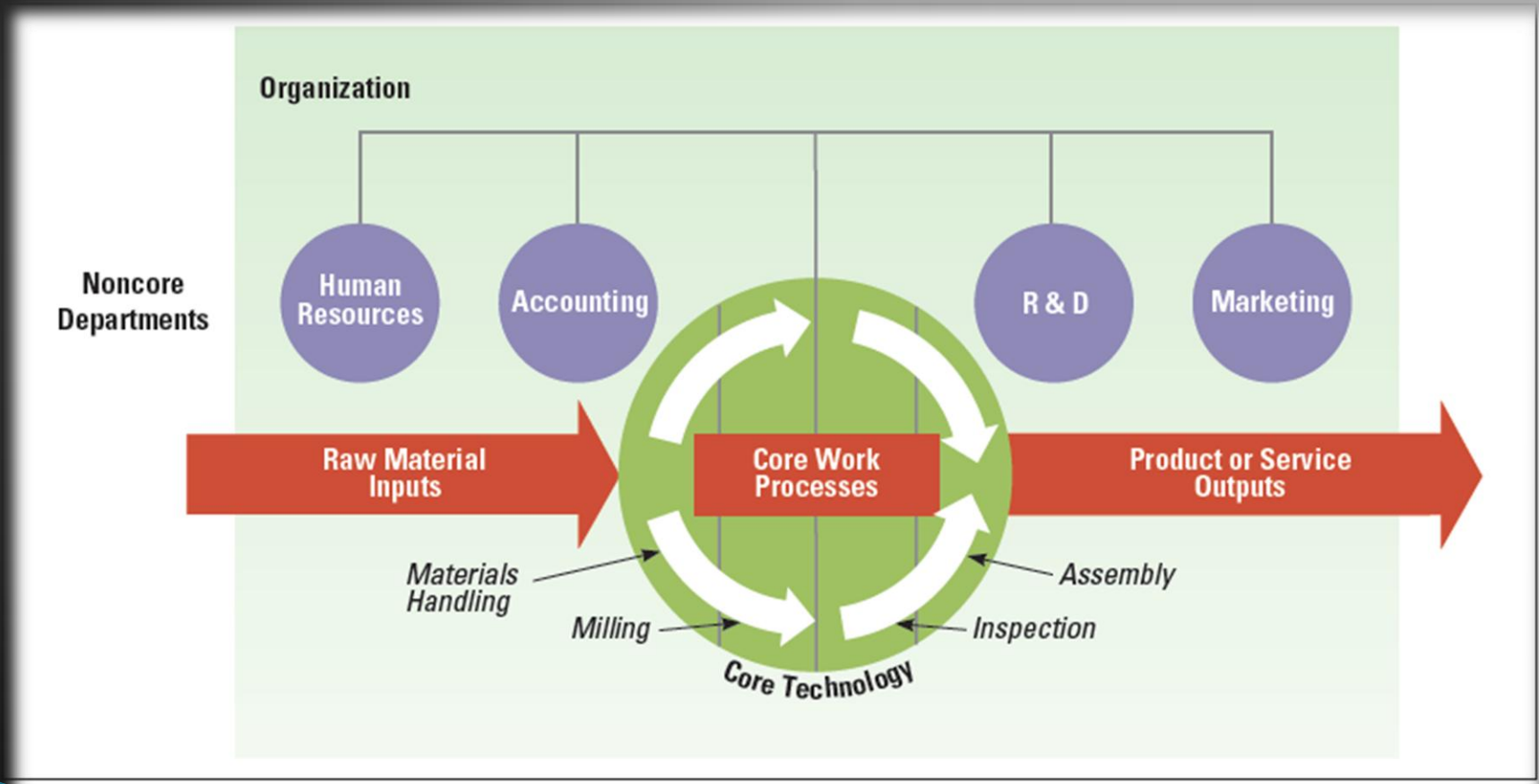
Workplace Technology and Design

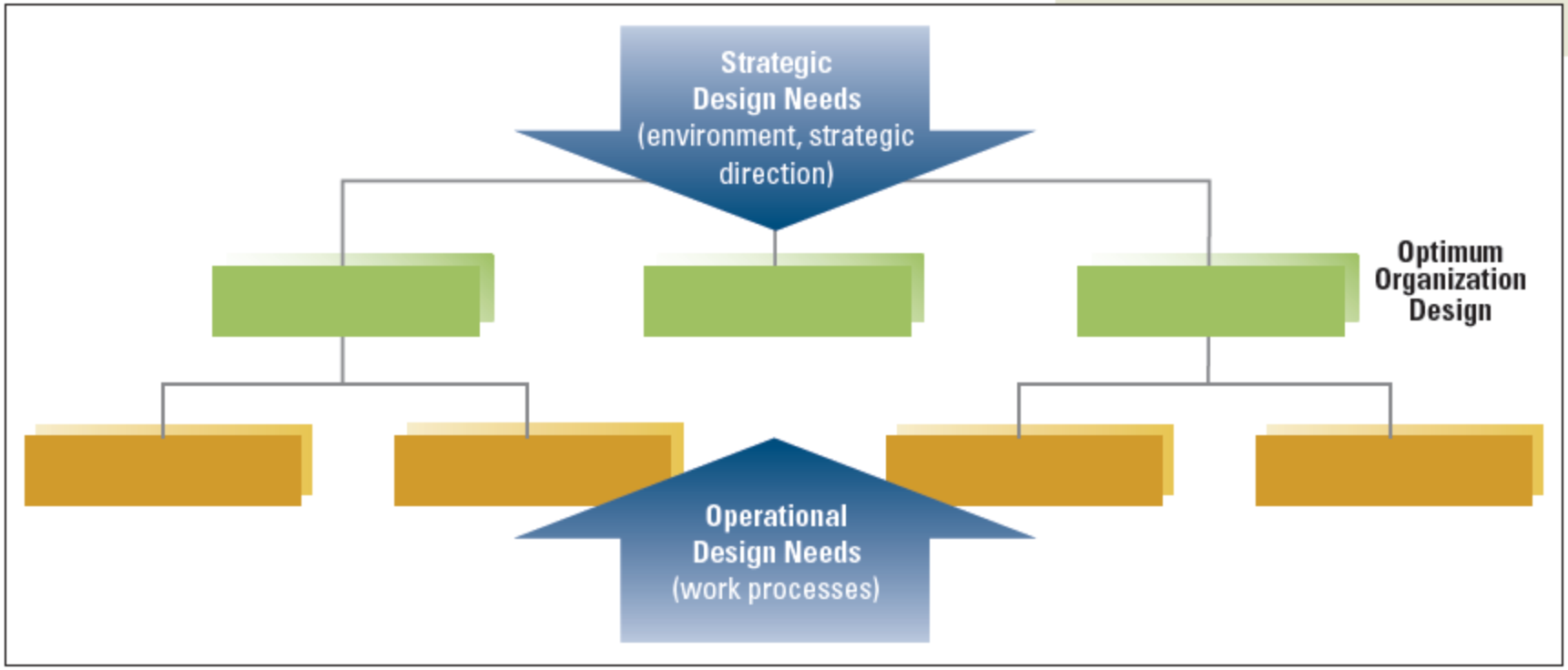
Service and Manufacturing Technologies

- Technology refers to the work processes, techniques, machines, and actions used to transform input into outputs
- Technology influences organizational structure
- Understanding technology helps dictate how organizations can be designed for efficiency
- **Core technology** relates to the transformation process to provide goods/service
- **Non-core technology** is not directly related to the primary mission of the organization

Core Transformation Process for a Manufacturing Company



Pressures Affecting Organization Design

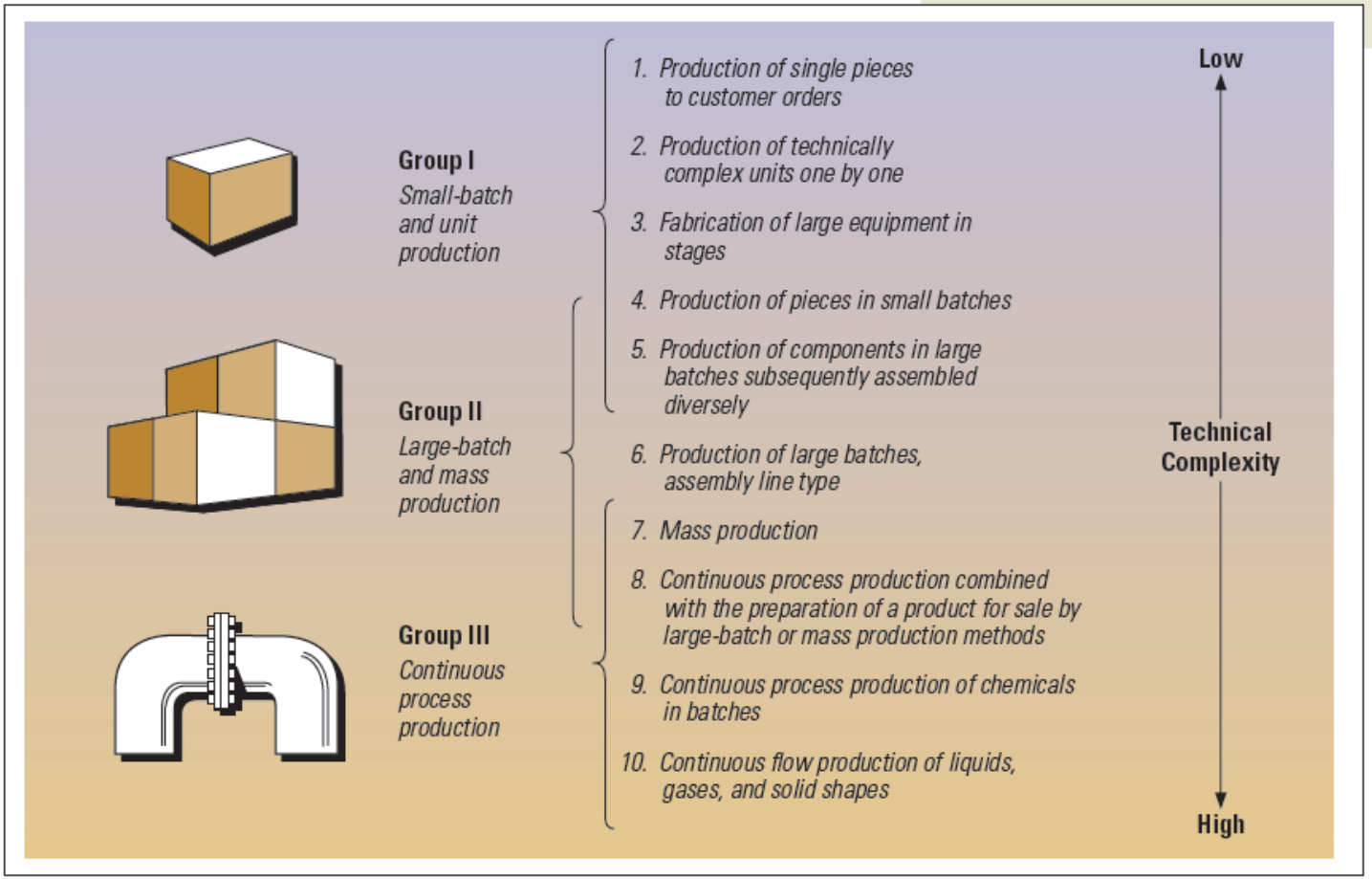


Source: Based on David A. Nadler and Michael L. Tushman, with Mark B. Nadler, *Competing by Design: The Power of Organizational Architecture* (New York: Oxford University Press, 1997), 54.

Manufacturing Firms

- **Technical complexity** defines the extent of mechanization of the manufacturing process
- Three basic technology groups defined by Woodward:
  - Small-batch and unit production
  - Large-batch and mass production
  - Continuous-process production

Woodward's Classification Based on System of Production



Source: Adapted from Joan Woodward, *Management and Technology* (London: Her Majesty's Stationery Office, 1958). Used with permission of Her Britannic Majesty's Stationery Office.

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Relationship between Technical Complexity and Structural Characteristics

	Technology		
Structural Characteristic	**Unit Production**	**Mass Production**	**Continuous Process**
Number of management levels	3	4	6
Supervisor span of control	23	48	15
Direct/indirect labor ratio	9:1	4:1	1:1
Manager/total personnel ratio	Low	Medium	High
Workers' skill level	High	Low	High
Formalized procedures	Low	High	Low
Centralization	Low	High	Low
Amount of verbal communication	High	Low	High
Amount of written communication	Low	High	Low
Overall structure	Organic	Mechanistic	Organic

Based on: Management and Technology by Joan Woodward, (London: Her Majestys Stationery Office, 1958).

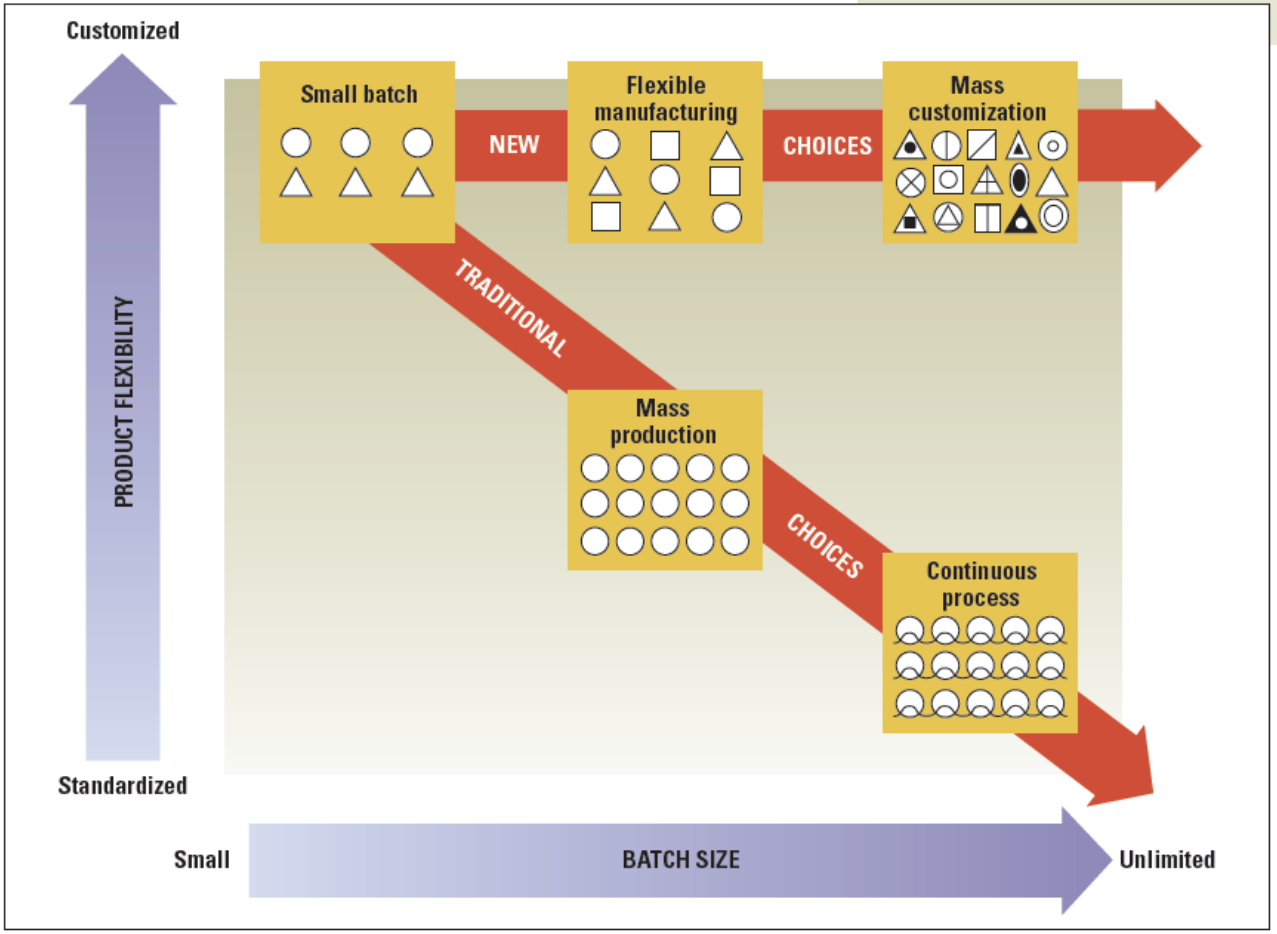
Strategy, Technology, and Performance

- **Strategy, structure, and technology need to be aligned**
- Successful firms have complementary structures and technologies
- Failing to adopt a new technology or failing to realign strategy can lead to poor performance

The Digital Factory

- **The shop floor has been revolutionized**
- Computer-aided Design (CAD)
- Computer-aided Manufacturing (CAM)
- Manufacturing Process Management (MPM)
- Integrated Information Network
- Product life-cycle Management (PLM)
- Also called computer-integrated manufacturing, flexible manufacturing systems, smart factories, advanced manufacturing technology, and agile manufacturing

Flexible Manufacturing Technology vs. Traditional Technologies



Source: Based on Jack Meredith, "The Strategic Advantages of New Manufacturing Technologies for Small Firms," *Strategic Management Journal* 8 (1987), 249–258; Paul Adler, "Managing Flexible Automation," *California Management Review* (Spring 1988), 34–56; and Otis Port, "Custom-made Direct from the Plant," *BusinessWeek*/21st Century Capitalism (November 18, 1994), 158–159.

Lean Manufacturing

- Highly trained employees at every stage of production
- Cut waste and improve quality
- Incorporates technological elements
- Paved the way for **mass customization**
  - Using mass-production technology to quickly and cost-effectively assemble individual goods for customers

Performance and Structural Implications

Flexible manufacturing allows diverse products to be made on one assembly line

- ✓ Computer-aided craftsmanship
- ✓ More efficient
- ✓ Increased productivity
- ✓ Decreased scrap
- ✓ Customer satisfaction

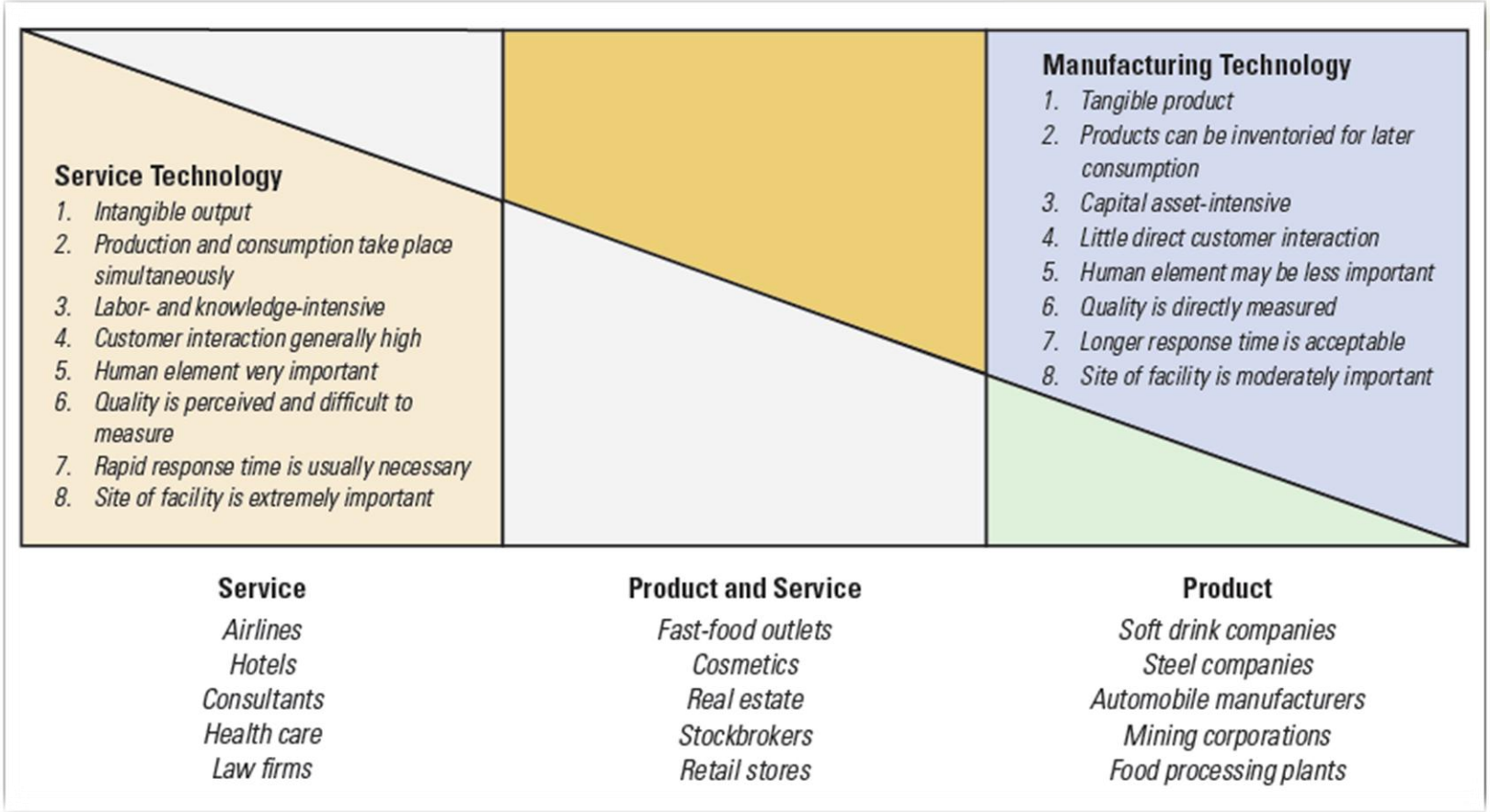
Comparison of Organizational Characteristics

Characteristic	Mass Production	Digital Factory
Structure		
Span of control	Wide	Narrow
Hierarchical levels	Many	Few
Tasks	Routine, repetitive	Adaptive, craftlike
Specialization	High	Low
Decision making	Centralized	Decentralized
Overall	Bureaucratic, mechanistic	Self-regulating, organic
Human Resources		
Interactions	Standalone	Teamwork
Training	Narrow, one time	Broad, frequent
Expertise	Manual, technical	Cognitive, social; solve problems
Interorganizational		
Customer demand	Stable	Changing
Suppliers	Many, arm's length	Few, close relationships

Service Firms

- Service technologies are different from manufacturing technologies and require different organizational design
- Education, health care, transportation, and banking all have unique dimensions
- Services have intangible output
- There is direct interaction with customer and employee
- Human element is important
- Quality of service cannot be directly measured

Core Organization Service Technology



Trend Toward Lean Services

- **Customer expectations are rising**
- Expectations have required that service firms must become lean, too
  - Cut waste
  - Improve customer service
- Adopt continuous improvement approach

Structural Characteristics of Service Organizations versus Product Organizations

	Service	Product
Structural Characteristic		
1. Separate boundary roles	Few	Many
2. Geographical dispersion	Much	Little
3. Decision making	Decentralized	Centralized
4. Formalization	Lower	Higher
Human Resources		
1. Employee skill level	Higher	Lower
2. Skill emphasis	Interpersonal	Technical

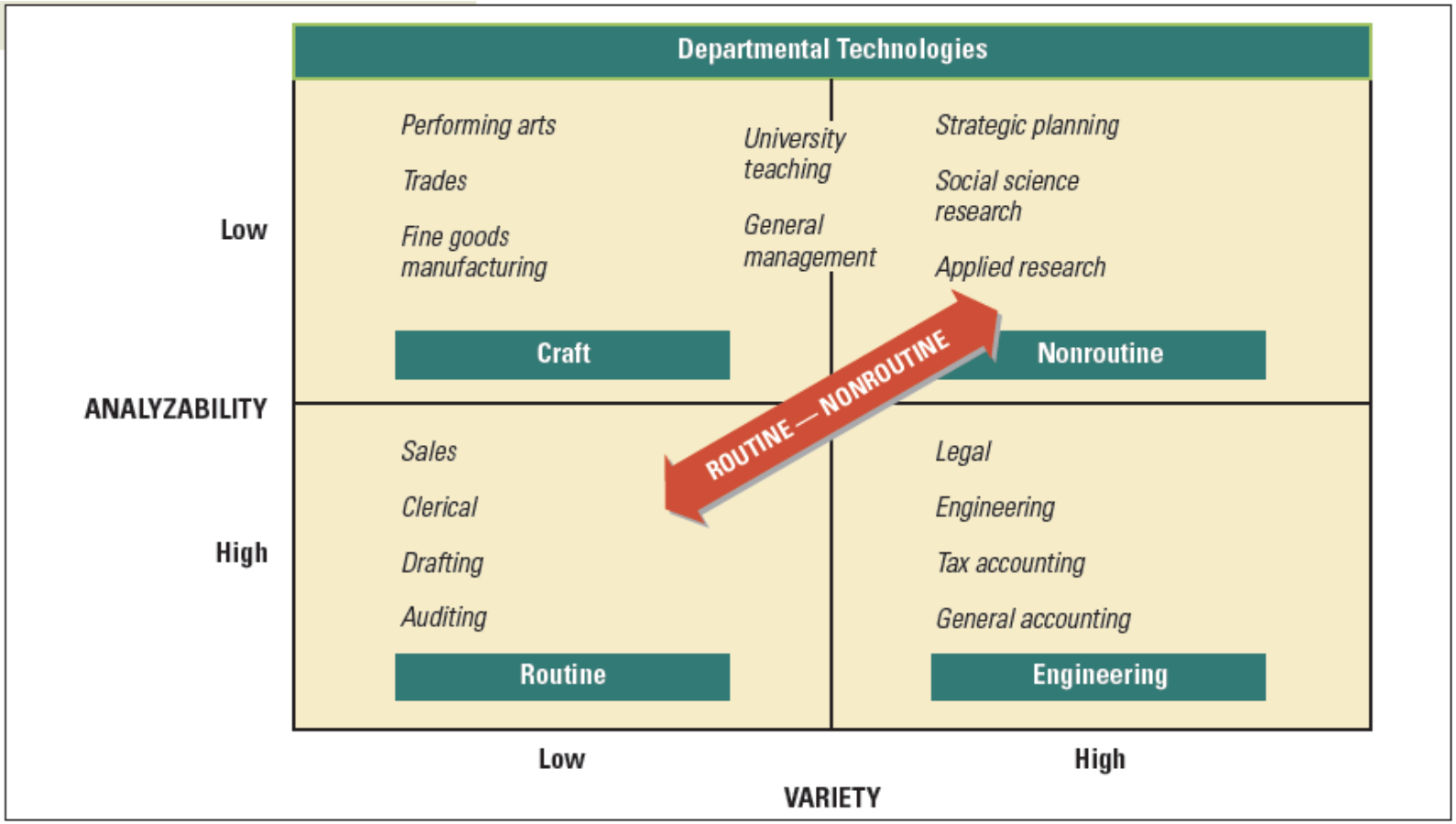
Designing the Service Organization

- Service organizations are not necessarily large
- Often small locations, close to customers
- Service organizations require technical core employees – close to customer
- Service customers interact directly with technical employees
- The skills of technical employees need to be high
- Employees need knowledge, awareness, and interpersonal skills
- Decision making is often decentralized

Non-Core Departmental Technology

- Every department in an organization has a production process
  - *Variety:* frequency of unexpected and novel events
  - *Analyzability:* ability to apply standard procedures
- Routine vs. Nonroutine Dimension
- Engineering Technologies
- Craft Technologies

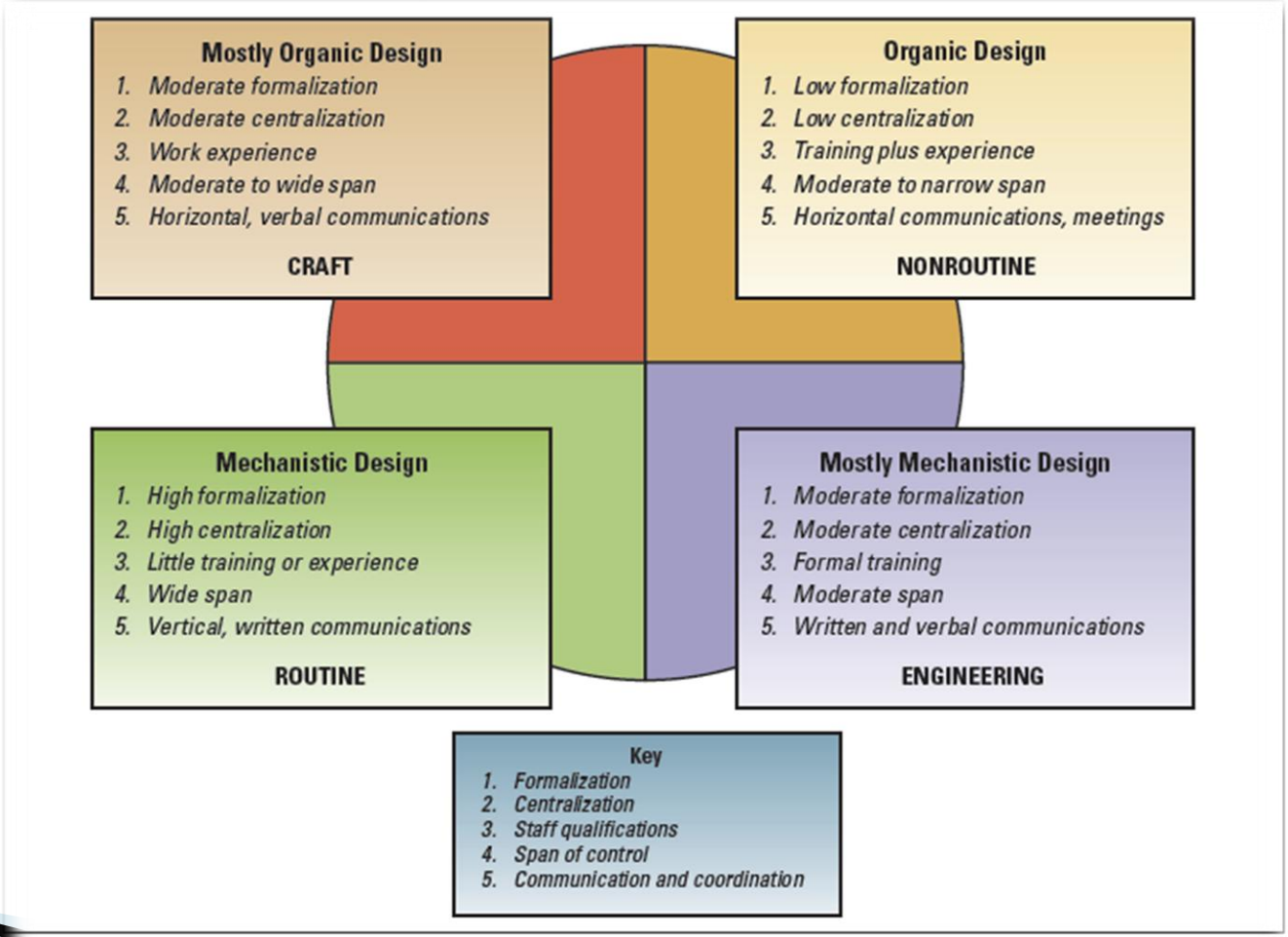
Framework for Department Technologies



Department Design

- Overall design is either organic or mechanistic
- Design characteristics vary depending on work unit
  - Formalization
  - Decentralization
  - Employee skill level
  - Span of control
  - Communication and coordination

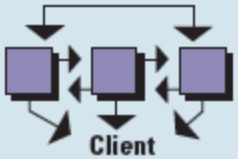
Relationship of Department Technology to Structural and Management Characteristics



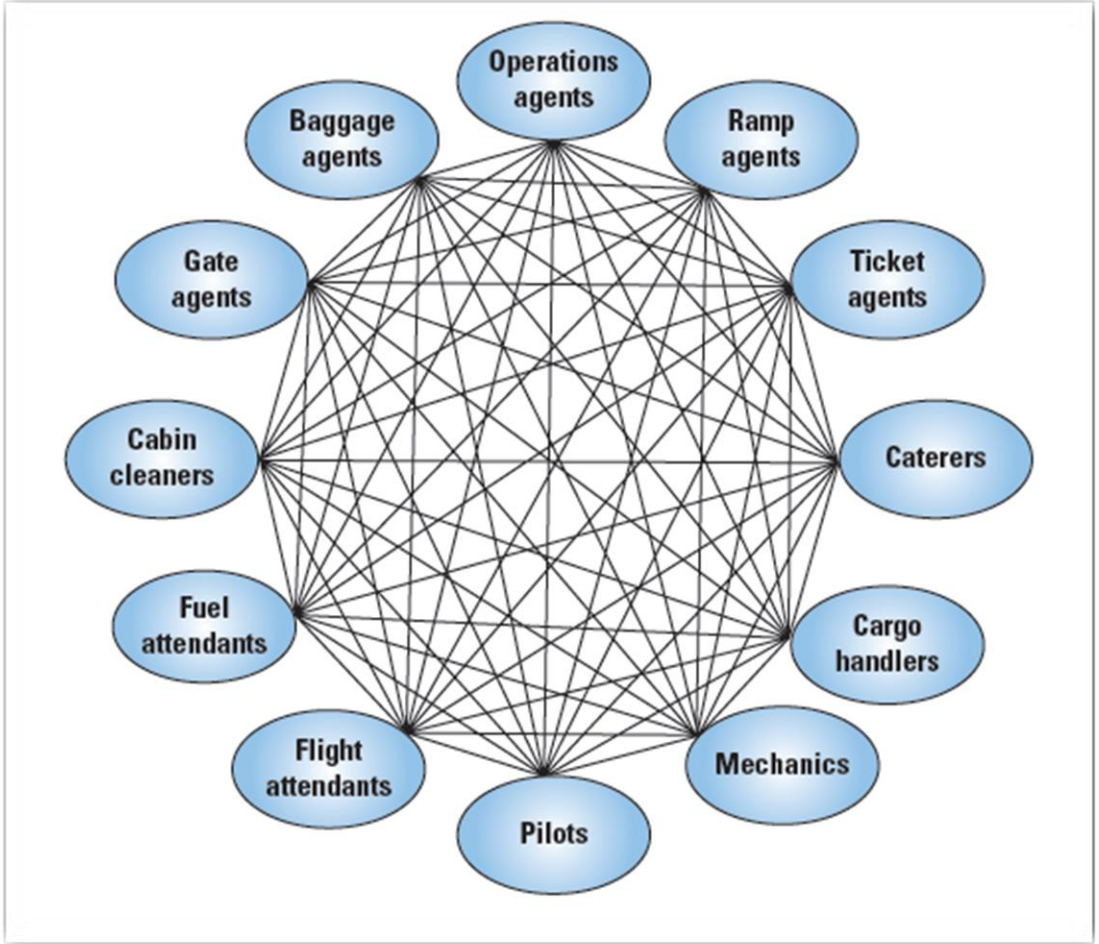
Workflow Interdependence Among Departments

- The extent to which departments depend on each other for resources or materials
- Low interdependence means that departments can do their work independently
- High interdependence means departments depend on each other

Interdependence and Management Implications

Form of Interdependence	Demands on Horizontal Communication, Decision Making	Type of Coordination Required	Priority for Locating Units Close Together
Pooled (bank)  Clients	Low communication	Standardization, rules, procedures Divisional structure	Low
Sequential (assembly line)  Client	Medium communication	Plans, schedules, feedback Task forces	Medium
Reciprocal (hospital)  Client	High communication	Mutual adjustment, relational coordination, teamwork Horizontal structure	High

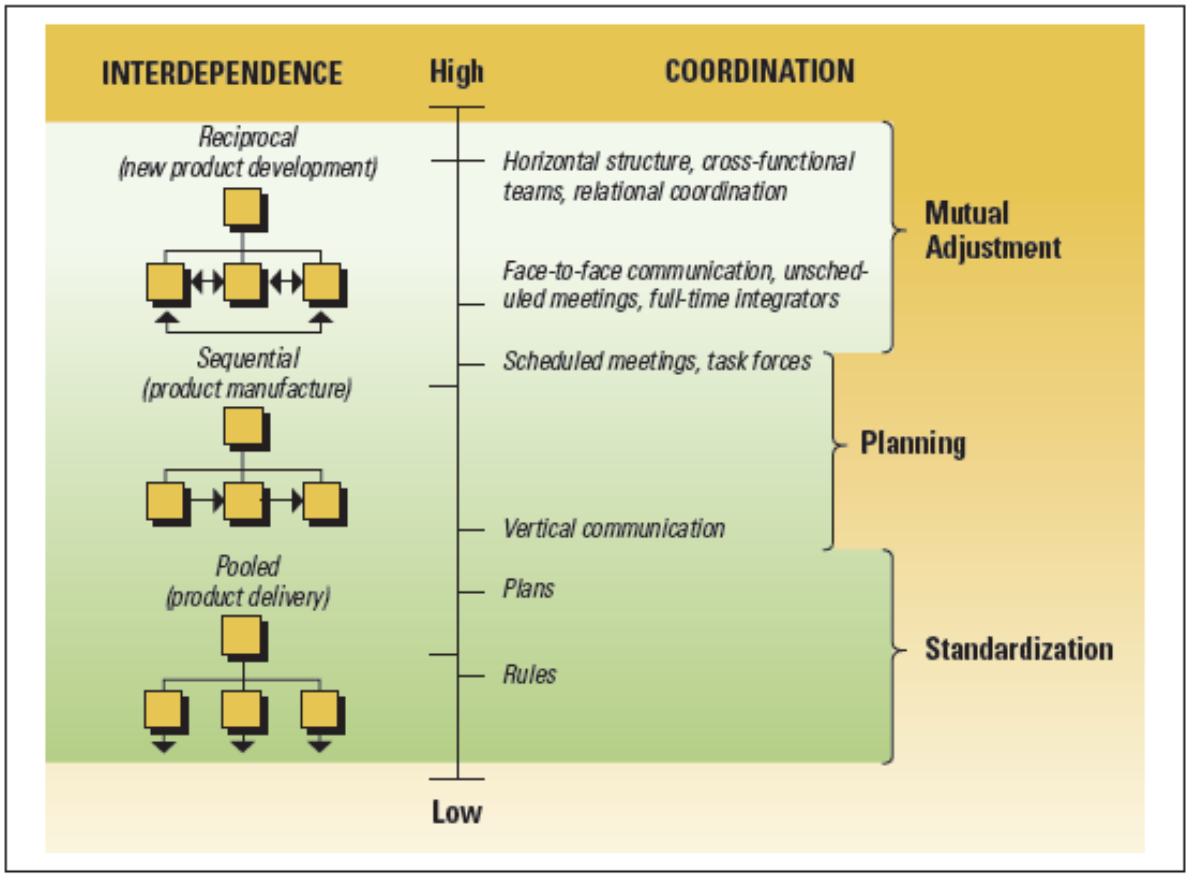
Interdependence of Departments Involved in the Flight Departure Process



Structural Priority and Implications

- Reciprocal interdependence should receive first priority
- Reciprocal activities should be grouped together
- Poor coordination will cause poor performance
- Organizations should be designed to address interdependence

Coordination for Interdependence



Relationship of Interdependence and Team Play Characteristics

	Baseball	Football	Basketball
Interdependence	Pooled	Sequential	Reciprocal
Physical dispersion of players	High	Medium	Low
Coordination	Rules that govern the sport	Game plan and position roles	Mutual adjustment and shared responsibility
Key management job	Select players and develop their skills	Prepare and execute game	Influence flow of game

Impact of Technology on Job Design

Technology impacts:

1) Job Design
2) Sociotechnical systems

- ✓ Job Design
- ✓ Job Simplification
- ✓ Job Rotation
- ✓ Job Enrichment
- ✓ Job Enlargement

Sociotechnical systems approach recognizes the interaction of technical and human needs

Sociotechnical Systems Model

Design Essentials

- Key research notes that technology and structure can be co-aligned
- Service technologies differ in a systematic way from manufacturing technologies
- It is important to apply the correct management system to a department
- Interdependence among departments dictates the amount of communication and coordination required in design
- New technologies are enriching jobs to make organizations a happier place to work
- Sociotechnical system theory attempts to design systems that meet technical and human aspects