The SIX SIGMA WAY

How GE, Motorola, and Other Top Companies Are Honing Their Performance

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To Anne and Al Pande, who've been
"Six Sigma" parents and my best friends.

—*P.S.P.*

To my dear wife, Mabel.

—*R.P.N.*

To my dad, Hale Cavanagh,
who would have been pleased and proud
to see the results of this undertaking.

—*R.R.C.*

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Contents

Preface

THIS BOOK is designed to help business leaders—from CEOs to supervisors—tap into the power of the Six Sigma movement that's transforming some of the world's most successful companies. Six Sigma initiatives have tallied billions of dollars in savings, dramatic increases in speed, strong new customer relationships—in short, remarkable results and rave reviews.

Are these results for real? And is it really possible for you and your business to achieve some of the same gains?

The answer is "yes." It can happen in any type of business and, contrary to many people's fears, you don't have to have an in-depth background in statistical analysis. Six Sigma can contribute not only to how your company measures and analyzes its performance, but also to improving your basic approach to managing the business.

Six Sigma: Changing Business Habits

A story from our early experiences implementing Six Sigma illustrates how this new approach to business impacts the very habits that drive an organization. We were working with leaders and Six Sigma project teams at one of largest business units of GE Capital (the first totally service-based company to launch Six Sigma).

It was during a "Gallery Walk"—at which the teams were explaining their progress to company leaders—that the firm's CEO began challenging one of the team leaders. "If you think that's the problem," the

CEO suggested, "why don't you just…?" and he suggested a solution. The team leader tried to explain that their analysis and data were preliminary, and that more work was needed to confirm their suspicions. The executive persisted over several minutes, however, in arguing for his proposed solution. In the face of grilling from his "boss's boss's boss," the team leader grew increasingly flustered and unsure of how to respond.

At that moment, in an act of corporate courage, one of the firm's "Black Belts," a financial services manager we had trained to coach Six Sigma teams, literally stepped between the CEO and the team's charts. He declared, in so many words: "We're not going to jump to a solution because we're using the Six Sigma process!"

Immediately the company leader recognized his mistake. Instead of getting angry, he laughed and apologized. Later, speaking to the entire group, he related the story and gave credit to the Black Belt for defending the Six Sigma Way. "We're not in the 'Just Do It' mode anymore," he noted. "Taking the time to understand a problem and process before we fix it is better—but you may have to *remind* us from time to time until we get used to this new way."

That company went on to achieve millions of dollars in savings through Six Sigma projects, and to totally revamp their approach to strategic and new product planning. While they still haven't lost all their old, "just do it" spirit, they are approaching processes and problems with better questions, and better solutions.

So, What Is Six Sigma?

If you've read this far, you already know that "Six Sigma" is not some kind of new sorority or fraternity. On the other hand, there are different perspectives on what "Six Sigma" is. Business media often describe Six Sigma as a "highly technical method used by engineers and statisticians to fine-tune products and processes." True, in part. Measures and statistics are a key ingredient of Six Sigma improvement—but they are by no means the whole story.

Another definition of Six Sigma is that it's a goal of near-perfection in meeting customer requirements. This also is accurate; in fact, the term "Six Sigma" itself refers to a statistically derived performance target of operating with only 3.4 defects for every *million* activities or "opportunities." It's a goal few companies or processes can claim to have achieved.

Still another way to define Six Sigma is as a sweeping "culture change" effort to position a company for greater customer satisfaction, profitability, and competitiveness. Considering the companywide commitment to Six Sigma at places like General Electric or Motorola, "culture change" is certainly a valid way to describe Six Sigma. But it's also possible to "do" Six Sigma without making a frontal assault on your company culture.

If all these definitions—measure, goal, or culture change—are at least partly but not totally accurate, what's the *best* way to define Six Sigma? Based on our experience—and examples set by the growing number of companies seeking Six Sigma improvement—we've developed a definition that captures the breadth and flexibility of Six Sigma as a way to boost performance:

> SIX SIGMA: A comprehensive and flexible *system* for achieving, sustaining and maximizing business success. Six Sigma is uniquely driven by close understanding of customer needs, disciplined use of facts, data, and statistical analysis, and diligent attention to managing, improving, and reinventing business processes.

This is the definition that will provide the foundation for our efforts to unlock the potential of Six Sigma for your organization. The types of "business success" you may achieve are broad because the proven benefits of the Six Sigma "system" are diverse, including

- Cost reduction
- Productivity improvement
- Market-share growth
- Customer retention
- Cycle-time reduction
- Defect reduction
- Culture change
- Product/service development

And many more.

Is Six Sigma *Really* Different?

Some people, when first exposed to Six Sigma concepts, complain that it's similar to the "Total Quality" efforts of the last 15 to 20 years. Indeed,

the origins of many Six Sigma principles and tools are found in the teachings of influential "quality" thinkers like W. Edwards Deming and Joseph Juran. In some companies—GE and Motorola among them—the terms "quality" and "Six Sigma" often go together. So it's true that in some ways Six Sigma's expansion is heralding a rebirth of the quality movement. Cynics who gave up on "TQM" might choose to think of Six Sigma as that generic horror movie plot: the beast that wouldn't die.

But as we'll see, Six Sigma makes for a new and very much *improved* beast. If you've been through TQM, CQI, BPR, ABC, LMNOP (that's a joke), etc. you'll probably find some familiar material in *The Six Sigma Way*. However, we're sure you'll also find a lot that's new, and that you'll see familiar tools applied with greater impact on the business's competitiveness and bottom-line results. A foundation in "TQM" can give you or your business an advantage in ramping-up a successful Six Sigma effort. So, for the time being, it's perfectly okay for you to think of Six Sigma as "TQM on steroids."

To help you unlock the value of Six Sigma, we need to uncover some truths that have been missed in most of the Six Sigma literature so far. Understanding them means Six Sigma can offer some unexpected benefits to you and your organization.

Six Sigma's Hidden Truths—and Potential Payoff

Hidden Truth #1

Six Sigma encompasses a broad array of business best practices and skills (some advanced, some common sense) that are essential ingredients for success and growth. Where it's shown the most impressive impact, "Six Sigma" is much more than a detailed statistics-based analytical method. We'll address the full range of Six Sigma as it's being applied in these diverse and growing organizations.

The Payoff: You'll be able to apply Six Sigma to many different business activities and challenges—from strategic planning to operations to customer service—and maximize the impact of your efforts.

Hidden Truth #2

There are many "Six Sigma Ways." Following a fixed prescription, or modeling your effort after another company, is guaranteed to fail—or

come close. This book will offer customizable options and guidelines, not rigid formulas, that take into account your level of influence, your business needs and priorities, and your organization's readiness for change.

The Payoff: The benefits of Six Sigma will be accessible whether you lead an entire organization or a department. Moreover, you'll be able to scale your efforts, from tackling specific problems to renewing the entire business.

Hidden Truth #3

The potential gains from Six Sigma are equally significant (if not greater) in service organizations and non-manufacturing activities as they are in "technical" environments.

The huge opportunities outside the plant floor (in order management, finance, customer service, marketing, logistics, IT, etc.) exist for two main reasons. First, these activities are key to today's sustained competitive advantage, as tangible products turn into commodities in short order. Second, there's a lot to gain, because most non-manufacturing activities are only about 70 percent effective/efficient (if that).

We won't ignore manufacturing, but a high priority in this book will be to explain how to make Six Sigma work in commercial, transactional, or administrative areas that require a special approach and mix of tools.

The Payoff: You'll be prepared to achieve breakthroughs in these untapped gold mines of opportunity—and to broaden Six Sigma beyond the realm of the engineering community.

Hidden Truth #4

Six Sigma is as much about people excellence as it is about technical excellence. Creativity, collaboration, communication, dedication—these are infinitely more powerful than a corps of super-statisticians. Fortunately, the fundamental ideas of "big picture" Six Sigma can inspire and motivate better ideas and performance from people—and create synergy between individual talents and technical prowess.

The Payoff: You'll gain insights into how to strike a balance between push and pull—accommodating people and demanding performance. That balance is where real sustained improvement is found. On either

side—being "too nice," or forcing people beyond their understanding and readiness—lie merely short-term gains or no results at all.

Hidden Truth #5

Done right, Six Sigma improvement is thrilling and rewarding. We've seen people rave about the positive changes that have come to their organization, thanks to the new, smarter way they are running their business. We've watched executive teams abandon their decorum, as they race around trying to speed up and perfect a "broken" process in a Six Sigma workshop.

It's a lot of work, too. And it's not without its risks. Any level of Six Sigma effort takes an investment in time, energy, and money. In this book, we'll try to share some of the fun and enthusiasm we've seen and feel about Six Sigma as we describe how to make the investment and ensure big returns. (If at times our attempts at sparkling wit fall flat, we apologize in advance.) We'll also make a big effort to warn you away from the dangers and mistakes that can derail a Six Sigma initiative.

The Payoff: The good news is, Six Sigma is a lot more fun than root canal. Seriously, the significant financial gains from Six Sigma may be exceeded in value by the intangible benefits. In fact, the changes in attitude and enthusiasm that come from improved processes and better-informed people are often easier to observe, and more emotionally rewarding, than dollar savings. It's very exciting, for example, to talk to front-line people who are energized and enthusiastic because they've gained confidence, learned new skills, and improved their process. Each individual Six Sigma improvement is a success story in itself.

Key Features of the *Six Sigma Way*

This book is designed with maximum customer satisfaction in mind. We hope that by reading it you'll gain a complete picture of what's behind the Six Sigma movement, how it's paying off, and how you can implement the system so as to best fit your circumstances. Our goal is to provide a flexible resource and reference, whether you've been engaged in Six Sigma for several years or are just starting to learn and apply it.

Here are some of the features that will help you get the most out of the book:

1. A guide to finding just what you need. Following this Preface, you'll find an overview of each section and chapter, with tips on which pieces to use (or skip over) depending on your objectives and circumstances.

2. Practical implementation guidelines. Whether it's fixing a process problem or implementing Six Sigma companywide, we'll review important information to help you get started and keep moving.

3. Insights, comments, and examples from real people—business leaders, experts, and managers—who are using Six Sigma in their organizations. These thoughts have helped reinforce and refine our ideas; we're confident you'll learn a lot from them, too.

4. Checklists for a number of the essential steps in Six Sigma improvement. We hope to prepare you to go out and do Six Sigma activities, so we've mapped out key steps to help you make the right choices.

5. An introduction to advanced techniques. This is not a technical manual; plenty of other texts cover the nuances of process statistics and advanced experimental design. We will, however, help anyone understand what the "sophisticated" tools of Six Sigma are, why and how they're used, and when they should be applied.

6. Our own perspectives and advice. In giving you a guide to Six Sigma best practices, we've had to synthesize different viewpoints, guided by our experience and understanding of what works best, when and how. Some of our thoughts challenge the views of Six Sigma "experts"—where they do, we'll give evidence for our perspective. Because we've worked with some of the most visible Six Sigma companies and have applied these concepts in many types of businesses, we believe our views can make Six Sigma even more powerful than it might otherwise be.

A Final Philosophical Word

Lastly, we'd like to offer you a theme that we think represents one of the most important aspects of Six Sigma and hence will be key to your success in applying it to your business.

In their book *Built to Last,* James Collins and Jerry Porras provide insights into many of the most successful and admired companies of the 20th century. The dimension that they found most remarkable among these firms is their ability—and willingness—to simultaneously adopt two seemingly contrary objectives *at the same time.* Stability and

Table P.1 "Genius of the And" Examples.

We can . . .	*AND* we can . . .
Reduce errors to almost none	Get things done faster
Engage people in understanding and improving their processes and procedures	Maintain control of how work gets done
Measure and analyze what we do	Apply creative solutions to "push the envelope"
Make customers extremely happy	Make a lot of money

renewal, big picture and minute detail, creativity and rational analysis—these forces, working together, make organizations great. This "we can do it all" approach they call the "Genius of the And."

You can see this genius in action in everyday business if you look closely. The best managers, for example, are usually those who set broad goals and direction (big picture), yet who can still offer effective input and ask tough questions (the details). In a larger business context, an example of the "Genius of the And" would be a company's constant attention to *both* long-term growth and quarterly results.

The opposite effect, to which lesser organizations fall victim, Collins and Porras dub the "Tyranny of the Or."[1] That's the paralyzing view that we can have it one way or the other, but not *both*.

Six Sigma, we believe, depends on your business learning to exhibit the Genius of the And—and it offers a way to unlock this genius in your own people and processes. Table P.1 provides some examples of those seemingly opposing ideas we encounter in this book that *in fact* are key to success.

As you learn about the what, why, and how of Six Sigma in this book, try to remember that the success you're seeking will be based on your ability to focus on the "And" and not the "Or." The key to unlocking the "Genius of the And" in you and your organization can be found in these pages. . . .

[1] James Collins and Jerry Porras, *Built to Last* (New York: Harper Business, 1994), p. 44.

A Guide to the *Six Sigma Way*

THIS BOOK is organized for use by a variety of readers, from Six Sigma novices to people right in the thick of improvement efforts. While you may prefer to read it from cover to cover, the content is organized in three parts to help you learn about Six Sigma now at just the level of depth you need—you can read the rest of the book later when you need it.

Here's a guide to the content, first by part, then by chapter.

The Major Sections

Part One: An Executive Summary of Six Sigma

For the executive or the newcomer to Six Sigma, Part One provides a thorough overview of key concepts and background including success stories, themes, measurement, improvement strategies, and the Six Sigma Roadmap—a five-phase model for building the Six Sigma organization. We also look at how Six Sigma efforts can avoid some of the mistakes that hurt "Total Quality" efforts—and how to apply Six Sigma in Service as well as Manufacturing processes or businesses.

Part Two: Gearing Up and Adapting Six Sigma to Your Organization

This section looks at the organizational challenges of launching, leading, and preparing people for the Six Sigma effort. We examine the key

question of whether or not to start a Six Sigma effort—and where to begin your effort. This is also where you can find out about responsibilities of business leaders, Black Belts, and other roles. Finally, we explore how to choose the right improvement projects.

Part Three: Implementing Six Sigma—The Roadmap and the Tools

This section focuses on the "How-to" of the major components and tools in the Six Sigma system. For those who want to begin doing the work of making Six Sigma gains—or just want to know more about what's really involved in the effort—this section should answer many of your questions. If your concern is about measurement, for example, you can concentrate on Chapter 14; if you're looking at redesigning a process, Chapter 16 will be your focus. We cover some of the more important advanced tools of Six Sigma in this section as well. As a conclusion, we offer a list of 12 Keys to Success for your Six Sigma journey.

The Appendices: Practical Support

In addition to worksheets and checklists for key Six Sigma activities, the appendix features basic instructions on some of the more common Six Sigma improvement tools and a generic "implementation plan" as a starting point for launching your effort. A glossary of key terms and references by topics are included as well.

The Chapters

Here's a quick summary of each chapter, focused on the questions addressed in each.

Chapter One: A Powerful Strategy for Sustained Success

How does Six Sigma apply to the business challenges of the new century? What are some of the results and successes that have brought Six Sigma to the forefront of business leadership today—including at GE, Motorola, and AlliedSignal? What are some of the key organizational benefits it offers—and the themes that drive Six Sigma improvement?

Chapter Two: Key Concepts of the Six Sigma System

What kind of organizational "system" can Six Sigma create and how does in apply to short- and long-term success? What does the *measure* "Six Sigma" mean? What role do customers and defects play in measuring Six Sigma performance? What are the core improvement and management methodologies of Six Sigma? What is the "DMAIC" model? What really is—or should be—a "Six Sigma Organization"?

Chapter Three: Why Is Six Sigma Succeeding Where Total Quality "Failed"?

What aspects of the Total Quality legacy are still alive in businesses today? How can Six Sigma–focused companies avoid some of the most crucial mistakes that gave TQM a black eye?

Chapter Four: Applying Six Sigma to Service and Manufacturing

Why does Six Sigma hold as much—if not more—promise in Service processes and organizations than in Manufacturing? What are the keys to making Six Sigma work well and provide results in a Service environment? What are the unique challenges that can arise in applying Six Sigma in Manufacturing functions, and how do you address them?

Chapter Five: The Six Sigma Roadmap

What's the best sequence for implementing the "core competencies" of Six Sigma? What are the advantages of the "ideal" Six Sigma Roadmap? What is the value provided by each component to a responsive, competitive organization?

Chapter Six: Is Six Sigma Right for Us Now?

What key questions should we ask to determine if our organization is ready for and can benefit from Six Sigma? When would Six Sigma *not* be a good idea for a business? What are the cost/benefit considerations when deciding whether to embark on a Six Sigma initiative?

Chapter Seven: How and Where Should We Start Our Efforts?

What options can we consider in planning our Six Sigma launch? What are the "on-ramps" to the Six Sigma roadmap? How do we scale our effort to meet our needs? How can we use an assessment of our strengths and weaknesses to focus our resources? Why is a piloting strategy essential, and how should it work?

Chapter Eight: The Politics of Six Sigma: Preparing Leaders to Launch and Guide the Effort

What are the key responsibilities for organizational leaders in guiding the effort? How do communication, demand for results, and "change marketing" impact our potential for success?

Chapter Nine: Preparing Black Belts and Key Roles

What roles are typically needed in a Six Sigma implementation? What is a "Black Belt," and what are the options for defining his/her function? How can the various roles be structured, and conflicts be avoided? What are the key considerations when choosing members for team projects?

Chapter Ten: Training the Organization for Six Sigma

Why doesn't Six Sigma necessarily demand weeks and weeks of training to start? What are the keys to effective Six Sigma training? What are the common elements in a Six Sigma "curriculum"?

Chapter Eleven: The Key to Successful Improvement: Selecting the Right Six Sigma Projects

What are the key steps in choosing and setting up Six Sigma improvement projects? How do we decide which improvement "model"—DMAIC or some other approach—is best for our business?

Chapter Twelve: Identifying Core Processes and Key Customers (Roadmap Step I)

What are "core processes," and how have they become a key to understanding businesses? What are some common types of core processes

and how do you identify those in your organization? How do you identify the key customers and outputs of your core processes? What is a SIPOC model and diagram, and how can they be applied to a better understanding of our business?

Chapter Thirteen: Defining Customer Requirements (Roadmap Step 2)

Why is having a Voice of the Customer (VOC) system so critical in business today? What are the key actions and challenges in strengthening your VOC system? How do we identify and specify Output and Service requirements of our customers? How does better understanding of customer needs link up to our strategy and priorities?

Chapter Fourteen: Measuring Current Performance (Roadmap Step 3)

What are the basic concepts in business process measurement? What are the basic steps in implementing customer- and process-focused measures? How do you effectively carry out data collection and sampling? What types of defect and performance measures are fundamental to the Six Sigma system? How do you calculate "Sigma" for your processes?

Chapter Fifteen: Six Sigma Process Improvement (Roadmap Step 4—A)

How do you Define, Measure, Analyze, and Improve a key business process, while focusing on identifying and eliminating root causes? What are the basic tools of process improvement, and when can each be used effectively? What are some of the key obstacles to executing a Six Sigma improvement project?

Chapter Sixteen: Six Sigma Process Design/Redesign (Roadmap Step 4—B)

How is Six Sigma Process Design/Redesign different—and why is it a critical element in maximizing business performance? What conditions are essential to take on a process design or redesign project? How does redesign differ in execution from improvement? What special tools and challenges come into play when you are designing/redesigning a business process? How do you test and overcome assumptions that limit the value of redesigned processes?

Chapter Seventeen: Expanding and Integrating the Six Sigma System (Roadmap Step 5)

How do you measure and solidify the gains made through Six Sigma improvement projects? What are the methods and tools of Process Control? What are the specific responsibilities of and considerations for a Process Owner? How does the evolutionary discipline of Process Management support the Six Sigma system and long-term improvement?

Chapter Eighteen: Advanced Six Sigma Tools: An Overview

What are some of the most prevalent "power tools" of Six Sigma improvement? What role does each play in helping you to understand and improve processes and products/services? What are the basic steps to these sophisticated techniques?

Conclusion: 12 Keys to Success

What are some of the key actions and considerations any company or leader should keep in mind to make Six Sigma pay off?

Acknowledgments

We now understand why the awards shows on TV always run long. Partly, of course, it's due to slow delivery of canned jokes by the presenters. Usually, though, it's that the winners need to thank so many people. We haven't won an award, but we could go on for a while thanking people. Our friends at McGraw-Hill have threatened to cut to a commercial if we run long, however, so we'll try to keep this brief.

The most important acknowledgment is to the person who put in hours of tireless, good-natured, and indispensable work to make this book a reality: Percy Madamba. She kept everything organized, proofread, offered countless suggestions, laughed at jokes (we're hoping her sense of humor is representative of the general reading public), did graphics and countless other small acts, including shipping out the manuscript. (Our worry now is that Percy will quit and go write her own d__n book.)

Carolyn Talasek, Kelly Fisher, Carla Queen, Chet Harmer, Mona Draper, and Amanda Dutra—along with other members of the great team at Pivotal Resources—contributed graphics, editing help, suggestions, and research, as well as many ideas and insights. That group (the "Pivotal Pack") has been instrumental in bringing together a vast amount of experience and success that we've "channeled" into these pages. Other key contributors to that well of knowledge have included Pamela Schmidt-Cavaliero, Fred Kleiman, Mercie Lopez, Greg Gibbs, Jane Keller, and Rosalie Pryor. Also thanks to our colleague Larry Holpp, for advice and publishing contacts that helped us to bring this book to life.

There are dozens of people in our client organizations, practicing Six Sigma here and in other parts of the world, to whom we owe special thanks. These are the people who are making Six Sigma pay off, and who are learning how to make it work in many different environments. Some of the individuals we thank in particular for their support include all our friends at GE Capital's Center for Learning and Organizational Excellence—Mike Markovits, Mo Cayer, Hilly Dunn, Jenene Nicholson, Kelly Babij, Mike Mosher, and many others. This book would not exist without the terrific work the folks at GE have done, and without their commitment to Six Sigma. Thanks also to: the great people at Employers Reinsurance, including Kaj Ahlmann, Alan Mauch, Tom Felgate, Lee Tenold, Julie Hertel, Mike Nichols, and many others there, too; John Eck and the QNBC people at NBC, where we got to watch the *Tonight Show* live and help introduce Six Sigma to a primetime organization; at Cendant Mortage, a whole group of great people including our pal Pat Connolly, Tanya DeLia, Suzanne Wetherington, and many others; at Auspex Systems, where process redesign has been part of quality for years, Tamas Farkas and Charlie Golden (who's actually now at Genentech).

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At McGraw-Hill, much appreciation to our editor, Richard Narramore, for coaching us through, getting this project off the ground, and put to bed. We're aiming for Six Sigma performance!

Our families deserve loving mention, and sincere thanks, for putting up with the hours of time spent watching daddies and husbands hunched over a computer. (To Olga, Stephanie, and Brian Pande: *Now* the book is finished. Let's go play!)

Finally, we'd like to make a special dedication of this book to the memory of our great friend and colleague, Bill Lindenfelder. Bill was not only our partner in helping teach people about Six Sigma, but taught everyone who knew him about enthusiasm, encouragement, and boundless energy. We're among the many people who miss Bill enormously, and we hope he'd be proud to see some of his ideas and so much of his influence in these pages.

I

An Executive Overview of Six Sigma

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CHAPTER

1

A Powerful Strategy for Sustained Success

THE MOST CHALLENGING question confronting business leaders and managers in the new millennium is not "How do we succeed?" It's: "How do we stay successful?"

Business today offers the spectacle of a succession of companies, leaders, products, and even industries getting their "15 minutes of fame" and then fading away. Even corporate powerhouses—the IBMs, Fords, Apples, Kodaks, and many others—go through dramatic cycles of near-death and rebirth. It's like riding the wheel of fortune as consumer tastes, technologies, financial conditions, and competitive playing fields change ever-more-quickly. In this high-risk environment, the clamor for ideas on how to get the edge, stop the wheel (while on top, of course), or anticipate the next change gets louder and louder. Hot new answers are almost as common as hot new companies.

Six Sigma can seem like another "hot new answer." But looking closer, you'll find there is a significant difference: Six Sigma is not a business fad tied to a single method or strategy, but rather a *flexible system* for improved business leadership and performance. It builds on many of the most important management ideas and best practices of the past century, creating a new formula for 21st-century business success. It's not about theory, it's about action. Evidence of the power of the Six Sigma Way is already visible in the huge gains tallied by some

very high-profile companies and some not-so-high-profile ones, which we'll examine in a moment. Just as important, though, is the role Six Sigma plays in building new structures and practices to support *sustained* success.

The goal of *The Six Sigma Way* is to enable you to understand *what* Six Sigma is (both a simple and a complex question), *why* it's probably the best answer to improved business performance in years, and *how* to put it to work in the unique environment of your organization. In our mission to demystify Six Sigma for the executive and professional, we hope to show you that it's just as much about a passion for serving customers and a drive for great new ideas as it is about statistics and number-crunching; that the value of Six Sigma applies just as much to marketing, service, human resources, finance, and sales as it does to manufacturing and engineering. In the end we hope to give you a clearer picture of how Six Sigma—the *system*—can dramatically raise your odds for staying successful, even as you watch other companies ride one wave of good times only to wipe out on the next. (Our first and last surfing analogy!)

Some Six Sigma Success Stories

Seeing the impact that Six Sigma is having on some leading companies sets the stage for understanding how it can impact *your* business. As we relate some of these results, we'll also be reviewing the history that has brought Six Sigma to the forefront.

General Electric

> *Six Sigma has forever changed GE. Everyone—from the Six Sigma zealots emerging from their Black Belt tours, to the engineers, the auditors, and the scientists, to the senior leadership that will take this Company into the new millennium—is a true believer in Six Sigma, the way this Company now works." —GE Chairman John F. Welch*[1]

When a high-profile corporate leader* starts using words like "unbalanced" or "lunatics" in connection with the future of the com-

* Since launching GE's effort in 1995, Jack Welch has urged his top lieutenants to become "passionate lunatics" about Six Sigma. He has described GE's commitment to Six Sigma as "unbalanced."

pany—you might expect a plunge in the company's share price. At General Electric, however, that passion and drive behind Six Sigma have produced some very positive results.

The hard numbers behind GE's Six Sigma initiative tell just part of the story. From an initial year or so of break-even efforts, the payoff has accelerated: $750 million by the end of 1998, a forecasted $1.5 billion by the end of 1999, and expectations of more billions down the road. Some Wall Street analysts have predicted *$5 billion* in gains from the effort, early in the decade. GE's operating margins—for decades in the 10 percent range—continue to hit new records quarter after quarter. The numbers are now consistently above 15 percent, and even higher in some periods. GE leaders cite this margin expansion as the most visible evidence of the financial contribution made by Six Sigma.

Improvements from Services to Manufacturing

The financial "big picture," though, is just a reflection of the many individual successes GE has achieved through its Six Sigma initiative. For example:

- A Six Sigma team at GE's Lighting unit repaired problems in its billing to one of its top customers—Wal-Mart—cutting invoice defects and disputes by 98 percent, speeding payment, and creating better productivity for both companies.
- A group led by a staff attorney—a Six Sigma team leader—at one of GE Capital's service businesses streamlined the contract review process, leading to faster completion of deals—in other words, more responsive service to customers—and annual savings of $1 million.
- GE's Power Systems group addressed a major irritant with its utility company customers, simply by developing a better understanding of their requirements and improving the *documentation* provided along with new power equipment. The result: Utilities can respond more effectively to their regulatory agencies, and both the utilities and GE have saved hundreds of thousands of dollars a year.
- The Medical Systems business—GEMS—used Six Sigma design techniques to create a breakthrough in medical scanning technology. Patients can now get a full-body scan in half a minute, versus three minutes or more with previous technology. Hospitals can

increase their usage of the equipment and achieve a lower cost per scan, as well.

- GE Capital Mortgage analyzed the processes at one of its top performing branches and—expanding these "best practices" across its other 42 branches—improved the rate of a caller reaching a "live" GE person from 76 to 99 percent. Beyond the much greater convenience and responsiveness to customers, the improved process is translating into millions of dollars in new business.

The Actions behind the Results

GE's successes are the result of a "passionate" commitment and effort. Notes Welch: "In nearly four decades with GE I have never seen a Company initiative move so willingly and so rapidly in pursuit of a big idea."[2] Tens of thousands of GE managers and associates have been trained in Six Sigma methods—a hefty investment in time and money (which is appropriately deducted from the gains cited earlier). The training has gone well beyond "Black Belts" and teams to include every manager and professional at GE—and many front-line people as well. They've instilled a new vocabulary revolving around customers, processes, and measurement.

While dollars and statistical tools seem to get the most publicity, the emphasis on *customers* is probably the most remarkable element of Six Sigma at GE. As Jack Welch explains it:

> **The best Six Sigma projects begin not inside the business but outside it, focused on answering the question—how can we make the customer more competitive? What is critical to the customer's success? . . . One thing we have discovered with certainty is that anything we do that makes the customer more successful inevitably results in a financial return for us.**[3]

Motorola—and Some Six Sigma History

Today, the very existence and success of electronics leader Motorola is tied to Six Sigma. It's the company that *invented* the concepts that have evolved into this comprehensive management system. And while GE has used Six Sigma to strengthen an already thriving company, for Motorola it was an answer to the question: How do we stay in business?

In the 1980s and early 1990s, Motorola was one of many U.S. and European corporations whose lunch (along with all other meals and snacks) was being eaten by Japanese competitors. Motorola's top leaders conceded that the quality of its products was awful. They were, to quote one Motorola Six Sigma veteran, "In a world of hurt." Like many companies at the time, Motorola didn't have one "quality" program, it had several. But in 1987, a new approach came out of Motorola's Communications Sector—at the time headed by George Fisher, later top exec at Kodak. The innovative improvement concept was called "Six Sigma."

What Six Sigma offered Motorola—though it involves much more today—was a simple, consistent way to track and compare performance to customer requirements (the Sigma *measure*) and an ambitious target of practically-perfect quality (the Six Sigma *goal*).

As it spread throughout the company—with the strong support of chairman Bob Galvin—Six Sigma gave Motorola extra "muscle" to drive what at the time seemed like impossible improvement goals: An initial target in the early 1980s of ten times improvement (noted as 10X, and pronounced "ten-ex") over five years, was dwarfed by a goal of 10X improvement every *two* years—or 100X in *four* years. While the objective of "Six Sigma" was important, much more attention was paid to the *rate* of improvement in processes and products.

Motorola's "turnaround" has been just as remarkable over the long term as GE's results in just a few years. Only two years after launching Six Sigma, Motorola was honored with the Malcolm Baldrige National Quality Award. The company's total employment has risen from 71,000 employees in 1980 to over 130,000 today. Meanwhile, in the decade between Six Sigma's beginning in 1987 and 1997, achievements have included the following:

- Five-fold growth in sales, with profits climbing nearly 20 percent per year
- Cumulative savings based on Six Sigma efforts pegged at $14 billion
- Motorola stock price gains compounded to an annual rate of 21.3 percent.

All this, in a business whose future was in jeopardy in the early 1980s. (While the late 1990s presented some tough challenges for

Motorola—based largely on setbacks and competition in the cellular and satellite telephone businesses—the company seems to be turning the corner in late 1999, with most areas back in the black.)

The results Motorola has achieved at the corporate level again have been the product of hundreds of individual improvement efforts affecting product design, manufacturing, and services in all its business units. Alan Larson, one of the early internal Six Sigma consultants at Motorola who later helped spread the concept to GE and AlliedSignal, says projects affected dozens of administrative and transactional processes. In customer support and product delivery, for example, improvements in measurement and a focus on better understanding of customer needs—along with new process management structures—made possible big strides toward improved services and on-time delivery.[4]

More than a set of tools, though, Motorola applied Six Sigma as a way to transform the business, a way driven by communication, training, leadership, teamwork, measurement, and a focus on customers (themes we'll be seeing plenty of throughout this book). As Larson notes: "Six Sigma is really a cultural thing—a way of behavior."

AlliedSignal/Honeywell

AlliedSignal—with the new name of "Honeywell" following its 1999 merger—is a Six Sigma success story that connects Motorola and GE. It was CEO Larry Bossidy—a longtime GE executive who took the helm at Allied in 1991—who convinced Jack Welch that Six Sigma was an approach worth considering. (Welch had been one of the few top managers not to become enamored of the TQM movement in the 1980s and early 1990s).

Allied began its own quality improvement activities in the early 1990s, and by 1999 was saving more than $600 million a year, thanks to the widespread employee training in and application of Six Sigma principles.[5] Not only were Allied's Six Sigma teams reducing the costs of reworking defects, they were applying the same principles to the design of new products like aircraft engines, reducing the time from design to certification from 42 to 33 months. The company credits Six Sigma with a 6 percent productivity increase in 1998 and with its record profit margins of 13 percent. Since the Six Sigma effort began,

the firm's market value had—through fiscal year 1998—climbed to a compounded 27 percent per year.

Allied's leaders view Six Sigma as "more than just numbers—it's a statement of our determination to pursue a standard of excellence using every tool at our disposal and never hesitating to reinvent the way we do things."[6]

As one of Allied's Six Sigma directors puts it: "It's changed the way we think and the way we communicate. We never used to talk about the process or the customer; now they're part of our everyday conversation."

AlliedSignal's Six Sigma leadership has helped it earn recognition as the world's best-diversified company (from *Forbes* global edition) and the most admired global aerospace company (from *Fortune*).

The Six Sigma Wave

As we've noted, it might be easy to dismiss Six Sigma as a fad—if it weren't for the caliber of the results it's producing and the companies adopting it. In almost an antifad mentality, in fact, a number of prominent companies in industries from financial services to transportation to high-tech are *quietly* embarking on Six Sigma efforts. They're joining others who have been more vocal about their efforts, including Asea Brown Boveri, Black & Decker, Bombardier, Dupont, Dow Chemical, Federal Express, Johnson & Johnson, Kodak (which had taken in $85 million in savings as of early 2000), Navistar, Polaroid, Seagate Technologies, Siebe Appliance Controls, Sony, Toshiba, and many others.

From these and other Six Sigma companies come a wide variety of other impressive improvements, benefiting both customers and shareholders. A sample from the hundreds of Six Sigma projects underway at organizations around the world includes the following:

Developing New Products

A telecommunication products company used Six Sigma Design techniques to enable greater flexibility and faster turnaround at a key manufacturing facility. At the plant, several specialized products are built on a single production line. Since each customer's order may require different circuit boards, the need to avoid retooling was critical. Working through alignment of customer needs, product design, and process

specifications, retooling was dramatically reduced. The plant was also able to institute parallel processing so that if one area of the line wasn't functioning, work-in-process could be easily rerouted without adding to cycle time.

Under the new plant design, customer orders are transmitted electronically, where "virtual design" applied to speed quick response. Altogether, these innovative changes improved overall cycle time from days to hours, as well as improving productivity and resource management.

Sending the Message Faster and Cheaper

Customers of a telecommunications service company were dismayed over the handling of their orders. Every request—for a few minutes of satellite time to a long-term, dedicated up-link—passed through several levels of legal and technical review before being approved. The process not only upset customers, but wasted resources and money.

A Six Sigma team measured and analyzed the problem. While proposed solutions were counter to the "tried and true" way of doing things, the team was able to sway opinions from solid data and knowledge of customer needs. After 6 months of effort the process was streamlined and $1 million in savings was tallied.

Providing a Prompt Answer

A credit financing center used a Six Sigma team approach to analyze and improve call center operations. The focus was on two objectives: (1) reducing average call answer time; and (2) increasing the percentage of customer issues and questions resolved in the initial call. The team "centralized and simplified" the call answering system, cutting average times from 54 seconds to 14 seconds. "First Call Resolution" jumped from 63 percent to 83 percent.

Thinking outside the Box

The spare parts marketing and logistics group for an aerospace manufacturing company was looking for ways to take costs and time out of their service to customers. One major cost element was parts packaging: Bulk parts shipments from manufacturing plants were unpacked, placed on warehouse shelves, then picked and repackaged for shipment to customers.

By focusing the process design on customer needs and value-adding activities, the spare parts packaging operation was moved from the warehouse to the plants. Packaging material cost savings alone were cut by half-a-million dollars per year. The change also contributed to major improvements in on-time-delivery, which have jumped from less than 80% to over 95% in about three years.

The Benefits of Six Sigma

These stories by themselves may be appealing, but if your company is doing okay—as GE was in 1995, when Jack Welch launched their effort—why should you consider a Six Sigma initiative? What's prompting so many businesses, prominent and modest, to invest in this funny-sounding business approach? Drawing from these success stories and those of other companies—and by looking behind the raw dollars—we can define several benefits that are attracting companies to the Six Sigma Way. Six Sigma:

1. *Generates sustained success.* John Chambers, CEO of Cisco Systems, the networking equipment powerhouse that's been one of the fastest-growing companies of the past decade, recently commented on the tenuous hold many companies have on their success: "There is the realization that you can be out of business in three years."[7] The only way to continue double-digit growth and retain a hold on shifting markets is to constantly innovate and remake the organization. Six Sigma creates the skills and culture for constant revival—what we'll describe in the next chapter as a "closed-loop system."
2. *Sets a performance goal for everyone.* In a company of any size—let alone a multibillion-dollar global corporation—getting everyone working in the same direction and focusing on a common goal is pretty tough. Each function, business unit, and individual has different objectives and targets. What everyone has in common, though, is the delivery of products, services, or information to customers (inside or outside the company). Six Sigma uses that common business framework—the process and the customer—to create a consistent goal: Six Sigma performance, or a level of performance that's about as close to perfect as most people can imagine. Anyone who understands their customers' requirements (and who shouldn't?) can assess their per-

formance against the Six Sigma goal of 99.9997 percent "perfect"—a standard so high that it makes most businesses' previous views of "excellent" performance look pretty weak. Figure 1.1 contrasts the number of problems that would be found with a goal of *99 percent quality* versus a goal of Six Sigma performance (99.9997 percent). The difference is pretty startling.

3. *Enhances value to customers.* When GE began its Six Sigma effort, executives admitted that the quality of the company's products was not what it should be. Though its quality was perhaps better than that of its competitors, Jack Welch stated that "We want to make our quality so special, so valuable to our customers, so important to their success that our products become their only real value choice."[8] With tighter competition in every industry, delivering just "good" or "defect-free" products and service won't guarantee success. The focus on customers at the heart of Six Sigma means learning *what* value means to customers (and prospective customers) and planning *how* to deliver it to them profitably.
4. *Accelerates the rate of improvement.* Motorola's goal of "100X improvement in four years" set an example for ambitious, driven organiza-

Performance Goals - What You'd Get ...	
For every 300,000 letters delivered:	
with 99%	*with Six Sigma*
3,000 misdeliveries	1 misdelivery
Out of every 500,000 computer restarts:	
with 99%	*with Six Sigma*
4,100 crashes	< 2 crashes
For 500 years of month-end closings:	
with 99%	*with Six Sigma*
60 months would not balance	.018 months would not balance
For every week of TV broadcasting (per channel):	
with 99%	*with Six Sigma*
1.68 hours of dead air	1.8 seconds of dead air

Figure 1.1 99% quality versus Six Sigma performance

tions to emulate. With information technology setting the pace by doubling its performance to cost ratio every 18 months, the customer expectation for improvement gets ever more demanding. The competitor who improves the fastest is likely to win the race. By borrowing tools and ideas from many disciplines, Six Sigma helps a company not only improve performance, but improve *improvement.*

5. *Promotes learning and "cross-pollination."* The 1990s saw the birth of the "Learning Organization," a concept that appeals to many but seems hard to put into action. AlliedSignal leaders have commented that "everyone talks about learning, but few succeed in weaving it into the fabric of everyday life for so many employees."[9] Six Sigma is an approach that can increase and accelerate the development and sharing of new ideas throughout an organization. Even in a company as diverse as GE, the value of Six Sigma as a learning tool is seen as critical. Skilled people with expertise in *processes* and how to manage and improve them can be shifted from, say, GE Plastics to GE Capital, not only with a shorter learning curve but actually bringing with them *better* ideas and the ability to apply them more quickly. Ideas can be shared and performance compared more readily. GE's vice president for Six Sigma, Piet van Abeelen, has noted that in the past, a manager in one part of the organization could discount input from a counterpart in another area: " 'Your ideas won't work, because I'm different.' " Van Abeelen says Six Sigma eliminates those defenses: "Well, cry me a river. The commonalities are what matter. If you make the metrics the same, we can talk."[10]
6. *Executes strategic change.* Introducing new products, launching new ventures, entering new markets, acquiring new organizations—what were once occasional business activities are now daily events in many companies. Better understanding of your company's processes and procedures will give you a greater ability to carry out *both* the minor adjustments and the major shifts that 21st-century business success will demand.

The Tools and Themes of Six Sigma

Like most great inventions, Six Sigma is not "all new." While some themes of Six Sigma arise out of fairly recent breakthroughs in management thinking, others have their foundation in common sense.

Before you dismiss that origin as no big deal, we'd remind you of a saying we picked up once while working in Europe: "Common sense is the least common of the senses." From a "tools" perspective, Six Sigma is a pretty vast universe. Figure 1.2 summarizes many—but by no means all—of the most important Six Sigma methods.

The more we have learned over the years about the Six Sigma system, the more we have come to see it as a way to link together—and even to implement—many otherwise disconnected ideas, trends, and tools in business today. Some of the "hot topics" that have direct application or can complement a Six Sigma initiative include:

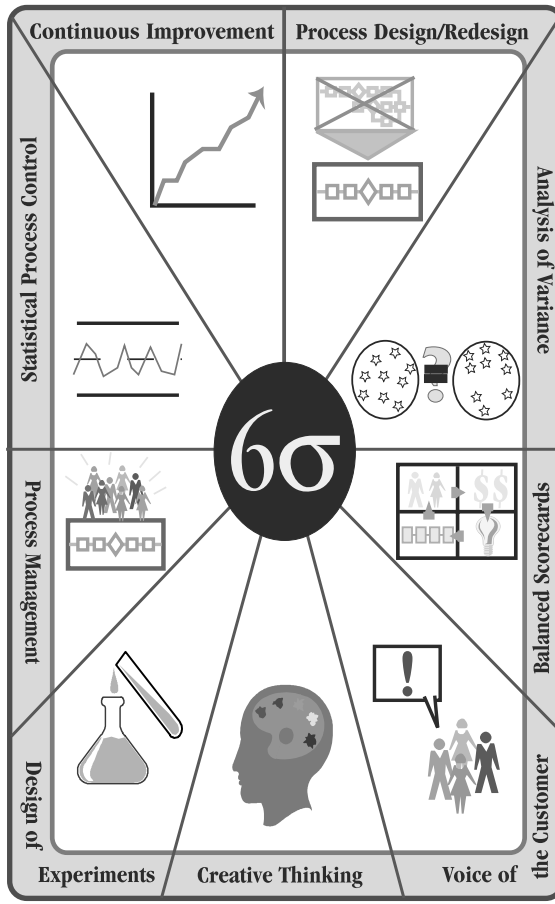

Figure 1.2 Essential Six Sigma methods and tools

- e-Commerce and Services
- Enterprise Resource Planning
- Lean manufacturing
- Customer Relationship Management systems
- Strategic business partnerships
- Knowledge management
- Activity-based management
- The "process-centered organization"
- Globalization
- Just-in-time inventory/production

Six Themes of Six Sigma

We'll close out this introductory look at Six Sigma by distilling the critical elements of this leadership system into six "themes." These principles—supported by the many Six Sigma tools and methods we'll be presenting throughout this book—will give you a preview of *how* we'll help you make Six Sigma work for your business.

Theme One: Genuine Focus on the Customer

During the big Total Quality push of the 1980s and 1990s, dozens of companies wrote policies and mission statements vowing to "meet or exceed customer expectations and requirements." Unfortunately, however, few businesses tried very hard to improve their *understanding* of customers' requirements or expectations. Even when they did, customer data-gathering typically was a one-time or short-lived initiative that ignored the dynamic nature of customer needs. (How many of your customers want the same stuff today as five years ago? Two years ago? Last month?)

In Six Sigma, customer focus becomes the top priority. For example, the measures of Six Sigma performance begin with the customer. Six Sigma improvements are defined by their impact on customer satisfaction and value. We'll look at why and how your business can define customer requirements, measure performance against them, and stay on top of new developments and unmet needs.

Theme Two: Data- and Fact-Driven Management

Six Sigma takes the concept of "management by fact" to a new, more powerful level. Despite the attention paid in recent years to measures,

improved information systems, knowledge management, etc., it should come as no shock to you to hear that many business decisions are still being based on opinions and assumptions. Six Sigma discipline begins by clarifying *what* measures are key to gauging business performance; then it applies data and analysis so as to build an understanding of key variables and optimize results.

At a more down-to-earth level, Six Sigma helps managers answer two essential questions to support fact-driven decisions and solutions:

1. What data/information do I *really* need?
2. How do we *use* that data/information to maximum benefit?

Theme Three: Process Focus, Management, and Improvement

In Six Sigma, processes are where the action is. Whether designing products and services, measuring performance, improving efficiency and customer satisfaction—or even running the business—Six Sigma positions the *process* as the key vehicle of success.

One of the most remarkable breakthroughs in Six Sigma efforts to-date has been convincing leaders and managers—particularly in the service-based functions and industries—that mastering processes is not just a necessary evil but actually a way to build competitive advantage in delivering value to customers. There are many more people to convince—with huge dollar opportunities tied up in those activities.

Theme Four: Proactive Management

Most simply, being "proactive" signifies acting in advance of events—the opposite of being "reactive." In the real world, though, proactive management means making *habits* out of what are, too often, neglected business practices: defining ambitious goals and reviewing them frequently; setting clear priorities; focusing on problem prevention versus firefighting; questioning *why* we do things instead of blindly defending them as "how we do things here."

Being truly proactive, far from being boring or overly analytical, is actually a starting point for creativity and effective change. Reactively bouncing from crisis to crisis makes you very busy—giving a false impression that you're on top of things. In reality, it's a sign of a manager or an organization that's lost control.

Six Sigma, as we'll see, encompasses tools and practices that replace reactive habits with a dynamic, responsive, proactive style of management. Considering today's slim-margin-for-error competitive environment, being proactive is (as the airline commercial said) "the only way to fly."

Theme Five: Boundaryless Collaboration

"Boundarylessness" is one of Jack Welch's mantras for business success. Years before launching Six Sigma, GE's chairman was working to break down barriers and improve teamwork, up, down, and across organizational lines. The opportunities available through improved collaboration within companies and with their vendors and customers are huge. Billions of dollars are left on the table (or on the floor) every day, because of disconnects and outright competition between groups that should be working for a common cause: providing value to customers.

As noted above, Six Sigma expands opportunities for collaboration as people learn how their roles fit into the "big picture" and can recognize and measure the interdependence of activities in all parts of a process. Boundaryless collaboration in Six Sigma does not mean selfless sacrifice, but it does require an understanding of both the real needs of end users and of the flow of work through a process or a supply chain. Moreover, it demands an attitude that is committed to using customer and process knowledge to benefit all parties. Thus, the Six Sigma system can create an environment and management structures that support true teamwork.[11]

Theme Six: Drive for Perfection; Tolerance for Failure

This last theme may seem contradictory. How can you be driven to achieve perfection and yet also tolerate failure? In essence, though, the two ideas are complementary. No company will get anywhere close to Six Sigma without launching new ideas and approaches—which always involve some risk. If people who see a possible path to better service, lower costs, new capabilities, etc. (i.e. ways to be closer-to-perfect) are too afraid of the consequences of mistakes, they'll never try. The result: stagnation, putrefaction, death. (Pretty grim, eh?)

Fortunately, the techniques we'll review for improving performance include a significant dose of risk management (if you're gonna fail,

make it a safe failure). The bottom line, though, is that any company that makes Six Sigma its goal will have to constantly push to be ever-more-perfect (since the customer's definition of "perfect" will always be changing) while being willing to accept—and manage—occasional setbacks.

Where You Stand

We would be surprised if you weren't saying to yourself right about now: "We're already *doing* some of those things." But remember, we've already noted that much of Six Sigma is not brand-new. What *is* new is its ability to bring together all these themes into a coherent management process.

As you review this introduction and guide to the Six Sigma way, we encourage you to take stock of what you are already doing that supports the themes or tools of Six Sigma—and keep doing them. Meanwhile, be honest about your business's strengths and weaknesses. One thing we've noticed about Six Sigma is that results come much faster when an organization is willing to admit to its shortcomings, learn from them, and start setting priorities to correct them.

Businesses or managers who puff out their chests and claim to have all the answers are invariably the ones in greatest danger; they stop learning, fall behind, and end up having to scramble to catch up—if it isn't too late.

The SIX SIGMA WAY

How GE, Motorola, and Other Top Companies Are Honing Their Performance

Peter S. Pande, Robert P. Neuman, Roland R. Cavanagh

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To Anne and Al Pande, who've been
"Six Sigma" parents and my best friends.

—*P.S.P.*

To my dear wife, Mabel.

—*R.P.N.*

To my dad, Hale Cavanagh,
who would have been pleased and proud
to see the results of this undertaking.

—*R.R.C.*

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Contents

Preface

THIS BOOK is designed to help business leaders—from CEOs to supervisors—tap into the power of the Six Sigma movement that's transforming some of the world's most successful companies. Six Sigma initiatives have tallied billions of dollars in savings, dramatic increases in speed, strong new customer relationships—in short, remarkable results and rave reviews.

Are these results for real? And is it really possible for you and your business to achieve some of the same gains?

The answer is "yes." It can happen in any type of business and, contrary to many people's fears, you don't have to have an in-depth background in statistical analysis. Six Sigma can contribute not only to how your company measures and analyzes its performance, but also to improving your basic approach to managing the business.

Six Sigma: Changing Business Habits

A story from our early experiences implementing Six Sigma illustrates how this new approach to business impacts the very habits that drive an organization. We were working with leaders and Six Sigma project teams at one of largest business units of GE Capital (the first totally service-based company to launch Six Sigma).

It was during a "Gallery Walk"—at which the teams were explaining their progress to company leaders—that the firm's CEO began challenging one of the team leaders. "If you think that's the problem," the

CEO suggested, "why don't you just…?" and he suggested a solution. The team leader tried to explain that their analysis and data were preliminary, and that more work was needed to confirm their suspicions. The executive persisted over several minutes, however, in arguing for his proposed solution. In the face of grilling from his "boss's boss's boss," the team leader grew increasingly flustered and unsure of how to respond.

At that moment, in an act of corporate courage, one of the firm's "Black Belts," a financial services manager we had trained to coach Six Sigma teams, literally stepped between the CEO and the team's charts. He declared, in so many words: "We're not going to jump to a solution because we're using the Six Sigma process!"

Immediately the company leader recognized his mistake. Instead of getting angry, he laughed and apologized. Later, speaking to the entire group, he related the story and gave credit to the Black Belt for defending the Six Sigma Way. "We're not in the 'Just Do It' mode anymore," he noted. "Taking the time to understand a problem and process before we fix it is better—but you may have to *remind* us from time to time until we get used to this new way."

That company went on to achieve millions of dollars in savings through Six Sigma projects, and to totally revamp their approach to strategic and new product planning. While they still haven't lost all their old, "just do it" spirit, they are approaching processes and problems with better questions, and better solutions.

So, What Is Six Sigma?

If you've read this far, you already know that "Six Sigma" is not some kind of new sorority or fraternity. On the other hand, there are different perspectives on what "Six Sigma" is. Business media often describe Six Sigma as a "highly technical method used by engineers and statisticians to fine-tune products and processes." True, in part. Measures and statistics are a key ingredient of Six Sigma improvement—but they are by no means the whole story.

Another definition of Six Sigma is that it's a goal of near-perfection in meeting customer requirements. This also is accurate; in fact, the term "Six Sigma" itself refers to a statistically derived performance target of operating with only 3.4 defects for every *million* activities or "opportunities." It's a goal few companies or processes can claim to have achieved.

Still another way to define Six Sigma is as a sweeping "culture change" effort to position a company for greater customer satisfaction, profitability, and competitiveness. Considering the companywide commitment to Six Sigma at places like General Electric or Motorola, "culture change" is certainly a valid way to describe Six Sigma. But it's also possible to "do" Six Sigma without making a frontal assault on your company culture.

If all these definitions—measure, goal, or culture change—are at least partly but not totally accurate, what's the *best* way to define Six Sigma? Based on our experience—and examples set by the growing number of companies seeking Six Sigma improvement—we've developed a definition that captures the breadth and flexibility of Six Sigma as a way to boost performance:

> SIX SIGMA: A comprehensive and flexible *system* for achieving, sustaining and maximizing business success. Six Sigma is uniquely driven by close understanding of customer needs, disciplined use of facts, data, and statistical analysis, and diligent attention to managing, improving, and reinventing business processes.

This is the definition that will provide the foundation for our efforts to unlock the potential of Six Sigma for your organization. The types of "business success" you may achieve are broad because the proven benefits of the Six Sigma "system" are diverse, including

- Cost reduction
- Productivity improvement
- Market-share growth
- Customer retention
- Cycle-time reduction
- Defect reduction
- Culture change
- Product/service development

And many more.

Is Six Sigma *Really* Different?

Some people, when first exposed to Six Sigma concepts, complain that it's similar to the "Total Quality" efforts of the last 15 to 20 years. Indeed,

the origins of many Six Sigma principles and tools are found in the teachings of influential "quality" thinkers like W. Edwards Deming and Joseph Juran. In some companies—GE and Motorola among them—the terms "quality" and "Six Sigma" often go together. So it's true that in some ways Six Sigma's expansion is heralding a rebirth of the quality movement. Cynics who gave up on "TQM" might choose to think of Six Sigma as that generic horror movie plot: the beast that wouldn't die.

But as we'll see, Six Sigma makes for a new and very much *improved* beast. If you've been through TQM, CQI, BPR, ABC, LMNOP (that's a joke), etc. you'll probably find some familiar material in *The Six Sigma Way*. However, we're sure you'll also find a lot that's new, and that you'll see familiar tools applied with greater impact on the business's competitiveness and bottom-line results. A foundation in "TQM" can give you or your business an advantage in ramping-up a successful Six Sigma effort. So, for the time being, it's perfectly okay for you to think of Six Sigma as "TQM on steroids."

To help you unlock the value of Six Sigma, we need to uncover some truths that have been missed in most of the Six Sigma literature so far. Understanding them means Six Sigma can offer some unexpected benefits to you and your organization.

Six Sigma's Hidden Truths—and Potential Payoff

Hidden Truth #1

Six Sigma encompasses a broad array of business best practices and skills (some advanced, some common sense) that are essential ingredients for success and growth. Where it's shown the most impressive impact, "Six Sigma" is much more than a detailed statistics-based analytical method. We'll address the full range of Six Sigma as it's being applied in these diverse and growing organizations.

The Payoff: You'll be able to apply Six Sigma to many different business activities and challenges—from strategic planning to operations to customer service—and maximize the impact of your efforts.

Hidden Truth #2

There are many "Six Sigma Ways." Following a fixed prescription, or modeling your effort after another company, is guaranteed to fail—or

come close. This book will offer customizable options and guidelines, not rigid formulas, that take into account your level of influence, your business needs and priorities, and your organization's readiness for change.

The Payoff: The benefits of Six Sigma will be accessible whether you lead an entire organization or a department. Moreover, you'll be able to scale your efforts, from tackling specific problems to renewing the entire business.

Hidden Truth #3

The potential gains from Six Sigma are equally significant (if not greater) in service organizations and non-manufacturing activities as they are in "technical" environments.

The huge opportunities outside the plant floor (in order management, finance, customer service, marketing, logistics, IT, etc.) exist for two main reasons. First, these activities are key to today's sustained competitive advantage, as tangible products turn into commodities in short order. Second, there's a lot to gain, because most non-manufacturing activities are only about 70 percent effective/efficient (if that).

We won't ignore manufacturing, but a high priority in this book will be to explain how to make Six Sigma work in commercial, transactional, or administrative areas that require a special approach and mix of tools.

The Payoff: You'll be prepared to achieve breakthroughs in these untapped gold mines of opportunity—and to broaden Six Sigma beyond the realm of the engineering community.

Hidden Truth #4

Six Sigma is as much about people excellence as it is about technical excellence. Creativity, collaboration, communication, dedication—these are infinitely more powerful than a corps of super-statisticians. Fortunately, the fundamental ideas of "big picture" Six Sigma can inspire and motivate better ideas and performance from people—and create synergy between individual talents and technical prowess.

The Payoff: You'll gain insights into how to strike a balance between push and pull—accommodating people and demanding performance. That balance is where real sustained improvement is found. On either

side—being "too nice," or forcing people beyond their understanding and readiness—lie merely short-term gains or no results at all.

Hidden Truth #5

Done right, Six Sigma improvement is thrilling and rewarding. We've seen people rave about the positive changes that have come to their organization, thanks to the new, smarter way they are running their business. We've watched executive teams abandon their decorum, as they race around trying to speed up and perfect a "broken" process in a Six Sigma workshop.

It's a lot of work, too. And it's not without its risks. Any level of Six Sigma effort takes an investment in time, energy, and money. In this book, we'll try to share some of the fun and enthusiasm we've seen and feel about Six Sigma as we describe how to make the investment and ensure big returns. (If at times our attempts at sparkling wit fall flat, we apologize in advance.) We'll also make a big effort to warn you away from the dangers and mistakes that can derail a Six Sigma initiative.

The Payoff: The good news is, Six Sigma is a lot more fun than root canal. Seriously, the significant financial gains from Six Sigma may be exceeded in value by the intangible benefits. In fact, the changes in attitude and enthusiasm that come from improved processes and better-informed people are often easier to observe, and more emotionally rewarding, than dollar savings. It's very exciting, for example, to talk to front-line people who are energized and enthusiastic because they've gained confidence, learned new skills, and improved their process. Each individual Six Sigma improvement is a success story in itself.

Key Features of the *Six Sigma Way*

This book is designed with maximum customer satisfaction in mind. We hope that by reading it you'll gain a complete picture of what's behind the Six Sigma movement, how it's paying off, and how you can implement the system so as to best fit your circumstances. Our goal is to provide a flexible resource and reference, whether you've been engaged in Six Sigma for several years or are just starting to learn and apply it.

Here are some of the features that will help you get the most out of the book:

1. A guide to finding just what you need. Following this Preface, you'll find an overview of each section and chapter, with tips on which pieces to use (or skip over) depending on your objectives and circumstances.

2. Practical implementation guidelines. Whether it's fixing a process problem or implementing Six Sigma companywide, we'll review important information to help you get started and keep moving.

3. Insights, comments, and examples from real people—business leaders, experts, and managers—who are using Six Sigma in their organizations. These thoughts have helped reinforce and refine our ideas; we're confident you'll learn a lot from them, too.

4. Checklists for a number of the essential steps in Six Sigma improvement. We hope to prepare you to go out and do Six Sigma activities, so we've mapped out key steps to help you make the right choices.

5. An introduction to advanced techniques. This is not a technical manual; plenty of other texts cover the nuances of process statistics and advanced experimental design. We will, however, help anyone understand what the "sophisticated" tools of Six Sigma are, why and how they're used, and when they should be applied.

6. Our own perspectives and advice. In giving you a guide to Six Sigma best practices, we've had to synthesize different viewpoints, guided by our experience and understanding of what works best, when and how. Some of our thoughts challenge the views of Six Sigma "experts"—where they do, we'll give evidence for our perspective. Because we've worked with some of the most visible Six Sigma companies and have applied these concepts in many types of businesses, we believe our views can make Six Sigma even more powerful than it might otherwise be.

A Final Philosophical Word

Lastly, we'd like to offer you a theme that we think represents one of the most important aspects of Six Sigma and hence will be key to your success in applying it to your business.

In their book *Built to Last,* James Collins and Jerry Porras provide insights into many of the most successful and admired companies of the 20th century. The dimension that they found most remarkable among these firms is their ability—and willingness—to simultaneously adopt two seemingly contrary objectives *at the same time.* Stability and

Table P.1 "Genius of the And" Examples.

We can . . .	*AND* we can . . .
Reduce errors to almost none	Get things done faster
Engage people in understanding and improving their processes and procedures	Maintain control of how work gets done
Measure and analyze what we do	Apply creative solutions to "push the envelope"
Make customers extremely happy	Make a lot of money

renewal, big picture and minute detail, creativity and rational analysis—these forces, working together, make organizations great. This "we can do it all" approach they call the "Genius of the And."

You can see this genius in action in everyday business if you look closely. The best managers, for example, are usually those who set broad goals and direction (big picture), yet who can still offer effective input and ask tough questions (the details). In a larger business context, an example of the "Genius of the And" would be a company's constant attention to *both* long-term growth and quarterly results.

The opposite effect, to which lesser organizations fall victim, Collins and Porras dub the "Tyranny of the Or."[1] That's the paralyzing view that we can have it one way or the other, but not *both*.

Six Sigma, we believe, depends on your business learning to exhibit the Genius of the And—and it offers a way to unlock this genius in your own people and processes. Table P.1 provides some examples of those seemingly opposing ideas we encounter in this book that *in fact* are key to success.

As you learn about the what, why, and how of Six Sigma in this book, try to remember that the success you're seeking will be based on your ability to focus on the "And" and not the "Or." The key to unlocking the "Genius of the And" in you and your organization can be found in these pages. . . .

[1] James Collins and Jerry Porras, *Built to Last* (New York: Harper Business, 1994), p. 44.

A Guide to the *Six Sigma Way*

THIS BOOK is organized for use by a variety of readers, from Six Sigma novices to people right in the thick of improvement efforts. While you may prefer to read it from cover to cover, the content is organized in three parts to help you learn about Six Sigma now at just the level of depth you need—you can read the rest of the book later when you need it.

Here's a guide to the content, first by part, then by chapter.

The Major Sections

Part One: An Executive Summary of Six Sigma

For the executive or the newcomer to Six Sigma, Part One provides a thorough overview of key concepts and background including success stories, themes, measurement, improvement strategies, and the Six Sigma Roadmap—a five-phase model for building the Six Sigma organization. We also look at how Six Sigma efforts can avoid some of the mistakes that hurt "Total Quality" efforts—and how to apply Six Sigma in Service as well as Manufacturing processes or businesses.

Part Two: Gearing Up and Adapting Six Sigma to Your Organization

This section looks at the organizational challenges of launching, leading, and preparing people for the Six Sigma effort. We examine the key

question of whether or not to start a Six Sigma effort—and where to begin your effort. This is also where you can find out about responsibilities of business leaders, Black Belts, and other roles. Finally, we explore how to choose the right improvement projects.

Part Three: Implementing Six Sigma—The Roadmap and the Tools

This section focuses on the "How-to" of the major components and tools in the Six Sigma system. For those who want to begin doing the work of making Six Sigma gains—or just want to know more about what's really involved in the effort—this section should answer many of your questions. If your concern is about measurement, for example, you can concentrate on Chapter 14; if you're looking at redesigning a process, Chapter 16 will be your focus. We cover some of the more important advanced tools of Six Sigma in this section as well. As a conclusion, we offer a list of 12 Keys to Success for your Six Sigma journey.

The Appendices: Practical Support

In addition to worksheets and checklists for key Six Sigma activities, the appendix features basic instructions on some of the more common Six Sigma improvement tools and a generic "implementation plan" as a starting point for launching your effort. A glossary of key terms and references by topics are included as well.

The Chapters

Here's a quick summary of each chapter, focused on the questions addressed in each.

Chapter One: A Powerful Strategy for Sustained Success

How does Six Sigma apply to the business challenges of the new century? What are some of the results and successes that have brought Six Sigma to the forefront of business leadership today—including at GE, Motorola, and AlliedSignal? What are some of the key organizational benefits it offers—and the themes that drive Six Sigma improvement?

Chapter Two: Key Concepts of the Six Sigma System

What kind of organizational "system" can Six Sigma create and how does in apply to short- and long-term success? What does the *measure* "Six Sigma" mean? What role do customers and defects play in measuring Six Sigma performance? What are the core improvement and management methodologies of Six Sigma? What is the "DMAIC" model? What really is—or should be—a "Six Sigma Organization"?

Chapter Three: Why Is Six Sigma Succeeding Where Total Quality "Failed"?

What aspects of the Total Quality legacy are still alive in businesses today? How can Six Sigma–focused companies avoid some of the most crucial mistakes that gave TQM a black eye?

Chapter Four: Applying Six Sigma to Service and Manufacturing

Why does Six Sigma hold as much—if not more—promise in Service processes and organizations than in Manufacturing? What are the keys to making Six Sigma work well and provide results in a Service environment? What are the unique challenges that can arise in applying Six Sigma in Manufacturing functions, and how do you address them?

Chapter Five: The Six Sigma Roadmap

What's the best sequence for implementing the "core competencies" of Six Sigma? What are the advantages of the "ideal" Six Sigma Roadmap? What is the value provided by each component to a responsive, competitive organization?

Chapter Six: Is Six Sigma Right for Us Now?

What key questions should we ask to determine if our organization is ready for and can benefit from Six Sigma? When would Six Sigma *not* be a good idea for a business? What are the cost/benefit considerations when deciding whether to embark on a Six Sigma initiative?

Chapter Seven: How and Where Should We Start Our Efforts?

What options can we consider in planning our Six Sigma launch? What are the "on-ramps" to the Six Sigma roadmap? How do we scale our effort to meet our needs? How can we use an assessment of our strengths and weaknesses to focus our resources? Why is a piloting strategy essential, and how should it work?

Chapter Eight: The Politics of Six Sigma: Preparing Leaders to Launch and Guide the Effort

What are the key responsibilities for organizational leaders in guiding the effort? How do communication, demand for results, and "change marketing" impact our potential for success?

Chapter Nine: Preparing Black Belts and Key Roles

What roles are typically needed in a Six Sigma implementation? What is a "Black Belt," and what are the options for defining his/her function? How can the various roles be structured, and conflicts be avoided? What are the key considerations when choosing members for team projects?

Chapter Ten: Training the Organization for Six Sigma

Why doesn't Six Sigma necessarily demand weeks and weeks of training to start? What are the keys to effective Six Sigma training? What are the common elements in a Six Sigma "curriculum"?

Chapter Eleven: The Key to Successful Improvement: Selecting the Right Six Sigma Projects

What are the key steps in choosing and setting up Six Sigma improvement projects? How do we decide which improvement "model"—DMAIC or some other approach—is best for our business?

Chapter Twelve: Identifying Core Processes and Key Customers (Roadmap Step I)

What are "core processes," and how have they become a key to understanding businesses? What are some common types of core processes

and how do you identify those in your organization? How do you identify the key customers and outputs of your core processes? What is a SIPOC model and diagram, and how can they be applied to a better understanding of our business?

Chapter Thirteen: Defining Customer Requirements (Roadmap Step 2)

Why is having a Voice of the Customer (VOC) system so critical in business today? What are the key actions and challenges in strengthening your VOC system? How do we identify and specify Output and Service requirements of our customers? How does better understanding of customer needs link up to our strategy and priorities?

Chapter Fourteen: Measuring Current Performance (Roadmap Step 3)

What are the basic concepts in business process measurement? What are the basic steps in implementing customer- and process-focused measures? How do you effectively carry out data collection and sampling? What types of defect and performance measures are fundamental to the Six Sigma system? How do you calculate "Sigma" for your processes?

Chapter Fifteen: Six Sigma Process Improvement (Roadmap Step 4—A)

How do you Define, Measure, Analyze, and Improve a key business process, while focusing on identifying and eliminating root causes? What are the basic tools of process improvement, and when can each be used effectively? What are some of the key obstacles to executing a Six Sigma improvement project?

Chapter Sixteen: Six Sigma Process Design/Redesign (Roadmap Step 4—B)

How is Six Sigma Process Design/Redesign different—and why is it a critical element in maximizing business performance? What conditions are essential to take on a process design or redesign project? How does redesign differ in execution from improvement? What special tools and challenges come into play when you are designing/redesigning a business process? How do you test and overcome assumptions that limit the value of redesigned processes?

Chapter Seventeen: Expanding and Integrating the Six Sigma System (Roadmap Step 5)

How do you measure and solidify the gains made through Six Sigma improvement projects? What are the methods and tools of Process Control? What are the specific responsibilities of and considerations for a Process Owner? How does the evolutionary discipline of Process Management support the Six Sigma system and long-term improvement?

Chapter Eighteen: Advanced Six Sigma Tools: An Overview

What are some of the most prevalent "power tools" of Six Sigma improvement? What role does each play in helping you to understand and improve processes and products/services? What are the basic steps to these sophisticated techniques?

Conclusion: 12 Keys to Success

What are some of the key actions and considerations any company or leader should keep in mind to make Six Sigma pay off?

Acknowledgments

We now understand why the awards shows on TV always run long. Partly, of course, it's due to slow delivery of canned jokes by the presenters. Usually, though, it's that the winners need to thank so many people. We haven't won an award, but we could go on for a while thanking people. Our friends at McGraw-Hill have threatened to cut to a commercial if we run long, however, so we'll try to keep this brief.

The most important acknowledgment is to the person who put in hours of tireless, good-natured, and indispensable work to make this book a reality: Percy Madamba. She kept everything organized, proofread, offered countless suggestions, laughed at jokes (we're hoping her sense of humor is representative of the general reading public), did graphics and countless other small acts, including shipping out the manuscript. (Our worry now is that Percy will quit and go write her own d__n book.)

Carolyn Talasek, Kelly Fisher, Carla Queen, Chet Harmer, Mona Draper, and Amanda Dutra—along with other members of the great team at Pivotal Resources—contributed graphics, editing help, suggestions, and research, as well as many ideas and insights. That group (the "Pivotal Pack") has been instrumental in bringing together a vast amount of experience and success that we've "channeled" into these pages. Other key contributors to that well of knowledge have included Pamela Schmidt-Cavaliero, Fred Kleiman, Mercie Lopez, Greg Gibbs, Jane Keller, and Rosalie Pryor. Also thanks to our colleague Larry Holpp, for advice and publishing contacts that helped us to bring this book to life.

There are dozens of people in our client organizations, practicing Six Sigma here and in other parts of the world, to whom we owe special thanks. These are the people who are making Six Sigma pay off, and who are learning how to make it work in many different environments. Some of the individuals we thank in particular for their support include all our friends at GE Capital's Center for Learning and Organizational Excellence—Mike Markovits, Mo Cayer, Hilly Dunn, Jenene Nicholson, Kelly Babij, Mike Mosher, and many others. This book would not exist without the terrific work the folks at GE have done, and without their commitment to Six Sigma. Thanks also to: the great people at Employers Reinsurance, including Kaj Ahlmann, Alan Mauch, Tom Felgate, Lee Tenold, Julie Hertel, Mike Nichols, and many others there, too; John Eck and the QNBC people at NBC, where we got to watch the *Tonight Show* live and help introduce Six Sigma to a primetime organization; at Cendant Mortage, a whole group of great people including our pal Pat Connolly, Tanya DeLia, Suzanne Wetherington, and many others; at Auspex Systems, where process redesign has been part of quality for years, Tamas Farkas and Charlie Golden (who's actually now at Genentech).

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Our families deserve loving mention, and sincere thanks, for putting up with the hours of time spent watching daddies and husbands hunched over a computer. (To Olga, Stephanie, and Brian Pande: *Now* the book is finished. Let's go play!)

Finally, we'd like to make a special dedication of this book to the memory of our great friend and colleague, Bill Lindenfelder. Bill was not only our partner in helping teach people about Six Sigma, but taught everyone who knew him about enthusiasm, encouragement, and boundless energy. We're among the many people who miss Bill enormously, and we hope he'd be proud to see some of his ideas and so much of his influence in these pages.

An Executive Overview of Six Sigma

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CHAPTER

1

A Powerful Strategy for Sustained Success

THE MOST CHALLENGING question confronting business leaders and managers in the new millennium is not "How do we succeed?" It's: "How do we stay successful?"

Business today offers the spectacle of a succession of companies, leaders, products, and even industries getting their "15 minutes of fame" and then fading away. Even corporate powerhouses—the IBMs, Fords, Apples, Kodaks, and many others—go through dramatic cycles of near-death and rebirth. It's like riding the wheel of fortune as consumer tastes, technologies, financial conditions, and competitive playing fields change ever-more-quickly. In this high-risk environment, the clamor for ideas on how to get the edge, stop the wheel (while on top, of course), or anticipate the next change gets louder and louder. Hot new answers are almost as common as hot new companies.

Six Sigma can seem like another "hot new answer." But looking closer, you'll find there is a significant difference: Six Sigma is not a business fad tied to a single method or strategy, but rather a *flexible system* for improved business leadership and performance. It builds on many of the most important management ideas and best practices of the past century, creating a new formula for 21st-century business success. It's not about theory, it's about action. Evidence of the power of the Six Sigma Way is already visible in the huge gains tallied by some

very high-profile companies and some not-so-high-profile ones, which we'll examine in a moment. Just as important, though, is the role Six Sigma plays in building new structures and practices to support *sustained* success.

The goal of *The Six Sigma Way* is to enable you to understand *what* Six Sigma is (both a simple and a complex question), *why* it's probably the best answer to improved business performance in years, and *how* to put it to work in the unique environment of your organization. In our mission to demystify Six Sigma for the executive and professional, we hope to show you that it's just as much about a passion for serving customers and a drive for great new ideas as it is about statistics and number-crunching; that the value of Six Sigma applies just as much to marketing, service, human resources, finance, and sales as it does to manufacturing and engineering. In the end we hope to give you a clearer picture of how Six Sigma—the *system*—can dramatically raise your odds for staying successful, even as you watch other companies ride one wave of good times only to wipe out on the next. (Our first and last surfing analogy!)

Some Six Sigma Success Stories

Seeing the impact that Six Sigma is having on some leading companies sets the stage for understanding how it can impact *your* business. As we relate some of these results, we'll also be reviewing the history that has brought Six Sigma to the forefront.

General Electric

> *Six Sigma has forever changed GE. Everyone—from the Six Sigma zealots emerging from their Black Belt tours, to the engineers, the auditors, and the scientists, to the senior leadership that will take this Company into the new millennium—is a true believer in Six Sigma, the way this Company now works." —GE Chairman John F. Welch*[1]

When a high-profile corporate leader* starts using words like "unbalanced" or "lunatics" in connection with the future of the com-

* Since launching GE's effort in 1995, Jack Welch has urged his top lieutenants to become "passionate lunatics" about Six Sigma. He has described GE's commitment to Six Sigma as "unbalanced."

pany—you might expect a plunge in the company's share price. At General Electric, however, that passion and drive behind Six Sigma have produced some very positive results.

The hard numbers behind GE's Six Sigma initiative tell just part of the story. From an initial year or so of break-even efforts, the payoff has accelerated: $750 million by the end of 1998, a forecasted $1.5 billion by the end of 1999, and expectations of more billions down the road. Some Wall Street analysts have predicted *$5 billion* in gains from the effort, early in the decade. GE's operating margins—for decades in the 10 percent range—continue to hit new records quarter after quarter. The numbers are now consistently above 15 percent, and even higher in some periods. GE leaders cite this margin expansion as the most visible evidence of the financial contribution made by Six Sigma.

Improvements from Services to Manufacturing

The financial "big picture," though, is just a reflection of the many individual successes GE has achieved through its Six Sigma initiative. For example:

- A Six Sigma team at GE's Lighting unit repaired problems in its billing to one of its top customers—Wal-Mart—cutting invoice defects and disputes by 98 percent, speeding payment, and creating better productivity for both companies.
- A group led by a staff attorney—a Six Sigma team leader—at one of GE Capital's service businesses streamlined the contract review process, leading to faster completion of deals—in other words, more responsive service to customers—and annual savings of $1 million.
- GE's Power Systems group addressed a major irritant with its utility company customers, simply by developing a better understanding of their requirements and improving the *documentation* provided along with new power equipment. The result: Utilities can respond more effectively to their regulatory agencies, and both the utilities and GE have saved hundreds of thousands of dollars a year.
- The Medical Systems business—GEMS—used Six Sigma design techniques to create a breakthrough in medical scanning technology. Patients can now get a full-body scan in half a minute, versus three minutes or more with previous technology. Hospitals can

increase their usage of the equipment and achieve a lower cost per scan, as well.

- GE Capital Mortgage analyzed the processes at one of its top performing branches and—expanding these "best practices" across its other 42 branches—improved the rate of a caller reaching a "live" GE person from 76 to 99 percent. Beyond the much greater convenience and responsiveness to customers, the improved process is translating into millions of dollars in new business.

The Actions behind the Results

GE's successes are the result of a "passionate" commitment and effort. Notes Welch: "In nearly four decades with GE I have never seen a Company initiative move so willingly and so rapidly in pursuit of a big idea."[2] Tens of thousands of GE managers and associates have been trained in Six Sigma methods—a hefty investment in time and money (which is appropriately deducted from the gains cited earlier). The training has gone well beyond "Black Belts" and teams to include every manager and professional at GE—and many front-line people as well. They've instilled a new vocabulary revolving around customers, processes, and measurement.

While dollars and statistical tools seem to get the most publicity, the emphasis on *customers* is probably the most remarkable element of Six Sigma at GE. As Jack Welch explains it:

> **The best Six Sigma projects begin not inside the business but outside it, focused on answering the question—how can we make the customer more competitive? What is critical to the customer's success? . . . One thing we have discovered with certainty is that anything we do that makes the customer more successful inevitably results in a financial return for us.[3]**

Motorola—and Some Six Sigma History

Today, the very existence and success of electronics leader Motorola is tied to Six Sigma. It's the company that *invented* the concepts that have evolved into this comprehensive management system. And while GE has used Six Sigma to strengthen an already thriving company, for Motorola it was an answer to the question: How do we stay in business?

In the 1980s and early 1990s, Motorola was one of many U.S. and European corporations whose lunch (along with all other meals and snacks) was being eaten by Japanese competitors. Motorola's top leaders conceded that the quality of its products was awful. They were, to quote one Motorola Six Sigma veteran, "In a world of hurt." Like many companies at the time, Motorola didn't have one "quality" program, it had several. But in 1987, a new approach came out of Motorola's Communications Sector—at the time headed by George Fisher, later top exec at Kodak. The innovative improvement concept was called "Six Sigma."

What Six Sigma offered Motorola—though it involves much more today—was a simple, consistent way to track and compare performance to customer requirements (the Sigma *measure*) and an ambitious target of practically-perfect quality (the Six Sigma *goal*).

As it spread throughout the company—with the strong support of chairman Bob Galvin—Six Sigma gave Motorola extra "muscle" to drive what at the time seemed like impossible improvement goals: An initial target in the early 1980s of ten times improvement (noted as 10X, and pronounced "ten-ex") over five years, was dwarfed by a goal of 10X improvement every *two* years—or 100X in *four* years. While the objective of "Six Sigma" was important, much more attention was paid to the *rate* of improvement in processes and products.

Motorola's "turnaround" has been just as remarkable over the long term as GE's results in just a few years. Only two years after launching Six Sigma, Motorola was honored with the Malcolm Baldrige National Quality Award. The company's total employment has risen from 71,000 employees in 1980 to over 130,000 today. Meanwhile, in the decade between Six Sigma's beginning in 1987 and 1997, achievements have included the following:

- Five-fold growth in sales, with profits climbing nearly 20 percent per year
- Cumulative savings based on Six Sigma efforts pegged at $14 billion
- Motorola stock price gains compounded to an annual rate of 21.3 percent.

All this, in a business whose future was in jeopardy in the early 1980s. (While the late 1990s presented some tough challenges for

Motorola—based largely on setbacks and competition in the cellular and satellite telephone businesses—the company seems to be turning the corner in late 1999, with most areas back in the black.)

The results Motorola has achieved at the corporate level again have been the product of hundreds of individual improvement efforts affecting product design, manufacturing, and services in all its business units. Alan Larson, one of the early internal Six Sigma consultants at Motorola who later helped spread the concept to GE and AlliedSignal, says projects affected dozens of administrative and transactional processes. In customer support and product delivery, for example, improvements in measurement and a focus on better understanding of customer needs—along with new process management structures—made possible big strides toward improved services and on-time delivery.[4]

More than a set of tools, though, Motorola applied Six Sigma as a way to transform the business, a way driven by communication, training, leadership, teamwork, measurement, and a focus on customers (themes we'll be seeing plenty of throughout this book). As Larson notes: "Six Sigma is really a cultural thing—a way of behavior."

AlliedSignal/Honeywell

AlliedSignal—with the new name of "Honeywell" following its 1999 merger—is a Six Sigma success story that connects Motorola and GE. It was CEO Larry Bossidy—a longtime GE executive who took the helm at Allied in 1991—who convinced Jack Welch that Six Sigma was an approach worth considering. (Welch had been one of the few top managers not to become enamored of the TQM movement in the 1980s and early 1990s).

Allied began its own quality improvement activities in the early 1990s, and by 1999 was saving more than $600 million a year, thanks to the widespread employee training in and application of Six Sigma principles.[5] Not only were Allied's Six Sigma teams reducing the costs of reworking defects, they were applying the same principles to the design of new products like aircraft engines, reducing the time from design to certification from 42 to 33 months. The company credits Six Sigma with a 6 percent productivity increase in 1998 and with its record profit margins of 13 percent. Since the Six Sigma effort began,

the firm's market value had—through fiscal year 1998—climbed to a compounded 27 percent per year.

Allied's leaders view Six Sigma as "more than just numbers—it's a statement of our determination to pursue a standard of excellence using every tool at our disposal and never hesitating to reinvent the way we do things."[6]

As one of Allied's Six Sigma directors puts it: "It's changed the way we think and the way we communicate. We never used to talk about the process or the customer; now they're part of our everyday conversation."

AlliedSignal's Six Sigma leadership has helped it earn recognition as the world's best-diversified company (from *Forbes* global edition) and the most admired global aerospace company (from *Fortune*).

The Six Sigma Wave

As we've noted, it might be easy to dismiss Six Sigma as a fad—if it weren't for the caliber of the results it's producing and the companies adopting it. In almost an antifad mentality, in fact, a number of prominent companies in industries from financial services to transportation to high-tech are *quietly* embarking on Six Sigma efforts. They're joining others who have been more vocal about their efforts, including Asea Brown Boveri, Black & Decker, Bombardier, Dupont, Dow Chemical, Federal Express, Johnson & Johnson, Kodak (which had taken in $85 million in savings as of early 2000), Navistar, Polaroid, Seagate Technologies, Siebe Appliance Controls, Sony, Toshiba, and many others.

From these and other Six Sigma companies come a wide variety of other impressive improvements, benefiting both customers and shareholders. A sample from the hundreds of Six Sigma projects underway at organizations around the world includes the following:

Developing New Products

A telecommunication products company used Six Sigma Design techniques to enable greater flexibility and faster turnaround at a key manufacturing facility. At the plant, several specialized products are built on a single production line. Since each customer's order may require different circuit boards, the need to avoid retooling was critical. Working through alignment of customer needs, product design, and process

specifications, retooling was dramatically reduced. The plant was also able to institute parallel processing so that if one area of the line wasn't functioning, work-in-process could be easily rerouted without adding to cycle time.

Under the new plant design, customer orders are transmitted electronically, where "virtual design" applied to speed quick response. Altogether, these innovative changes improved overall cycle time from days to hours, as well as improving productivity and resource management.

Sending the Message Faster and Cheaper

Customers of a telecommunications service company were dismayed over the handling of their orders. Every request—for a few minutes of satellite time to a long-term, dedicated up-link—passed through several levels of legal and technical review before being approved. The process not only upset customers, but wasted resources and money.

A Six Sigma team measured and analyzed the problem. While proposed solutions were counter to the "tried and true" way of doing things, the team was able to sway opinions from solid data and knowledge of customer needs. After 6 months of effort the process was streamlined and $1 million in savings was tallied.

Providing a Prompt Answer

A credit financing center used a Six Sigma team approach to analyze and improve call center operations. The focus was on two objectives: (1) reducing average call answer time; and (2) increasing the percentage of customer issues and questions resolved in the initial call. The team "centralized and simplified" the call answering system, cutting average times from 54 seconds to 14 seconds. "First Call Resolution" jumped from 63 percent to 83 percent.

Thinking outside the Box

The spare parts marketing and logistics group for an aerospace manufacturing company was looking for ways to take costs and time out of their service to customers. One major cost element was parts packaging: Bulk parts shipments from manufacturing plants were unpacked, placed on warehouse shelves, then picked and repackaged for shipment to customers.

By focusing the process design on customer needs and value-adding activities, the spare parts packaging operation was moved from the warehouse to the plants. Packaging material cost savings alone were cut by half-a-million dollars per year. The change also contributed to major improvements in on-time-delivery, which have jumped from less than 80% to over 95% in about three years.

The Benefits of Six Sigma

These stories by themselves may be appealing, but if your company is doing okay—as GE was in 1995, when Jack Welch launched their effort—why should you consider a Six Sigma initiative? What's prompting so many businesses, prominent and modest, to invest in this funny-sounding business approach? Drawing from these success stories and those of other companies—and by looking behind the raw dollars—we can define several benefits that are attracting companies to the Six Sigma Way. Six Sigma:

1. *Generates sustained success.* John Chambers, CEO of Cisco Systems, the networking equipment powerhouse that's been one of the fastest-growing companies of the past decade, recently commented on the tenuous hold many companies have on their success: "There is the realization that you can be out of business in three years."[7] The only way to continue double-digit growth and retain a hold on shifting markets is to constantly innovate and remake the organization. Six Sigma creates the skills and culture for constant revival—what we'll describe in the next chapter as a "closed-loop system."
2. *Sets a performance goal for everyone.* In a company of any size—let alone a multibillion-dollar global corporation—getting everyone working in the same direction and focusing on a common goal is pretty tough. Each function, business unit, and individual has different objectives and targets. What everyone has in common, though, is the delivery of products, services, or information to customers (inside or outside the company). Six Sigma uses that common business framework—the process and the customer—to create a consistent goal: Six Sigma performance, or a level of performance that's about as close to perfect as most people can imagine. Anyone who understands their customers' requirements (and who shouldn't?) can assess their per-

formance against the Six Sigma goal of 99.9997 percent "perfect"—a standard so high that it makes most businesses' previous views of "excellent" performance look pretty weak. Figure 1.1 contrasts the number of problems that would be found with a goal of *99 percent quality* versus a goal of Six Sigma performance (99.9997 percent). The difference is pretty startling.

3. *Enhances value to customers.* When GE began its Six Sigma effort, executives admitted that the quality of the company's products was not what it should be. Though its quality was perhaps better than that of its competitors, Jack Welch stated that "We want to make our quality so special, so valuable to our customers, so important to their success that our products become their only real value choice."[8] With tighter competition in every industry, delivering just "good" or "defect-free" products and service won't guarantee success. The focus on customers at the heart of Six Sigma means learning *what* value means to customers (and prospective customers) and planning *how* to deliver it to them profitably.
4. *Accelerates the rate of improvement.* Motorola's goal of "100X improvement in four years" set an example for ambitious, driven organiza-

Performance Goals - What You'd Get ...	
For every 300,000 letters delivered:	
with 99%	*with Six Sigma*
3,000 misdeliveries	1 misdelivery
Out of every 500,000 computer restarts:	
with 99%	*with Six Sigma*
4,100 crashes	< 2 crashes
For 500 years of month-end closings:	
with 99%	*with Six Sigma*
60 months would not balance	.018 months would not balance
For every week of TV broadcasting (per channel):	
with 99%	*with Six Sigma*
1.68 hours of dead air	1.8 seconds of dead air

Figure 1.1 99% quality versus Six Sigma performance

tions to emulate. With information technology setting the pace by doubling its performance to cost ratio every 18 months, the customer expectation for improvement gets ever more demanding. The competitor who improves the fastest is likely to win the race. By borrowing tools and ideas from many disciplines, Six Sigma helps a company not only improve performance, but improve *improvement.*

5. *Promotes learning and "cross-pollination."* The 1990s saw the birth of the "Learning Organization," a concept that appeals to many but seems hard to put into action. AlliedSignal leaders have commented that "everyone talks about learning, but few succeed in weaving it into the fabric of everyday life for so many employees."[9] Six Sigma is an approach that can increase and accelerate the development and sharing of new ideas throughout an organization. Even in a company as diverse as GE, the value of Six Sigma as a learning tool is seen as critical. Skilled people with expertise in *processes* and how to manage and improve them can be shifted from, say, GE Plastics to GE Capital, not only with a shorter learning curve but actually bringing with them *better* ideas and the ability to apply them more quickly. Ideas can be shared and performance compared more readily. GE's vice president for Six Sigma, Piet van Abeelen, has noted that in the past, a manager in one part of the organization could discount input from a counterpart in another area: " 'Your ideas won't work, because I'm different.' " Van Abeelen says Six Sigma eliminates those defenses: "Well, cry me a river. The commonalities are what matter. If you make the metrics the same, we can talk."[10]
6. *Executes strategic change.* Introducing new products, launching new ventures, entering new markets, acquiring new organizations—what were once occasional business activities are now daily events in many companies. Better understanding of your company's processes and procedures will give you a greater ability to carry out *both* the minor adjustments and the major shifts that 21st-century business success will demand.

The Tools and Themes of Six Sigma

Like most great inventions, Six Sigma is not "all new." While some themes of Six Sigma arise out of fairly recent breakthroughs in management thinking, others have their foundation in common sense.

Before you dismiss that origin as no big deal, we'd remind you of a saying we picked up once while working in Europe: "Common sense is the least common of the senses." From a "tools" perspective, Six Sigma is a pretty vast universe. Figure 1.2 summarizes many—but by no means all—of the most important Six Sigma methods.

The more we have learned over the years about the Six Sigma system, the more we have come to see it as a way to link together—and even to implement—many otherwise disconnected ideas, trends, and tools in business today. Some of the "hot topics" that have direct application or can complement a Six Sigma initiative include:

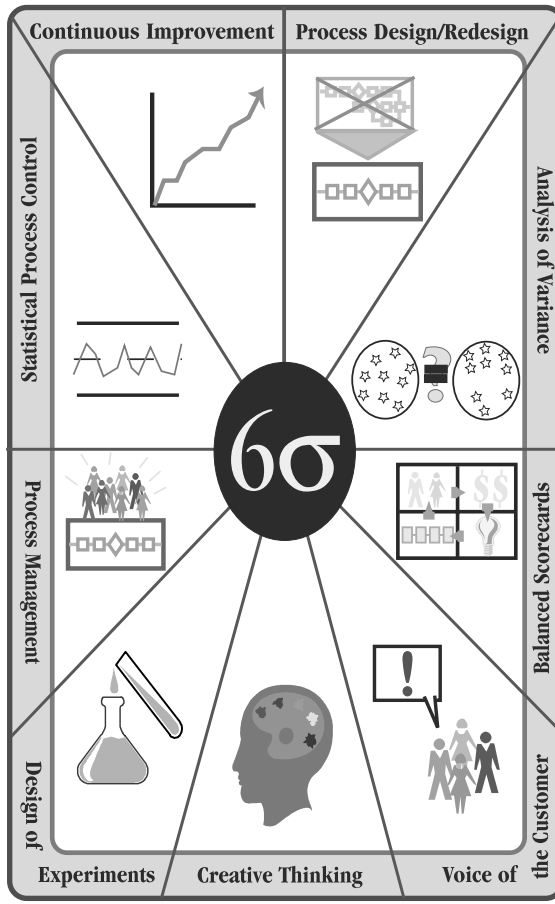

Figure 1.2 Essential Six Sigma methods and tools

- e-Commerce and Services
- Enterprise Resource Planning
- Lean manufacturing
- Customer Relationship Management systems
- Strategic business partnerships
- Knowledge management
- Activity-based management
- The "process-centered organization"
- Globalization
- Just-in-time inventory/production

Six Themes of Six Sigma

We'll close out this introductory look at Six Sigma by distilling the critical elements of this leadership system into six "themes." These principles—supported by the many Six Sigma tools and methods we'll be presenting throughout this book—will give you a preview of *how* we'll help you make Six Sigma work for your business.

Theme One: Genuine Focus on the Customer

During the big Total Quality push of the 1980s and 1990s, dozens of companies wrote policies and mission statements vowing to "meet or exceed customer expectations and requirements." Unfortunately, however, few businesses tried very hard to improve their *understanding* of customers' requirements or expectations. Even when they did, customer data-gathering typically was a one-time or short-lived initiative that ignored the dynamic nature of customer needs. (How many of your customers want the same stuff today as five years ago? Two years ago? Last month?)

In Six Sigma, customer focus becomes the top priority. For example, the measures of Six Sigma performance begin with the customer. Six Sigma improvements are defined by their impact on customer satisfaction and value. We'll look at why and how your business can define customer requirements, measure performance against them, and stay on top of new developments and unmet needs.

Theme Two: Data- and Fact-Driven Management

Six Sigma takes the concept of "management by fact" to a new, more powerful level. Despite the attention paid in recent years to measures,

improved information systems, knowledge management, etc., it should come as no shock to you to hear that many business decisions are still being based on opinions and assumptions. Six Sigma discipline begins by clarifying *what* measures are key to gauging business performance; then it applies data and analysis so as to build an understanding of key variables and optimize results.

At a more down-to-earth level, Six Sigma helps managers answer two essential questions to support fact-driven decisions and solutions:

1. What data/information do I *really* need?
2. How do we *use* that data/information to maximum benefit?

Theme Three: Process Focus, Management, and Improvement

In Six Sigma, processes are where the action is. Whether designing products and services, measuring performance, improving efficiency and customer satisfaction—or even running the business—Six Sigma positions the *process* as the key vehicle of success.

One of the most remarkable breakthroughs in Six Sigma efforts to-date has been convincing leaders and managers—particularly in the service-based functions and industries—that mastering processes is not just a necessary evil but actually a way to build competitive advantage in delivering value to customers. There are many more people to convince—with huge dollar opportunities tied up in those activities.

Theme Four: Proactive Management

Most simply, being "proactive" signifies acting in advance of events—the opposite of being "reactive." In the real world, though, proactive management means making *habits* out of what are, too often, neglected business practices: defining ambitious goals and reviewing them frequently; setting clear priorities; focusing on problem prevention versus firefighting; questioning *why* we do things instead of blindly defending them as "how we do things here."

Being truly proactive, far from being boring or overly analytical, is actually a starting point for creativity and effective change. Reactively bouncing from crisis to crisis makes you very busy—giving a false impression that you're on top of things. In reality, it's a sign of a manager or an organization that's lost control.

Six Sigma, as we'll see, encompasses tools and practices that replace reactive habits with a dynamic, responsive, proactive style of management. Considering today's slim-margin-for-error competitive environment, being proactive is (as the airline commercial said) "the only way to fly."

Theme Five: Boundaryless Collaboration

"Boundarylessness" is one of Jack Welch's mantras for business success. Years before launching Six Sigma, GE's chairman was working to break down barriers and improve teamwork, up, down, and across organizational lines. The opportunities available through improved collaboration within companies and with their vendors and customers are huge. Billions of dollars are left on the table (or on the floor) every day, because of disconnects and outright competition between groups that should be working for a common cause: providing value to customers.

As noted above, Six Sigma expands opportunities for collaboration as people learn how their roles fit into the "big picture" and can recognize and measure the interdependence of activities in all parts of a process. Boundaryless collaboration in Six Sigma does not mean selfless sacrifice, but it does require an understanding of both the real needs of end users and of the flow of work through a process or a supply chain. Moreover, it demands an attitude that is committed to using customer and process knowledge to benefit all parties. Thus, the Six Sigma system can create an environment and management structures that support true teamwork.[11]

Theme Six: Drive for Perfection; Tolerance for Failure

This last theme may seem contradictory. How can you be driven to achieve perfection and yet also tolerate failure? In essence, though, the two ideas are complementary. No company will get anywhere close to Six Sigma without launching new ideas and approaches—which always involve some risk. If people who see a possible path to better service, lower costs, new capabilities, etc. (i.e. ways to be closer-to-perfect) are too afraid of the consequences of mistakes, they'll never try. The result: stagnation, putrefaction, death. (Pretty grim, eh?)

Fortunately, the techniques we'll review for improving performance include a significant dose of risk management (if you're gonna fail,

make it a safe failure). The bottom line, though, is that any company that makes Six Sigma its goal will have to constantly push to be ever-more-perfect (since the customer's definition of "perfect" will always be changing) while being willing to accept—and manage—occasional setbacks.

Where You Stand

We would be surprised if you weren't saying to yourself right about now: "We're already *doing* some of those things." But remember, we've already noted that much of Six Sigma is not brand-new. What *is* new is its ability to bring together all these themes into a coherent management process.

As you review this introduction and guide to the Six Sigma way, we encourage you to take stock of what you are already doing that supports the themes or tools of Six Sigma—and keep doing them. Meanwhile, be honest about your business's strengths and weaknesses. One thing we've noticed about Six Sigma is that results come much faster when an organization is willing to admit to its shortcomings, learn from them, and start setting priorities to correct them.

Businesses or managers who puff out their chests and claim to have all the answers are invariably the ones in greatest danger; they stop learning, fall behind, and end up having to scramble to catch up—if it isn't too late.