.

Evans, D., & Yen, D. C. (2005). E-Government: An Analysis for Implementation: Framework for Understanding Cultural and Social Impact. *Government Information Quarterly*, *22*(3), 354–373. doi:10.1016/j.giq.2005.05.007

Gil-Garcia, J. R., Chengalur-Smith, I., & Duchessi, P. (2007). Collaborative E-Government: Impediments and Benefits of Information-Sharing Projects in the Public Sector. *European Journal of Information Systems*, *16*(2), 121–133. doi:10.1057/palgrave.ejis.3000673

Goh, D. H. L., Chua, A. Y. K., & Luyt, B. (2008). Knowledge Access, Creation and Transfer in E-Government Portals. *Online Information Review*, *32*(3), 348–369. doi:10.1108/14684520810889664

Gupta, M. P., & Jana, D. (2003). E-Government Evaluation: A Framework and Case Study. *Government Information Quarterly*, *20*(4), 365–387. doi:10.1016/j.giq.2003.08.002

Hardy, C. A., & Williams, S. P. (2008). E-Government Policy and Practice: A Theoretical and Empirical Exploration of Public E-Procurement. *Government Information Quarterly*, *25*(2), 155–180. doi:10.1016/j.giq.2007.02.003

Heeks, R., & Bailur, S. (2007). Analyzing E-Government Research: Perspectives, Philosophies, Theories, Methods, and Practice. *Government Information Quarterly*, *24*(2), 243–265. doi:10.1016/j.giq.2006.06.005

Helbig, N., Gil-García, J. R., & Ferro, E. (2008). Understanding the Complexity of Electronic Government: Implications from the Digital Divide Literature. *Government Information Quarterly*, *26*(1), 89–97. doi:10.1016/j.giq.2008.05.004

Jaeger, P. T., Shneiderman, B., & Kenneth, R. F. (2007). Community Response Grids: E-Government, Social Networks, and Effective Emergency Management. *Telecommunications Policy*, *31*(10-11), 592–604. doi:10.1016/j.telpol.2007.07.008

Jaeger, P. T., & Thompson, K. (2003). E-Government around the World: Lessons, Challenges, and Future Directions. *Government Information Quarterly*, *20*, 389–394. doi:10.1016/j.giq.2003.08.001

Kim, C. (2007). A Cross-National Analysis of Global E-Government. *Public Organization Review*, *7*(4), 317–329. doi:10.1007/s11115-007-0040-5

Morris, D. F., & Moon, M. J. (2005). Advancing E-Government at the Grassroots: Tortoise or Hare? *Public Administration Review*, *65*(1), 64–75. doi:10.1111/j.1540-6210.2005.00431.x

Olphert, W., & Damodaran, L. (2007). Citizen Participation and Engagement in the Design of E-Government Services: The Missing Link in Effective ICT Design and Delivery. *Journal of the Association for Information Systems*, *8*(9), 491–507.

Otjacques, B., Hitzelberger, P., & Feltz, F. (2007). Interoperability of E-Government Information Systems: Issues of Identification and Data Sharing. *Journal of Management Information Systems*, *23*(4), 29–51. doi:10.2753/MIS0742-1222230403

Tolbert, C., & Mossberger, K. (2006). The Effects of E-Government on Trust and Confidence in Government. *Public Administration Review*, *66*(3), 354–369. doi:10.1111/j.1540-6210.2006.00594.x

Traunmueller, R., & Wimmer, M. (2001). Directions in E-Government: Processes, Portals, Knowledge. *Proceedings of the DEXA International Workshop "On the Way to Electronic Government", Los Alamitos, CA: IEEE Computer Society Press*, pp. 313-317.

Vassilakis, C., Lepouras, G., & Halatsis, C. (2007). A Knowledge-Based Approach for Developing Multi-Channel E-Government Services. *Electronic Commerce Research and Applications*, *6*(1), 113–124. doi:10.1016/j.elerap.2006.07.004

West, D. (2004). E-Government and the Transformation of Service Delivery and Citizen Attitudes. *Public Administration Review*, *64*(1), 15–27. doi:10.1111/j.1540-6210.2004.00343.x

Wu, J., & Zhang, J. L. (2008). Multi-Agent Simulation of Group Behavior in E-Government Policy Decision. *Simulation Modelling Practice and Theory*, *16*(10), 1571–1587. doi:10.1016/j.simpat.2007.07.007

Yildiz, M. (2007). E-Government Research: Reviewing the Literature, Limitations, and Ways Forward. *Government Information Quarterly*, *24*, 646–665. doi:10.1016/j.giq.2007.01.002

## KEY TERMS AND DEFINITIONS

**E-Government:** The term 'e-government' refers to the facilitation of G2G, G2C, and G2B (and vice versa) processes by the means of information technology. This includes not merely information processes but also communication and, more importantly, transaction processes.

**E-Democracy:** E-democracy represents a sub-category of e-government and embraces processes being concerned with the forming of the political will.

**E-Voting:** E-voting describes a component of e-democracy being concerned with the electronic realization and execution of electoral processes including both online elections and electronic voting machines.

**E-Service:** Within e-government research, the term e-service refers to those applications being provided electronically by a particular public authority both for administrative purposes as well as for democratic participation.

**Adoption:** As opposed to the mere acceptance of e-government services, adoption accounts for the actual use of digital government services.

**Trust:** Research on trust is multifaceted and is present in many different realms of research. With respect to electronic government, trust has got distinct dimensions. Most importantly, trust in information and communication technology and trust in the government itself are crucial.

**Identity:** The electronic processing of digital government services requires a proper identity management, ensuring privacy, integrity, and confidentiality of identity-related data.

# Chapter 128
# Blog Marketing: Potential and Limits

**Călin Gurău**
*GSCM – Montpellier Business School, France*

## INTRODUCTION

In the last ten years blogs have become a familiar feature of the Internet landscape, and the number of blogs multiplied exponentially. A blog is a specific form of online community, organised, coordinated and moderated by a person or an organisation, which attracts a number of participants/members, because of the specific topics posted and discussed on the blog web site. The interest of marketers for blog communities was quickly translated in a number of methods designed to enhance online marketing campaigns (Cohen, 2005):

- gather marketing intelligence: the marketers can collect important information about consumers' reactions to specific product and/or services, by surfing the open-access blogs available on the Internet;
- directly engage blog members to comment on key business topics: some marketers might find useful to post their opinion on blogs that discuss specific business issues, such as product launch, product characteristics, quality and price levels, in order to initiate a direct dialog with active bloggers;
- advertise on blogs to reach influencials or to target a well-defined niche audience;
- engage consumers in a direct dialogue by opening and managing a corporate, brand, or product blog. These corporate blogs can attract consumers that are passionate about the company and/or its products, providing an open discussion forum for improving existing products or the functional features of the new product ideas. This type of blogs can represent a tool for enhancing company-customer interactions, building mutually beneficial relationships and creating opportunities for value co-creation.

Despite the obvious potential of blog marketing, until now very few studies have explored directly the potential and the limits of this new marketing tool. Some of these limits are related to the existing technology in terms of online interaction and

DOI: 10.4018/978-1-61520-611-7.ch128

communication. However, probably the most restrictive limitation is the attitude of many blog members, who consider blog marketing as a serious infringement of their privacy right and of the rules of ethics established within the blogosphere. For this reason, the exploration of blog members' attitudes and perceptions regarding marketing activities can increase the understanding of the specific opportunities and limits of this form of online community for marketers.

After a brief discussion of the main studies already published on this topic, the research methodology applied to collect both secondary and primary data is presented. The results of primary data analysis are then considered, in direct relation to the formulated research objectives. On the basis of these findings a discussion of the practical and theoretical implications of blog marketing communication is developed. The paper concludes with a summary of the main findings and with propositions for future research.

## BACKGROUND

Existing research has focused either on the use of blogs as text-mining source (Rickman and Cosenza, 2007), or on the strategies applied by firms to reach the blog audience (Raab, 2009; Teich, 2008) or to manage corporate communication (Cox et al., 2008). The blog is an extremely attractive tool for virtual social interaction, because it provides opportunities for individual expression in a shared social environment (Ko et al., 2008).

The importance of blog marketing is determined by the popularity of this new type of social media (Raab, 2009). The 2008 report on the state of the Blogosphere published online by Technorati (2008) identifies the demographic profile of bloggers, as well as the most important blogging practices. According to this report, 77% of the active Internet users read blogs. There were 94.1 million blog readers in 2007, only in the US. The European and Asian bloggers are predominantly male, while in the US the proportion of males and females that access blogs is more even. On the other hand, a large percentage of Asian bloggers are young (18-34 years old), while in the US and Europe most bloggers are 35 years of age or older.

Building on the work of Gruhl et al. (2004) and Kumar et al. (2003), Nakajima et al. (2005) proposed and tested a methodology to search weblogs to find influential bloggers. They found two groups of important bloggers, the agitators, and the summarizers. The agitators are able to generate the buzz – analogous to the trendsetter, while the summarizers are capable to synthesize well various discussion topics that are published on the blog.

Despite the obvious potential of blog marketing, until now very few studies have explored directly the potential and the limits of this new marketing tool.

## RESEARCH METHODOLOGY

This paper attempts to investigate blog members' perceptions and level of acceptance of blog marketing. To achieve this, the following research objectives have been formulated:

- To identify the perceptions of blog members regarding blog marketing.
- To analyse the level of acceptance of blog members regarding blog advertising.
- To investigate the effect of blog advertising on consumer behaviour.
- To identify the variation in perceptions, level of acceptance and consumer behaviour in relation to the gender and the age of blog members.

In the first stage of the research process, a series of articles about blogs in general, and blog marketing in particular, have been collected and analysed. This secondary research material provided useful information about existing research, and helped the development of a primary research framework. In the second stage of this project, the moderators of three general topics blogs have been contacted and asked to facilitate the collection of primary data. After their approval, a questionnaire was sent to the three moderators. The moderators answered the questionnaire, and provided feed-back about its content and structure. The improved questionnaires were then posted by the three moderators on their blogs, together with a clear explanation of the research aims and objectives. For reasons of confidentiality, the name of the three blogs used for data collection cannot be provided.

A total of 568 people returned the questionnaire. However, only 543 questionnaires were properly completed and could be used for data analysis: 177 questionnaires from the first blog, 231 from the second blog, and 135 from the third one. Data has then been introduced and analysed using the SPSS software. Although the questionnaire was designed to collect mainly quantitative information, the comments provided by respondents offered some insight into the qualitative aspects of bloggers perspective concerning blog marketing.

## PRESENTATION AND ANALYSIS OF DATA

294 respondents were male (54.1%) and 249 female (45.9%). In terms of age categories, 21% were less than 18 years old, 35% between 18 and 25 years, 32% between 26 and 35 years old, and finally, only 12% were between 36 and 50 years old. No respondent was 50 years or older, which might be explained either by the lack of interest of this category of bloggers on this topic, or by the specific population of the selected blogs.

Overall, more than half of respondents agreed with the use of the blog for marketing purposes (57.7%) or for the use of the blog to post advertising messages (58.3%). However, 168 respondents disagreed with both these questions. This is the reason why only 375 respondents have provided information regarding their direct involvement in various blog marketing or advertising activities. The answer options ‘do not know’ or ‘neither agree nor disagree’ have not been used in order to force the respondents to adopt a specific position regarding blog marketing.

The majority of these remaining respondents are favourable concerning the development of discussion threads regarding specific products or services (75.2%), their active participation to these discussion threads (78.9%), the use of the marketing information for making personal choices about products or services (73.4%), or the communication of the informational benefits of the blog to their friends or relatives. However, if we consider those respondents that declined to answer to all these questions, the percentages are much lower:

- only 52% of the total respondents agree with the presence of discussion threads regarding products or services;
- only 54.5% of the total respondents would like to participate in these discussion threads;
- only 49.9% of the total respondents would advise their friends or relatives to use the marketing information posted on the blog; and
- only 50.7% of the total respondents would use the marketing information to make more informed choices about products or services.

In general, it can be considered that the attitude of these respondents is favourable towards marketing or advertising information. However, this tendency can be the result of a bias in the self-selection of the respondents to this survey.

The data presented in Table 2 give some interesting insights regarding the differences of opinion between males and females. Overall, a slightly

*Table 1. The opinion of respondents concerning the marketing use of blogs*

| | Strongly agree | | Moderately agree | | Moderately disagree | | Strongly disagree | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | N | % | |
| Use of the blog for marketing purposes | 140 | 25.8 | 173 | 31.9 | 171 | 31.5 | 59 | 10.9 | 543 |
| Use of blog to post advertising messages | 143 | 26.3 | 174 | 32 | 173 | 31.9 | 53 | 9.8 | 543 |
| Discussion threads about products or services | 116 | 30.9 | 166 | 44.3 | 74 | 19.7 | 19 | 5.1 | 375 |
| Active participation in product/service discussions | 134 | 35.7 | 162 | 43.2 | 60 | 16 | 19 | 5.1 | 375 |
| Advise the friends to use the marketing information posted on this blog | 121 | 32.3 | 150 | 40 | 83 | 22.1 | 21 | 5.6 | 375 |
| Use the marketing information to make informed product/service choices | 115 | 30.7 | 160 | 42.7 | 80 | 21.3 | 20 | 5.3 | 375 |

larger percentage of males disagrees with the use of the blog for marketing or advertising purposes than the females (comparing the 'moderately disagree' and 'strongly disagree' percentages of answers with the general percentages of males and females in the population of study.

This trend is reversed in the acceptance of the practical applications of blog marketing, where the male population has a slightly larger percentage of respondents that moderately or strongly agree. The tendency of respondents to advise their friends or relatives about the marketing information provided on the blog is statistically significant to a level of $p = 0.042$. In this instance, the male population is clearly more inclined than the female population to agree with this statement.

The analysis of answer on various categories of ages is presented in Table 3. The general tendency is favourable to blog marketing and advertising, with the two younger categories of respondents (people up to 35 years old) accepting in slightly larger percentages the application of blog marketing techniques. This trend is particularly easy to identify for the general question regarding the use of the blog for marketing purposes, in which the distribution of answers on various categories of age is statistically significant to a level of $p = 0.045$.

Despite the positive results obtained in this survey, it is important, once again, to consider the various sources of bias that could have distorted the findings. For example, it should be outlined that the three blogs used in this survey contain general topics discussions, which can explain the more relaxed attitude of many bloggers regarding the possible introduction of blog marketing. It is possible that the members of more specialised communities are more protective against the use of their blogs for commercial purposes.

On the other hand, since the affiliation of respondents to a specific blog does not explain the distribution of the provided opinions, it has been concluded that the demographic characteristics of blog members influence their opinion regarding blog marketing.

## FUTURE TRENDS

Blog marketing is a phenomenon in continuous development. The most probable development of blog marketing is based on a better segmen-

*Table 2. The influence of respondents' gender on their opinion concerning blog marketing*

| Use of blog for marketing purposes | Strongly agree N % | Moderately agree N % | Moderately disagree N % | Strongly disagree N % | Total N % |
|---|---|---|---|---|---|
| Male | 72 51.4 | 91 52.6 | 98 57.3 | 33 55.9 | 294 54.1 |
| Female | 68 48.6 | 82 47.4 | 73 42.7 | 26 44.1 | 249 45.9 |
| Total | 140 100 | 173 100 | 171 100 | 59 100 | 543 100 |
| Chi square = 1.348 p = 0.718 | | | | | |
| Use of blog to post advertising messages | | | | | |
| Male | 73 51 | 90 51.7 | 101 58.4 | 30 56.6 | 294 54.1 |
| Female | 70 49 | 84 48.3 | 72 41.6 | 23 43.4 | 249 45.9 |
| Total | 143 100 | 174 100 | 173 100 | 53 100 | 543 100 |
| Chi square = 2.342 p = 0.504 | | | | | |
| Discussion threads about products/services | | | | | |
| Male | 61 52.6 | 91 54.8 | 27 36.5 | 10 52.6 | 189 50.4 |
| Female | 55 47.4 | 75 45.2 | 47 63.5 | 9 47.4 | 186 49.6 |
| Total | 116 100 | 166 44.3 | 74 100 | 19 100 | 375 100 |
| Chi square = 7.287 p = 0.063 | | | | | |
| Participation in product/service discussions | | | | | |
| Male | 68 50.7 | 87 53.7 | 27 45 | 7 36.8 | 189 50.4 |
| Female | 66 49.3 | 75 46.3 | 33 55 | 12 63.2 | 186 49.6 |
| Total | 134 100 | 162 100 | 60 100 | 19 100 | 375 100 |
| Chi square = 2.811 p = 0.422 | | | | | |
| Advise friends to use this blog for marketing information | | | | | |
| Male | 66 54.5 | 83 55.3 | 32 38.6 | 8 38.1 | 189 50.4 |
| Female | 55 45.5 | 67 44.7 | 51 61.4 | 13 61.9 | 186 49.6 |
| Total | 121 100 | 150 100 | 83 100 | 21 100 | 375 100 |
| **Chi square = 8.223 p = 0.042** | | | | | |
| Use marketing information for your choices | | | | | |
| Male | 58 50.4 | 88 55 | 36 45 | 7 35 | 189 50.4 |
| Female | 57 49.6 | 72 45 | 44 55 | 13 65 | 186 49.6 |
| Total | 115 100 | 160 100 | 80 100 | 20 100 | 375 100 |
| Chi square = 4.185 p = 0.242 | | | | | |

tation of various online communities, and on the use of an increasingly diversified range of various marketing and advertising techniques (Lee et al., 2006). Marketing specialists can adopt a passive, reactive or pro-active approach to blogs.

The passive approach is characterised by the use of the existing blogs as a source of primary

*Table 3. The influence of respondents' age on their opinion concerning blog marketing*

| **Use of blog for marketing purposes** | **Strongly agree N %** | **Moderately agree N %** | **Moderately disagree N %** | **Strongly disagree N %** | **Total N %** |
|---|---|---|---|---|---|
| Less than 18 | 34 24.3 | 29 16.8 | 40 23.4 | 11 18.6 | 114 21 |
| 18-25 | 57 40.7 | 70 40.5 | 46 26.9 | 17 28.8 | 190 35 |
| 26-35 | 33 23.6 | 59 34.1 | 59 34.5 | 23 39 | 174 32 |
| 36-50 | 16 11.4 | 15 8.7 | 26 15.2 | 8 13.6 | 65 12 |
| Total | 140 100 | 173 100 | 171 100 | 59 100 | 543 100 |
| **Chi square = 17.255 p = 0.045** | | | | | |
| Use of blog to post advertising messages | | | | | |
| Less than 18 | 39 27.3 | 32 18.4 | 33 19.1 | 10 18.9 | 114 21 |
| 18-25 | 57 39.9 | 66 37.9 | 53 30.6 | 14 26.4 | 190 35 |
| 26-35 | 32 22.4 | 58 33.3 | 61 35.3 | 23 43.4 | 174 32 |
| 36-50 | 15 10.5 | 18 10.3 | 26 15 | 6 11.3 | 65 12 |
| Total | 143 100 | 174 100 | 173 100 | 53 100 | 543 100 |
| Chi square = 16.082 p = 0.065 | | | | | |
| Discussion threads about products/services | | | | | |
| Less than 18 | 26 22.4 | 32 19.3 | 16 21.6 | 1 5.3 | 75 20 |
| 18-25 | 48 41.4 | 66 39.8 | 26 35.1 | 10 52.6 | 150 40 |
| 26-35 | 31 26.7 | 50 30.1 | 21 28.4 | 6 31.6 | 108 28.8 |
| 36-50 | 11 9.5 | 18 10.8 | 11 14.9 | 2 10.5 | 42 11.2 |
| Total | 116 100 | 166 100 | 74 100 | 19 100 | 375 100 |
| Chi square = 5.344 p = 0.803 | | | | | |
| Participation in product/ service discussions | | | | | |
| Less than 18 | 32 23.9 | 27 16.7 | 12 20 | 4 21.1 | 75 20 |
| 18-25 | 54 40.3 | 65 40.1 | 24 40 | 7 36.8 | 150 40 |
| 26-35 | 35 26.1 | 54 33.3 | 13 21.7 | 6 31.6 | 108 28.8 |
| 36-50 | 13 9.7 | 16 9.9 | 11 18.3 | 2 10.5 | 42 11.2 |
| Total | 134 100 | 162 100 | 60 100 | 19 100 | 375 100 |
| Chi square = 7.827 p = 0.552 | | | | | |
| Advise friends to use this blog for marketing information | | | | | |
| Less than 18 | 30 24.8 | 27 18 | 16 19.3 | 2 9.5 | 75 20 |
| 18-25 | 44 36.4 | 63 42 | 33 39.8 | 10 47.6 | 150 40 |
| 26-35 | 34 28.1 | 44 29.3 | 24 28.9 | 6 28.6 | 108 28.8 |
| 36-50 | 13 10.7 | 16 10.7 | 10 12 | 3 14.3 | 42 11.2 |
| Total | 121 100 | 150 100 | 83 100 | 21 100 | 375 100 |
| Chi square = 4.049 p = 0.908 | | | | | |

*continued on the following page*

*Table 3. continued*

| Use of blog for marketing purposes | Strongly agree N % | Moderately agree N % | Moderately disagree N % | Strongly disagree N % | Total N % |
|---|---|---|---|---|---|
| Use marketing information for your choices | | | | | |
| Less than 18 | 28 24.3 | 31 19.4 | 14 17.5 | 2 10 | 75 20 |
| 18-25 | 46 40 | 61 38.1 | 33 41.3 | 10 50 | 150 40 |
| 26-35 | 28 24.3 | 52 32.5 | 23 28.8 | 5 25 | 108 28.8 |
| 36-50 | 13 11.3 | 16 10 | 10 12.5 | 3 15 | 42 11.2 |
| Total | 115 100 | 160 100 | 80 100 | 20 100 | 375 100 |
| Chi square = 5.278 p = 0.809 | | | | | |

or secondary data collection. This can be done by simply observing the development of various discussion threads, or by searching for specific keywords in the blogs' archives. In this case, the marketer is not actively interfering with the posted discussion or with the bloggers. Sometimes, this stage can be considered as the first stage of a more sophisticated blog marketing strategy.

In the reactive approach, the marketer gets involved in the discussion threads of selected blogs, by reacting to specific opinions expressed by bloggers. This is the case, for example, of a commercial person intervening in a discussion thread to correct or to answer a criticism expressed towards its company or its activities. This intervention can became significant when the marketer has to develop a veritable dialogue with other bloggers.

Finally, in a pro-active approach, the marketer can either attempt to actively develop a new discussion topic, or even to create a moderate a company, or product-related blog (Cox et al., 2008). The advantage of this type of blog marketing is the increased control over the messages posted on the blog, and the specialised nature of this community. A product-related blog, for example, can represent a virtual club in which loyal consumers can provide advice or comments regarding the possible improvement of existing products, and the desired feature of future products.

## CONCLUSION

The main limitations of this paper are related with its methodological approach. First of all, the number of respondents is relatively small in comparison with the number of active members of the three blogs. In addition, we cannot claim that the sample is representative, since it was based on a self-selection of respondents; therefore it is not possible to generalise the results to the entire population of study.

Although limited in research depth, this exploratory study provides some interesting information both for academic researchers and professional marketers. The research framework applied in this study could and should be used in other similar research projects in order to reinforce the validity of the obtained results. The development of a critical mass of research can determine the formulation of new theoretical models that can be used to explain more accurately consumers' behaviour in relation to blog advertising. On the other hand, marketers can use the research findings presented in the paper in order to design advertising campaigns directed to blog members and to predict more accurately consumers' response to their messages. The influence of gender and age on the perception of blog members provides a possible basis for segmenting and targeting more precisely blog populations with specific marketing messages.

## REFERENCES


Cohen, H. (2005). Blog Marketing Strategies (and How to Measure Them). *ClickZ, May 12*. Retrieved May 2009 from http://www.clickz.com/3504241.

Cox, J. L., Martinez, E. R., & Quinlan, K. B. (2008). Blogs and the corporation: managing the risk, reaping the benefits. *The Journal of Business Strategy*, *29*(3), 4–12. doi:10.1108/02756660810873164

Gruhl, D., Guha, R., Liben-Newell, D., & Tomkins, A. (2004, May). *Information diffusion through blogspace*. Paper presented at The Thirteenth International World Wide Web Conference, 17-22 May 2004, New York. Retrieved December 2005 from http://www2004.org/proceedings/docs/1p491.pdf.

Ko, H.-C., Yin, C.-P., & Kuo, F.-Y. (2008). Exploring individual communication power in the blogosphere. *Internet Research*, *18*(5), 541–561. doi:10.1108/10662240810912774

Kumar, R., Novak, J., Raghavan, P., & Tomkins, A. (2003, May). *On the bursty evolution of blogspace*. Paper presented at The Twelfth International World Wide Web Conference, 20-24 May 2003, Budapest, Hungary. Retrieved August 2006 from http://www2003.org/cdrom/papers/refereed/p477/p477-kumar/p477-kumar.htm

Lee, S., Hwang, T., & Lee, H.-H. (2006). Corporate blogging strategies of the Fortune 500 companies. *Management Decision*, *44*(3), 316–334. doi:10.1108/00251740610656232

Nakajima, S., Tatemura, J., Hino, Y., Hara, Y., & Tanaka, K. (2005, May). *Discovering important bloggers based on analyzing blog threads*. Paper presented at The 2nd Annual Workshop on the Weblogging Ecosystem: Aggregation, Analysis and Dynamics, 10 May 2005, Chiba, Japan. Retrieved November 2005 from http://www.blogpulse.com/www2005-workshop.html

Raab, D. M. (2009). Tools to Support Social Media Marketing: Choose an application within the framework of an enterprise strategy. *Information & Management*, *19*(4), 27.

Rickman, T. A., & Cosenza, R. M. (2007). The changing digital dynamics of multichannel marketing: The feasibility of the weblog: text mining approach for fast fashion trending. *Journal of Fashion Marketing and Management*, *11*(4), 604–621. doi:10.1108/13612020710824634

Technorati. (2008). *State of the Blogosphere 2008*. Retrieved May 2009 from http://technorati.com/blogging/state-of-the-blogosphere

Teich, A. G. (2008). Using Company Blogs to Win over Decision Makers. *Publishing Research Quarterly*, *24*(4), 261. doi:10.1007/s12109-008-9090-y


## KEY TERMS AND DEFINITIONS

**Blog Advertising:** posting advertising messages on a blog.

**Blog Marketing:** The marketing techniques used to collect information, advertise or sell product or services on a blog.

**Discussion Thread:** Chain of written ideas or opinions, exchanged among two or more participants in an online discussion, linked in the sequences in which they were expressed by the participants.

**Influencials:** Individuals considered as opinion leaders by their peers.

**Online Community:** a group of people that have a common interest and who interact using online communications tools.

**Shared Social Environment:** A physical or virtual space used by a group of people that have a common interest.

**Text-Mining:** The process of searching, collating and deriving useful data or information from text sources.

# Chapter 129
# RFID Enabled B2B E-Commerce Technologies and Applications

**Ygal Bendavid**
*UQAM, Université du Québec à Montréal, Canada & ACADEMIA RFID, Canada*

## ABSTRACT

*This article focuses on the emerging phenomenon of Radio Frequency Identification (RFID) technologies & the EPC Network by examining how it enables innovative B2B E-Commerce supply chain applications. A business process approach is used to facilitate the understanding on HOW to design RFID enabled B2B E-Commerce scenarios. Results indicate that RFID with other ubiquitous computing technologies constitute another step in the evolution from E-Commerce to "U-commerce".*

## INTRODUCTION

In recent years RFID emerged as powerful and disrupting technologies (Krotov and Junglas, 2008), which can have a major impact on enterprise business practices, changing the way business processes are designed (Lefebvre et al., 2005). It is perhaps the biggest thing to hit the IT world since the Internet (Heinrich, 2005). In fact, it has been coined as "the next big thing for management" (Wyld, 2006), the "key to automate everything" (Want, 2004) enabling "the next wave of the IT revolution" (Srivastava, 2004), and fostering a higher level of electronic integration between supply chain members (Bendavid et al., 2009).

RFID represents far more than a technological hype and has deep implications for organizations B2B E-Commerce practices. It is still an emerging phenomenon with a relatively rapid speed of adoption and its diffusion global, spanning over industries in different continents. In 2008 the value of the entire RFID market was estimated to $5.29 billion, up from $4.93 billion in 2007 (IDTechEx, 2008). Although the current slow-down in the economic environment is impacting the worldwide RFID market for RFID hardware, software and services, according to VDC Research Group (2008), compared to earlier estimates, the market forecasts have to be lowered

DOI: 10.4018/978-1-61520-611-7.ch129

but the demand will remain relatively strong. The revised annual growth rate (CAGR) between 2008 and 2012 are of 23.2 percent with a RFID market size for 2008 of $3.7 billion, $4.04 billion for 2009, and $4.7 billion in 2010. Finally, by 2012, it expects the worldwide market to be valued at about $8.42 billion.

This paper explores one aspect of the RFID technologies by analysing its potential in term of emerging B2B E-Commerce supply chain applications. More specifically, it focuses on the business process potential of RFID technologies by examining how intra & inter-organizational processes can be redesigned. In terms of practical implications, it is in line with recent questions raised by (Ngai et al., 2008) and (Curtin et al., 2007) about RFID while these authors are asking for models, theories, concepts, frameworks, methods, techniques, and tools to support the needs of professionals developing and implementing such technologies, raising the importance on RFID research to meet the needs of practitioners and managers.

The paper is organized as follows. The first section will define RFID technologies & EPC Global Network, though we will attempt to position RFID in a continuum of E-Commerce technologies adoption. The second section present RFID enabled applications in various industries. In section three, using a business process modeling approach (Davis, 2001), a specific application is selected in order to analyze "how" RFID enabled processes can be redesigned. Furthermore, in section 4, future research direction is proposed.

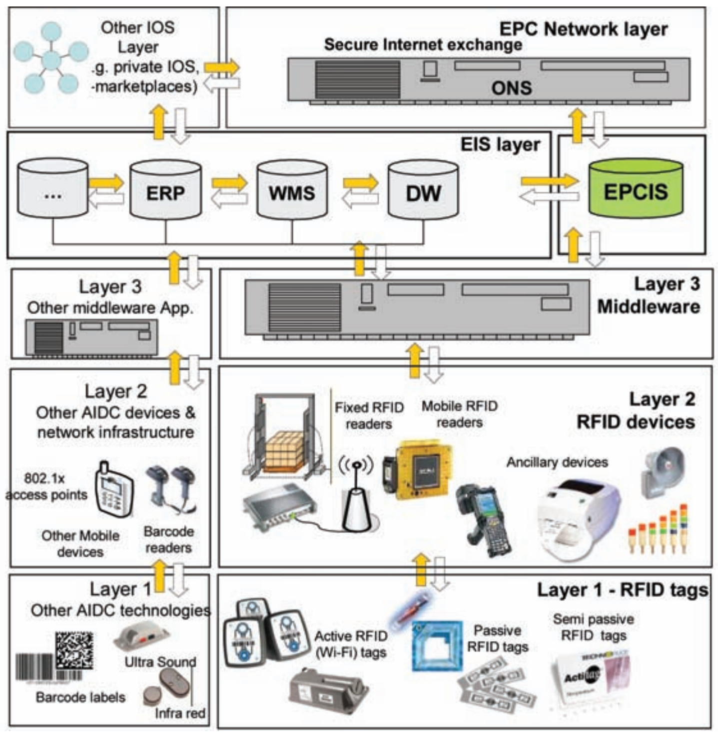
## RFID TECHNOLOGIES & THE EPC GLOBAL NETWORK

Basically, RFID technology is a wireless Automatic Identification and Data Capture (AIDC) technology. As presented in **Figure 1** (adapted from Lefebvre et al., 2008), RFID belong to a broader portfolio of AIDC technologies including among others barcode readers, Infra-Red (IR), Ultra Sound, 802.1x access points for wireless Local Area Networks (LANs), etc. **(left hand side of Figure 1).** An RFID solution can be represented as a multi layer system composed by tags, readers and middleware integrated with Enterprise Information Systems (EIS) and connected to Inter Organizational Information Systems (IOS).

### RFID System: A Multi Layer Architecture

**Layer 1** consists of RFID tags also named transponders which can be passive (powered by the reader RF with a read range from couple mm up to 4 m), semi-passive (with embedded sensors powered by a battery) or active (powered by a battery and equipped with a transmitter allowing a read range up to 100 m). These tags, embedded in or attached to any physical objects are used to record information and communicate with the readers using RF signals. **Layer 2** represents the RFID devices that enable the bulk communication with the tags without requiring the line of sight, namely readers and antennas and other ancillary devices (i.e. printers-encoders and feed back devices). These devices also transfer the data from the tags to the RFID middleware (layer 3). **Layer 3** is the software platform or middleware which acts as a bridge between hardware components (i.e. layers 1 and 2) and host applications (e.g. EIS) by enabling backend system integration. In fact, the RFID middleware not only monitors RFID equipment but also ensures the essential data management functions such as collection, storage, smoothing, filtering and aggregation. Moreover, it is critical for the events and workflow management functions based on preconfigured business rules and for other more advanced features such as analytics, business intelligence, reports and notifications.

*Figure 1. RFID multi layer architecture*




## RFID Technologies & the EPC Network: in the Continuum E-Commerce Adoption

The RFID system reaps its whole added-value when connected to IOS and EIS such as ERP (Enterprise Resource Planning), WMS (Warehouse Management System) or logistic and transportation systems since the data processed by the RFID middleware allows automated B2B E-Commerce transactions to be performed: for instance update the inventory & trigger replenishment, invoice a client, obtain Advance Shipping Notice (ASN) for inbound deliveries, compare the received shipment with the ASN and accept/refuse it, etc. (EIS Layer in the top of Figure 1).

As presented in the last layer (EPC Network Layer in the top of Figure 1), the envisioned EPCglobal Network is a set of technologies and services that leverage on RFID technologies and the Internet and building on enterprise systems capabilities, to allow authorized supply chain members to access and share dynamic information associated to products reads at specific points (EPC Global 2004). Basically, each tag is assigned a standardized Electronic Product Code (EPC) that uniquely & universally identifies an individual object. Once a tag is read, the information is pushed to the EPC network where the Object Name Service (ONS) allows Internet routing computers to locate where each EPC related information is stored (i.e. IP address). Using EPC Information System (EPCIS) standards which enables the exchange of EPC related information (i.e. EPC number, time, date, location, condition), the main idea is therefore to create an "Internet of things" (Thiesse and Michahelles 2006) and offers the potential to modify the way in which electronic commerce is conducted.

Today, some leading providers of internet infrastructure services and B2B E-Commerce solutions such as Verisign or GXS propose

RFID technology integration with Global Data Synchronization (GDS) and collaboration capabilities in their service offer. Combined with EIS proposition, all these initiatives are revamping the opportunities provided in the early 2000's by ''collaboration electronic marketplaces'' (Markus and Christiaanse 2003). Moreover this constitutes an other step to the operationalisation of the broader concept of "Ubiquitous Commerce" (U-Commerce) supported by RFID enabled pervasive communication systems and networks, and "ubiquitous computing" defined as a system "in which computing devices are considered integrated into everyday objects to allow them to communicate and interact autonomously and provide numerous services to their users" (CASAGRAS, 2008, p 10).

## RFID ADOPTION: A MULTI SECTORIAL - MULTI APPLICATION TREND

Although some authors have dated the RFID concept back as far as the 1950s, commercial activities integrating RFID started in the late 1960s with applications such as electronic article surveillance (EAS) (Landt, 2001). Following decades of developmental work and large-scale deployment of applications such as electronic tolls, the technology has really attracted attention in 2003 with the **Wal-Mart** and **US DOD** mandates. Today the RFID adoption is spanning over any industry where data needs to be collected or products need to be tracked.

For instance, in the **defense** industry the **U.S. Department of Defense (US DoD)** has been a key leader in RFID adoption to improve logistics support to US forces. Since its early initiative in 2003 to have its suppliers RFID-tag their goods, and formally adopted in 2007, the U.S. Army Product Manager for Joint-Automatic Identification Technology (PM J-AIT), awarded multiyear contracts worth up to hundreds of million dollars for RFID hardware software and services.

In the **retail sector**, Wal-Mart, the largest retailer in the world, has deployed the technology in 1400 of its 4100 domestic stores, and is now examining the technology's value and its effect on business processes. The retail chain Sam club undertook a similar initiative and recently set an ambitious timetable for 2010 which requires tagging at the "sealable units" level shipment to its Distribution Centers (DC) and stores. Another early adopter is the Metro Group, which started using RFID-EPC along its supply chain in 2004. To date, the company is tracking products arriving at all Metro (Cash & Carry wholesale) stores and DC in Germany as well as 300 of its real hypermarkets. More recently, according to a survey from ABI Research (2008) compliance programs are no longer the leading driver behind RFID implementations. As users are recognizing RFID's potential to improve their operations, business process improvement was identified as the number one adoption driver.

In other industries such as the **aerospace,** Airbus and Boeing are clearly leading the way with major pilots and deployments in areas such as logistics and transportation, manufacturing-assembly, aircraft maintenance, tools inventory tracking, etc.

In **pharmaceuticals,** while supply chain management efficiency has always been a concern, reducing counterfeited and diverted drugs and regulatory compliance has led to governmental initiatives such as the tracking and tracing California "ePedigree" law. Additionally, beside channel integrity, RFID tags equipped with sensors can enable real time automated monitoring of temperature sensitive shipment and provide chain of custody management. Furthermore, drugmakers such as Pfizer have already launched their own initiatives and are integrating RFID-EPC tags application and verification process for Viagra sold in the United States. The company is also using a redundant 2D Barcode at case level and linear code 128 at pallet level.

Also, given the potential of RFID applications, the **health care** sector is increasing its spending on RFID systems dramatically from $474 million in 2008 to $3.1 billion in 2013; a potential market 6.5 times larger than the current one (Kalorama Information, 2008). Today, hundreds of healthcare facilities across the world are increasing their asset & maintenance management efficiency by using Real Time Location Systems (RTLS) to track mobile devices and assets, improve patient and staff workflow, improve patient safety by ensuring that correct drugs and operations are carried out on the right patients, improve patient charge capture with automated itemized billing, etc.

## RFID ENABLED B2B E-COMMERCE APPLICATION: A BUSINESS PROCESS APPROACH

Despite several leading companies' positive experiences in testing RFID, the adoption has been slower than expected with RFID projects mostly on a limited scale. Although this technology has improved substantially over the last few years, its adoption by the business community still raises some challenge and unanswered questions. For instance, understanding WHICH applications can be supported by RFID is not enough to assess the real challenges and impacts of adopting the technology. One must therefore investigate "HOW" to design emerging RFID enabled technological & business applications. Because RFID projects are similar to business process reengineering (BPR) projects integrating emerging E-Commerce technologies (Bourgault and Bendavid, 2009), in order to answer this question, the business process approach is selected as it also proved to be relevant to capture the potential benefits of RFID technology (Lefebre et al., 2005; Fosso Wamba et al. 2008).

### Mapping RFID-EPC Transactions: Using the Event-Driven Process Chains (EdPCs) Formalism

The Event-driven Process Chains (EdPCs) formalism which allows a logic representation of activities within and between processes (Sheer, 1999) is used to facilitate the design and analysis RFID enabled B2B E-Commerce processes. An interesting aspect of the EdPCs formalism is that it highlights all the "events" that trigger the "functions" (i.e. an activity which needs to be performed) and the resulting sequence of events; suggesting that a process can be seen as a chain of events and functions linked by logical connectors (i.e."^" and, "v" or, "XOR" exclusive or). In addition it is possible to assign responsibilities (i.e. employee) to a specific function, allocate a system which is used to perform the function (e.g. ERP, RFID reader, middleware), indicate information inputs and outputs (e.g. RFID-EPC data) specify some business rules (e.g. "if" tags correspond to the numbers on the PO "then" accept, "else" reject).

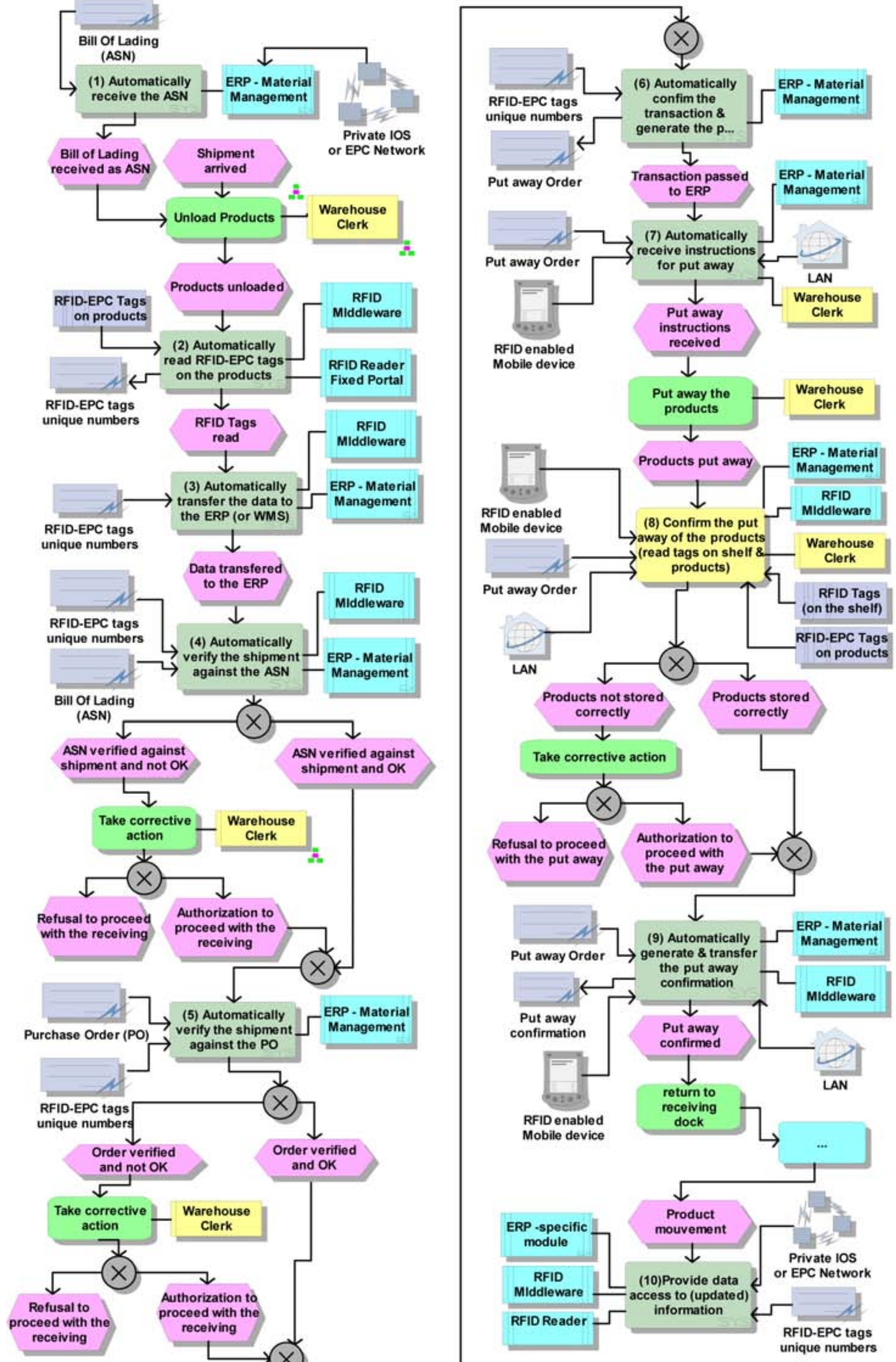
### RFID & the EPC Network: From Data Capture to Integrated B2B E-Commerce Transactions

For the purpose of the exercise, a specific process is designed using RFID-EPC technologies: namely a "receiving process" at a DC **(Figure 2)**. RFID enabled transactions are highlighted and respective technologies presented. At each specific step **(1 to 10)** the process is then briefly analyzed in term of impacts and potential benefits, and in term of RFID design (i.e. required RFID infrastructure). The analysis starts when the products are shipped from the supplier site, triggering the electronic bill of lading (i.e. ASN) sent through a private IOS or the EPC network, suggesting that all the information on the shipment have been received in the EIS at the customer site, prior to perform the receiving.

The process view proposed in **Figure 2** suggests that:

1. The optimization of intra organizational processes (i.e. focal firm DC warehouse management activities) is dependant upon the supplier agreement to adopt RFID technology and EPC standards and to conduct specific inter organizational E-Commerce transactions. For instance reading the tagged products as they leave its facility and automate the ASN containing the RFID-EPC numbers. Although using RFID and EPC Global standards allow the sharing EPC related information between trading partners (e.g. Wal-Mart and the U.S. DoD), this can only be achieved if suppliers face coercive pressure (e.g. Sams Club mandate) or see clear benefits of participating in such initiative. This can also be done by planning a RFID projects as a joint initiative, identifying conflicting goals and thinking out in term of incentive alignment when building up the business case (Bendavid et al., 2009).
2. As the products are received (& unloaded from the trucks) the RFID tags attached to the pallets or boxes are read using (i) a fixed RFID portal, (ii) a RFID hand held gun or (iii) a RFID mounted forklift. Usually, each design is specific to customer requirements and environment (see Boeck et al., 2008). For instance in a multi-door environment, it may be more interesting to select RFID mounted on forklifts for reducing the initial investment (e.g. Kimberly Clark).
3. As RFID-EPC tags are automatically read, the data is sent to the middleware where it is collected, processed and based on specific business rules, rooted to particular ERP modules (e.g. material management). This highlights the critical importance of properly configuring and integrating RFID middleware (see Fosso Wamba et al., 2008). In this context, most of the established EIS providers have recently introduced RFID integration capabilities within their systems by developing their own middleware. For instance, SAP is proposing "SAP AII" (Auto-ID Infrastructure), while Oracle's JD Edwards "EnterpriseOne solution" includes "RFID & Sensor-Based Services" to process data from sensors such as RFID, location, and temperature and "RFID Processor" to enable automated supply chain transactions.
4. The warehouse clerk is then automatically notified with an authorization (or not) to proceed with the receiving if the matching between the received products and the ASN is correct. While this verification is common in "traditional processes", in this context it is fully automated and paperless. Moreover, in specific sectors such as pharmaceutical, the same RFID-EPC tags could be used to prevent counterfeiting by matching the tags numbers against numbers in the manufacturer drug data base (e.g. Pfizer). Furthermore, for temperature sensitive products using additional semi passive RFID tags equipped with sensors, at the pallet level, the warehouse clerk could access the data log and perform a verification to ensure that the cold chain was not broken. To perform a similar verification, a very different RFID design could call for RFID enabled trucks equipped with readers & antennas to provide Unit In transit Visibility (UITV), hence reducing the amount of wasted products and increasing the quality of deliveries (e.g. Starbuck). Indeed, because various RFID technologies can be used to perform similar functions, a detailed business case to precisely define the project process requirements should be conducted using techniques such as use cases building and sensitivity analysis (i.e. trade off between needs and wants).
5. As indicated in step 5, the process then requires an other verification against the Purchase Order (PO). Again, this activity

*Figure 2. RFID enabled B2B e-commerce business processes*



is essentially performed using the existing ERP. Therefore, instead of manually entering the information, RFID data are automatically transferred to the system. While the benefits may sound trivial (i.e. data entry), in reality they are very important, such as (i) increasing the speed of the receiving process (ii) reducing data entry errors and (iii) allowing a near real time update of information (i.e. level of inventory). On the other hand, although RFID data can be captured in real time, there is an obviously limited capacity to managing this data as actual EIS are not designed nor configured to update their information in real time (i.e. rolling the ERP-MRP during the night). Furthermore, being able to gather real time data at this level of granularity constitutes a first building block in real time enterprise management; but not the least.

6. At this step (6), once the shipment is verified and accepted, the receiving transaction is finally performed in the system. The put away order is them automatically sent to the warehouse clerk. This raises an important consideration when quantifying the ROI of such technologies. For instance, once RFID becomes part of the EIS portfolio, it may become difficult to factor out their specific impacts and benefits vs. other existing systems in place (e.g. ERP, WMS, WLAN).
7. In step 7, following the receiving authorization the "smart products" require from the ERP to automatically provide the "put away" instructions to the clerk on his mobile RFID enabled device, through a WLAN. Another scenario would point to a cross docking process, not only canceling a temporary staging area with the put away of items immediately after receipt, but also by adopting the perspective of DC as a transit area where RFID technologies could help in multiple processes, including the receiving, the unpacking of the pallets, the assisted repacking of customized pallets, and the shipping. Adopting RFID technologies can therefore have incremental or radical changes to existing business processes for all the firms involved. For example, various activities could be canceled (e.g. temporary staging) or automated (e.g. data entry, counting) (Lefebvre et al., 2005). Moreover, emerging automated processes could be proposed such as automated anti-counterfeiting management, chain of custody self management, or as presented in the next step, self put away management.
8. In the retained scenario, once the warehouse clerk directly put away the products after receipt, he uses his mobile device to confirm the transaction, by reading & matching the tags on the products and the tags on the shelf. In another scenario, in order to fully automate the read & match process, the shelves could be equipped with readers& antennas; a more costly solution, but sometimes more interesting (i.e. smart shelves used to manage high cost consignment products in health care). In the case of mismatch, business rules built up on the middleware would therefore trigger an alert (e.g. red light). In a picking process, the same infrastructure and the same logic would also be used for the picking process, by automatically tracking & matching products tags against e-picking list.
9. Once the products are stored, a put away notification is automatically generated and transferred to the ERP system (material management module) in order to update the inventory once the MRP is rolled. Once again concerns rose at step 5 (EIS limitation) and 6 (factoring out RFID impacts vs. established systems) comes to mind. Indeed, such technological and business scenarios are possible only by coupling EIS, Middleware, LAN, Mobiles devices and finally RFID technologies.

10. The last step presented in Figure 2 is not part of the receiving process but highlights further steps where similar business process mapping could help to understand how products movements can be tracked, data captured in real time, and information accessed and shared between supply chain members through internal systems and IOS. In line with this idea, RFID technologies therefore act as an enabler of more collaborative and integrated B2B E-Commerce solutions, as it provides the required data for facilitating efficient supply chain initiatives such as Vendor Management Inventory (VMI) or Collaborative Planning, Forecasting, and Replenishment (CPFR). In the retail industry, for instance, some companies that are RFID tagging goods for Wal-Mart are using the data made available by the retailer to reduce Out Of Stocks (OOS), better manage new product introduction (NPI), reduce charge backs, improve reconciliation-deduction issues and minimize shrinkage (Wasserman, 2008).

## FUTURE RESEARCH DIRECTIONS

While over the past several years, RFID technologies has been promoted as "the next big thing" in supply chain management, in reality, the promised impacts and benefits are yet to be confirmed; leaving many potential adopters in a "wait and see" mode (Reyes et al., 2007).

It appears that some of the well promoted applications, while theoretically very attractive and potentially feasible, are quite challenging in the real world. Therefore, because of the lack of understanding of RFID technologies and integration issues with existing IOS, potential adopters could overestimate the technology's potential and develop unrealistic business process expectations, inevitably leading to disappointment in their E-Commerce project. Moreover the lagging adoption can also be attributed to unclear ROI yet, technology costs, as well as standards concerns for data sharing and a lack of industry unification behind a single technology (e.g. RFID, Near Field Communication (NFC), Ultra Wide Band (UWB); Wireless Fidelity - IEEE 802.11 (Wifi), RuBee, ZigBee, etc.).

On the other hand, as the technology and the markets are maturing, these barriers are being removed. Various factors should be therefore looked at, including: the continuous incremental products and process innovations (e.g. cheaper inlays, near & far field reads in a single tag, increased data capacity and data security, embedded sensors, thin-form batteries, readers with tag direction detection capabilities, etc.), the structuring of the market (fusions and acquisitions, cross- and joint-licensing strategies), the integration capabilities by EIS providers offering (i.e. middleware & applications), the emergence of dominant design and standards (e.g. passive RFID UHF 915-MHz class 1 Gen. 2 in supply chain management; active RFID-WiFi for asset tracking), the deployments by lead users and early initiatives by laggards (e.g. oil & gas, mining, chemicals), etc. These are all encouraging signs that will foster the adoption by reinforcing end-user confidence in the technology, and reducing uncertainties.

## CONCLUSION

As we are seeing evidence of economic related project push backs (Read and Timme, 2009), this could provide a conservative framework for RFID investment decisions, where cost reduction projects, or those focusing on increasing revenues, or improving operations efficiency, could find a echo in the short-term and be funded (Wimmer and Rezendes, 2008). The discussion proposed in the article can serve as a basis for such analysis. This chapter therefore attempted to clarify the use of RFID technologies and the EPC network on emerging applications, and to improve our understanding of their impacts on B2B E-Commerce supply chain business processes. It represents a partial answer to academics and professionals looking for ways to investigate RFID related issues. An assumption is made that RFID, with other "ubiquitous computing" technologies constitute an other step in the evolution from E-Commerce to "U-Commerce" as "intelligent products" (McFarlane et al., 2003) such as tagged object which possesses a unique ID, are now capable of sensing (i.e. sentient computing), communicating and interacting autonomously with their environment (i.e. pervasive computing), providing numerous services to their use and therefore participating in making decisions relevant to their own future.

## REFERENCES

Boeck, H., Lefebvre, E., & Lefebvre, L. A. (2008). Technological requirements and derived benefits from RFID enabled receiving in a supply chain. In S. Ahson & M. Ilyas, (ed.), *RFID Handbook: Applications, Technology, Security, and Privacy (295-310)*. Boca Raton, FL: Taylor and Francis, CRC Press.

Bourgault, M., & Bendavid, Y. (2009). Introducing Complex Technologies into the Enterprise: The Case of RFID. In M.H. Sherif (Ed.), *Handbook of Enterprise Integration.* Boca Raton, FL: Taylor & Francis group, Auerbach Publications.

CASAGRAS. *Coordination and Support Action for Global RFID-related Activities and Standardization.* (2008). Interim report, September. Retrieved February 10, 2009, from www.rfidglobal.eu/userfiles/documents/CASAGRAS%20 Report.pdf

Curtin, J., Kauffman, R. J., & Riggins, F. J. (2007). Making the most out of RFID technology: A research agenda for the study of the adoption, usage and impact of RFID. *Information Technology and Management*, *8*(2), 87–110. doi:10.1007/s10799-007-0010-1

Davis, R. (2001). *Business Process Modelling with ARIS: A Practical Guide.* London: Springer Verlag.

Fosso Wamba, S., Lefebvre, E., Bendavid, Y., & Lefebvre, L. A. (2008). From Automatic Identification and Data Capture to "smart Business Processes." In S. Ahson, & M. Ilyas, (ed.), *RFID Handbook: Applications, Technology, Security, and Privacy,* (279-294). Boca Raton, FL: Taylor and Francis, CRC Press.

Fosso Wamba, S., Lefebvre, L. A., Bendavid, Y., & Lefebvre, É. (2008). Exploring the impact of RFID and the EPC network on mobile B2B eCommerce: a case study in the retail industry. *International Journal of Production Economics, Special Issue on RFID: Technology, Applications, and Impact on Business Operations*, *112*, 614–629.

Global, E. P. C. (2004). *The EPCglobal Network™ and The Global Data Synchronization Network (GDSN), understanding the Information & the Information Networks*. Rep. No. 008216. Retrieved from EPC Global http://www.epcglobalinc.org/about/media_centre/EPCglobal_and_GDSN_v4_0_Final.pdf

Heinrich, K. (2005). RFID and Beyond: Growing Your Business Through Real World Awareness, Indinapolis, Wiley.

Kalorama Information. (2008). Key Healthcare Opportunities for Technology Companies. In J. Burnell (Ed.), *Healthcare, Pharma Industries to Increase RFID Spending, RFID Update.* Retrieved March 2, 2009, from http://www.rfidupdate.com

Krotov, V., & Junglas, I. (2008). RFID as a Disruptive Innovation. *Journal of Theoretical and Applied Electronic Commerce Research*, *3*(2), 44–59. doi:10.4067/S0718-18762008000100005

Lefebvre, E., Bendavid, Y., & Lefebvre, L. A. (2008, September). *Open innovation strategies in shaping technological progress: the case of RFID.* Paper presented at the International Association of Management of Technology (IAMOT) conference, Nice, France.

Lefebvre, L. A., Lefebvre, E., Bendavid, Y., Fosso Wamba, S., & Boeck, H. (2005). The potential of RFID in warehousing activities in a retail industry supply chain. *Journal of Chain and Network Science*, *5*(2), 101–111. doi:10.3920/JCNS2005.x059

Markus, M. L., & Christiaanse, E. (2003). Adoption and Impact of Collaboration Electronic Marketplaces. *Information Systems and e-Business Management, 1*(2), 1-17.

McFarlane, D., Sarma, S., Chirn, J. L., Wong, C. Y., & Ashton, K. (2003). Auto ID systems and intelligent manufacturing control. *Journal of Engineering Application of Artificial Intelligence*, *16*(4), 365–376. doi:10.1016/S0952-1976(03)00077-0

Ngai, E. W. T., Moon, K. L., Riggins, F. J., & Yi, C. Y. (2008). RFID research: An academic literature review (1995–2005) and future research directions. *International Journal of Production Economics*, *112*(2), 510–520. doi:10.1016/j.ijpe.2007.05.004

Read, R., & Timme, R. (2009, January). *RFID Monthly Technology Research report*. Retrieved from http://www.rwbaird.com/docs/RFIDMonthlyJan09.pdf

ABI Research. (2008). *Annual RFID End User Survey*. Research report.

Reyes, P. M., Frazier, G. V., Prater, E. L., & Cannon, A. R. (2007). RFID: the state of the union between promise and practice. *International Journal of Integrated Supply Management*, *3*(2), 192–206. doi:10.1504/IJISM.2007.011976

Sheer, A. W. (1999). *ARIS-Business Process Modelling,* (3rd ed.). Berlin: Springer.

Srivastava, B. (2004). Radio frequency ID technology: The next revolution in SCM. *Business Horizons*, *47*(6), 60–68. doi:10.1016/j.bushor.2004.09.009

Thiesse, F., & Michahelles, F. (2006). An overview of EPC technology. *Sensor Review*, *26*(2), 101–105. doi:10.1108/02602280610652677

Want, R. (2004). RFID: a Key to Automating Everything. *Scientific American*, *290*(1), 56–65. doi:10.1038/scientificamerican0104-56

Wasserman, E. (2008). Paddling to profits. *RFID Journal*, *5*(6), 26–32.

Wimmer, T., & Rezendes, C. (2008, November 20). *What's Next: AIDC Market Update, Trends and 2009 Outlook,* [PowerPoint slides and Audio File]. Retrieved from the VDC Research Web site: http://www.vdcresearch.com/misc/08_aidc_webinar.pdf

Wyld, D. C. (2006). RFID 101: the next big thing for management. *Management Research News*, *29*(4), 154–173. doi:10.1108/01409170610665022

## ADDITIONAL READING

Auto-ID Labs are an independent global network of (currently seven) academic research laboratories in the field of networked RFID. Various useful additional reading can be gathered in term of (i) white papers, (ii) academic publications, (iii) demonstrators / pilots, (iv) software packages such as simulation tools, (v) presentations at workshops: http://www.autoidlabs.org/

EPCglobal, the organization in charge of leading the development of industry-driven standards for the EPC to support the use of RFID: www.epcglobalinc.org/home

Poslad, S. (2009). Ubiquitous Computing: Smart Devices, Environments and Interactions. Wiley, 1 edition

## KEY TERMS AND DEFINITIONS

**AIDC:** Automatic Identification and Data Capture technologies including among other, bar codes, systems, infra red, ultra sound, biometry, magnetic stripes, etc.

**Electronic Product Code (EPC):** A standardized identification scheme for identifying physical objects using RFID technologies. EPC Global is the organization leading the industry-driven standards for standardized EPC data which consists of an EPC that uniquely & universally identifies an individual object.

**EPC Network:** The infrastructure allowing data sharing using standardized EPC numbers and data transfer protocol to retrieve product information over the internet.

**Radio Frequency Identification (RFID):** a technique that allows objects to be identified using radio waves.

**Transponders:** RFID tags are called transponders because they transmit and respond to RF signals.

**RTLS:** Real Time Location Systems are used to track assets, tools and people. Usually RTLS systems are based on active RFID tags leveraging on WiFi networks, UWB, or mesh networks.

**Business Process Modeling:** Using methodological approach to document, analyse and design the core processes supporting the structure of a business, it aims and objectives, the mechanisms and resources used to deliver them, the constraints it must work within and its relationship with the environment it operates.

# Index

## C

## D

## F



## G

## H



## I

## J



## K



## L



## M

## N

## O



## P

## V



## W

## Y