Chapter 1

Strategic Six Sigma

Current and Emerging Applications

We are living, once and for all, in the Age of the Customer. Did you hear what we said? *There has never been a better time to be a customer—or a tougher time to be a supplier. Customers have higher expectations and more choices than ever. Which means that you have to listen more closely than ever. Forget building a learning organization. You first have to build a* listening *organization—a company whose people have their ears to the ground.*

—Rekha Balu, Senior Writer
Fast Company
May 2000

Six Sigma. For years it was viewed simply as a process improvement tool (like total quality management) to help companies improve their manufacturing operations and reduce product defects. So why has it suddenly emerged as a methodology for driving business strategy and transforming organizations? Why are companies as diverse as General Electric (GE), JPMorgan Chase, Caterpillar, Raytheon, Dow Chemical, and Bombardier Transportation all using it, not just to cut costs and reduce product defects, but to drive and shape business strategy and transform how people work?

To understand that, one must understand the nature of business competition today and the nature of the business environment. Companies of all kinds today are facing crush-

ing business pressures, not just to continuously streamline their operations and cut costs (perennial issues facing all business enterprises), but also to grow their businesses, nurture innovation, and realize continuous gains in productivity.

In recent years, the pressure on companies to realize continuous productivity and profitability gains has been spurred not only by rising shareholder expectations. It has also intensified as the result of market consolidation, industry convergence, the growth of e-business, the scrutiny of Wall Street analysts (whose daily reassessments of corporate health and vitality can cause the capital valuations of companies to fluctuate by billions of dollars on a daily basis), and by the accelerating pace of business change.

As a result, the ability of companies to bring speed, agility, quality, and leanness to everything they do (e.g., to be fast to market, to shrink cycle times, to make global supply chains more efficient and responsive, and handle just-in-time inventory management and order fulfillment precisely) has become critical, not just to business success, but to business survival. The need for companies to serve these four marketplace masters puts enormous strains on businesses, not just in terms of infrastructure, design, and business practices, but also in terms of how they measure performance, leverage knowledge, serve customers, gauge productivity, and build competitive advantage.

■ DOING BUSINESS IN A WORLD OF GROWING RISK

There's yet another, very sobering reason why Strategic Six Sigma practices are emerging as important to companies today: the escalating prospect of catastrophic business risk. In the wake of the events of September 11, 2001, which took

over 3,000 lives and are estimated to have cost global companies in excess of $150 billion, companies are recognizing the need not only to reorder their priorities, but in many cases, to anticipate new risks—from bioterrorism and airliner attacks on skyscrapers, to the potential cascade effect that such catastrophic events can have on all sectors of the economy. After the events of September 11, virtually the entire world economy paused, thousands of people were laid off from their jobs in hundreds of industries, and hundreds of companies had to declare Chapter 11—all of this the result of one unanticipated terrorist event! As one quality expert put it at the time, "The tragic and catastrophic events of September 11 revealed a massive 'quality system failure' in the U.S.'s intelligence system—from security lapses and a lack of on-the-ground human intelligence on the one hand, to the inability of different federal agencies to work together effectively beforehand to avoid such a disaster."

■ QUALITY SYSTEM FAILURES ARE MORE COMMON THAN WE WANT TO BELIEVE

Sadly, however, the failure of such high-profile quality systems is not limited to the events of September 11 or to the public arena. In recent years, there have been numerous quality failures, many of them in the industrial and commercial arenas. The Chernobyl nuclear reactor accident, the worst nuclear industry accident in history, took 125,000 lives, caused 3.5 million people to become ill (according to the Ukrainian Health Ministry), and has cost countless billions to clean up so far. The Challenger space shuttle disaster took seven lives and cost U.S. taxpayers between $5 billion and 10 billion. The Bridgestone/Firestone/Ford tire failures have, to date, taken 203 lives and already cost those two

companies in excess of $4 billion—to say nothing of the hidden and intangible costs associated with lost sales, diminished prestige, reduced consumer confidence, damaged brand identity, and so forth.

What could have been done to avoid these disasters? What performance metrics or fail-safe manufacturing systems could have been put in place to avoid them? It begs the question, of course, of how we, as businesspeople (and human beings) define *quality*. Compounding the importance of answering this question is the fact that the events we've just described are only the most public and egregious examples of "quality failures" out there today. Many others, with untold financial, commercial, and even human ramifications, no doubt go unreported or even unknown in business every day.

For example, consider the fact that as we write these words, public scrutiny is focusing on the composite materials that in recent years have been used as a replacement for traditional aluminum in the construction of commercial aircraft, specifically in the tail section of airliners. In the wake of the crash of an American Airlines jet just moments after takeoff from New York's Kennedy Airport, transportation engineers, material specialists, and public safety advocates began raising questions about whether the honeycomb construction of these composite materials is of sufficient strength and durability to make it a worthy replacement for traditional alloys. Is there a potential quality issue here? You bet.

■ HOW DOES YOUR ORGANIZATION DEFINE *QUALITY?*

Renowned quality pioneer Phillip Crosby defined poor quality as ". . . conformance to requirements . . . doing it right the first time." Genichi Taguchi, another quality pioneer who

coined the term *loss function* to denote the degree of customer dissatisfaction with a product, has described poor quality as the "loss a product causes to society after being shipped. . . ." Meanwhile, Dr. Joseph Juran, one of the early fathers of the quality movement in the United States referred to quality as "those product features which meet the needs of a customer . . . and provide product satisfaction."

Perhaps quality guru Edwards Deming, however, came closest to describing the modern-day idea of what quality needs to mean for companies today. He observed that "quality must be defined in terms of customer satisfaction. . . . [and requires the total] transformation of . . . American management."

We agree but with a caveat. In our view, quality, as a guiding principle of business, is—and always has been—about customer satisfaction. After all, nobody in business *stays in business* if they don't please customers. But getting to the point of customer satisfaction with one's customers, especially in the world *after* September 11, requires a new dedication, a new emphasis. Today, it's no longer about any of us doing business as usual. Instead, it's about being more strategic, planning for the unexpected, anticipating problems and challenges ahead of time, dealing with marketplace downturns, and being able to ride through patches of marketplace whitewater. It means that all of us must pay more attention to the business environment, get tighter with our customers, analyze our performance data better, and by the way, avoid disasters. The writing was on the wall even before the events of September 11: The economy was sputtering, and the capital valuations of many companies were caving. Today, however, the message is crystal clear: The business world, if we didn't know it already, is an uncertain place. To build world-class performance and to create cultures of breakaway performance

in this brave new world, we need a new resolve and a fresh approach.

In today's new business world, quality can no longer be just about processes, products, services, or people. It must be about all four of these things—together. In other words, our notions of quality need to be both systemic and strategic, not piecemeal, inconsistent, or erratic. Indeed, it is only with a systemic and strategic quality framework in place that we will be able to anticipate the future and build sustainable excellence in meeting customer requirements.

■ CONSIDER A FRESH DEFINITION OF *QUALITY SYSTEMS*

For that reason, and from this point onward, we will speak in this book about the importance of companies creating quality systems to ensure their futures and to assure top-line growth, defect elimination, and customer satisfaction.

We define a *quality system* as an enterprise-wide framework of actively managed business processes that assures (over the long term) not only that the needs of one's customers are met (at a price customers are willing to pay), but also that the enterprise itself remains viable, profitable, and ongoing. To be sure, such systems should be able to prevent catastrophic failure and all the consequences that potentially can flow from such events—from loss of life and property to loss of market share, customer satisfaction, or product and service quality. At the same time, they should be constructed to allow for accurate monitoring and measurement of current performance, the taking of steps to ensure continuous improvement, and the constant infusion and application of new information and knowledge to improve efficiency, productivity, and operational excellence.

Assuring the development of such quality systems will be increasingly vital to companies in the future, not just as a result of the tragic events of September 11, but also as a result of the following:

- ➤ Increasing business competition
- ➤ Exploding customer demands for better products and better products faster
- ➤ Shrinking profit margins in many industries
- ➤ Skyrocketing costs for raw materials
- ➤ Growing shareholder pressure for sustainable top-line business growth
- ➤ The need for new products

THE USES OF STRATEGIC SIX SIGMA THINKING AND METHODS

Strategic Six Sigma principles and practices have a potentially huge role to play in the planning, building, management, and improvement of quality systems in companies today. Indeed, Strategic Six Sigma principles and practices, if employed effectively, can help a company turn its quality systems into a potent marketplace and competitive weapon. So, what exactly *is* Strategic Six Sigma? In essence, it is a whole-enterprise strategy of business process management and improvement based on the following four steps:

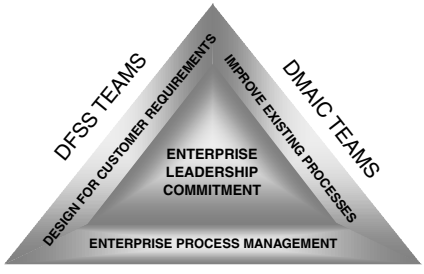
1. Measuring business and product/service conformance to customer requirements
2. Creating specific continuous actions to reduce variation in existing business processes that cause failures to conform to customer requirements
3. Creating new innovative products/services and pro-

cesses to specifically meet customer and market requirements
4. Repeating steps 1 through 3 continuously as necessary for the enterprise to remain viable and sustain shareholder value over the long term

Following are the three critical components to Strategic Six Sigma initiatives (see Figure 1.1):

1. *Designing processes for customer requirements using Design for Six Sigma (DFSS) teams.* DFSS is a robust and systematic improvement methodology that uses specific Six Sigma tools and metrics to design products, services, and processes that meet customer requirements from the outset, and that can be produced and delivered at Six Sigma quality levels.
2. *Improving existing processes using Define, Measure, Analyze, Improve, and Control (DMAIC) improvement teams.* DMAIC is a fact-based, closed-loop, problem-solving methodology that ensures continued process/product/service improvement. It focuses on eliminating unpro-

- DFSS generates new processes, products, services, and/or plants.
- DMAIC improves existing process performance.
- Process management is the system that enables leverage and sustains gains achieved by DFSS and DMAIC.
- Leaders drive and align the efforts strategically.



PROCESS TEAMS – Real-time process monitoring and analysis

Figure 1.1 What are the elements of Strategic Six Sigma?

ductive steps, developing and applying new metrics, and using technology to drive improvement.

3. *Enterprise-wide process management using process teams that work in real time to gauge, monitor, and analyze ongoing business and organizational performance.* The foundation for sustaining Six Sigma improvements over time is the institutionalizing of business improvement through ongoing process management. Process management requires that a company establish a series of dashboards, metrics, and performance indicators for its core processes through which the top leadership team can continuously monitor and assess performance. These dashboards and metrics typically track and monitor a variety of performance indicators, including: leading indicators, results indicators, customer indicators, and internal indicators.

Some companies, including GE, Honeywell, and Raytheon, are already taking a strategic approach to their use of Six Sigma, using it to integrate their business strategies, and to support the achievement of near-term as well as longer-term business objectives. At GE, for example, Six Sigma is today closely tied to the company's other major strategies, including services, globalization, and e-business. And at GE, individuals can't get ahead in management unless they become knowledgeable about and proficient at using Six Sigma practices in their everyday jobs.

Meanwhile, at Caterpillar, the world's largest manufacturer of construction and mining equipment, diesel and natural gas engines, and gas turbines, CEO Glen Barton is using Strategic Six Sigma principles to totally transform the company's business culture and to change how people work. He wants Six Sigma to be the engine that drives the company to

sales and revenues of $30 billion by 2006. "A key part of the strategy is institutionalizing a 6 Sigma culture and philosophy," he writes in the company's 2000 annual report. "6 Sigma is a relentless quest for perfection through the disciplined use of fact-based, data-driven, decision-making methodology. It will enable us to make quantum gains in quality and reliability, and will touch everything we do at Caterpillar." It will also, he says, "become our way of life, benefiting customers, dealers, suppliers, employees, and shareholders. We will become the benchmark for institutionalizing 6 Sigma culture deployment excellence."[1]

Other companies are moving toward implementation of Strategic Six Sigma initiatives as well. A well-known automotive parts supplier in the Midwest is using Strategic Six Sigma practices in conjunction with Lean Manufacturing, Shainin statistical engineering techniques, and DFSS/Robust Engineering approaches to fortify and accelerate its product and process improvement efforts. The marketplace pressures to do this are extreme, notes the company's manager for innovation and continuous improvement. "To compete in the marketplace, we must have Lean Manufacturing processes, we must optimize our product and process designs, and we must do effective problem resolution—all at the same time," he says. "We get the maximum benefit from all of these if they work in a strategic way to support one another."

Meanwhile, an aftermarket manufacturer of custom automotive products is using Strategic Six Sigma principles, again in tandem with Lean Manufacturing techniques, to drive improvements in quality, costs, and product delivery. Use of Six Sigma principles and practices, according to one of the company's Six Sigma Black Belts, is helping to create a common language of change within the company and is driving all company employees to take a process thinking

approach to getting their work done. The downstream results are that the company is more focused on the customer than it has ever been, is using Six Sigma to eliminate the root causes of product and service defects, and is building brand equity and customer loyalty in the process.

Other companies, such as Lockheed-Martin, recently awarded the largest defense contract in history to build the F-35 fighter (see Chapter 5) are using Six Sigma in various combinations with Lean Manufacturing, Kaizen projects, and other approaches. All this is to drive process, product, and service improvements that support overall strategy execution and ensure the health and vitality of the company's business processes on a sustained basis. "Businesses create earnings on the strength of their operating system," notes Mike Joyce, vice president of Lockheed-Martin's corporate-wide improvement initiative, known as LM-21 (for Lockheed-Martin 21st Century). "Look across our corporation and you'll see hundreds of processes that define what we do—in engineering, marketing, supply chain management, manufacturing, and so forth. Given the pace of change in today's marketplace, operating systems can't stand still."[2]

Joyce says Lockheed-Martin, which launched LM-21 in 1998, expects to capture "$3.7 billion in annual, steady-state cost savings in 2002" by leveraging "lean processes that operate at Six Sigma capability" across all areas of the company. "The integration of Lean thinking and Six Sigma methodologies forces us to change our paradigm of routine day-to-day work practices," he says. The goal is to "achieve waste-free products and defect-free processes that deliver sustained, increased earnings and customer loyalty."[2]

Despite the increasingly strategic orientation of many corporate Six Sigma initiatives today, many other companies continue to limit the use of Six Sigma principles and

practices to the local levels of their organizations, where they are used to incrementally improve process performance, reduce process defects, or to enhance performance in other, narrowly defined operational areas.

We submit, however, that the integrated use of Strategic Six Sigma approaches and principles will be increasingly critical to corporate success in the years just ahead. Because companies today face constant change, a proliferating number of risks, and must get to market with ever greater speed, Strategic Six Sigma practices and methods will be used to support not just individual improvement projects, but entire business strategies. For example, let's look at how strategic (transformational) use of Six Sigma principles can help companies with the challenges of:

- Globalization and mergers and acquisitions (M&A)
- E-business planning and implementation
- Supply chain design and planning
- Customer relationship management
- National and global brand building
- New product development
- Sustainable growth
- Management of innovation/emerging technologies
- Business risk management

➤ Globalization and M&A

Globalization and M&A are trends impacting the operations of virtually all businesses today. They are being driven by a variety of forces: tightening profit margins in mature markets, customers who demand increasingly diverse product sets, new enabling technologies that facilitate the merging of corporate cultures, the need to acquire new manufacturing

competencies, and expanding companies' global market reach. While the benefits of companies going global have been widely proclaimed, doing it successfully requires that a company's leaders ask themselves some thoughtful and probing questions. For example:

- How does a company effectively integrate its global business operations and deal with increasingly sophisticated and complicated customer requirements?
- How does a company's CEO unify a worldwide workforce under the banner of a common work language, common management practices, and a common culture?
- How does a company effectively build (and then protect) the integrity of its national or global brands?
- How does a company achieve optimal *speed and scale* so it can stretch itself to operate both *globally* (in terms of market reach and product sets) and *locally* (in terms of product and/or service customization)?

Grady Means, coauthor (with Bill Dauphinais and Colin Price) of *Wisdom of the CEO* (Wiley, 2000), notes that while there is a good deal of evidence linking globalization to high performance, globalization is a high-risk, high-reward proposition. "When a company globalizes from a strong core strategy, it maximizes reward," he says. But "when a company globalizes from a weak core strategy, it maximizes risk."

The implications of this are truly daunting if one considers the complexity of modern transnational M&A, and the requisite meshing of diverse workforces, business practices, and cultures across continents as part of forming modern, global business enterprises. Today, companies are embarking on "large-scale, high-risk global strategies and consolidations

aimed at [helping them become] dominant competitors in particular sectors," write Means, Dauphinais, and Price in *Wisdom of the CEO*. "Such business plans require detailed analysis and planning and a major commitment from corporate leadership and the board of directors to move forward."[3]

In our opinion, such plans also require robust systems, methodologies, and disciplines—such as strategic use of Six Sigma—to help companies integrate and deploy their business operations and strategies, while realizing organizational synergies and top-line business growth.

One company that's using Strategic Six Sigma to strengthen its global business operations, build customer loyalty, and accelerate top-line business growth is Dow Chemical. In recent years, Dow has transformed itself from a "geographically organized and functionally driven company into a global, business-led company with annual sales of over $30 billion," notes Dow President and CEO, Mike Parker.[4] It has also embarked on an aggressive growth campaign, focused both on growing top-line business revenue, and on undertaking strategically significant M&A, one of the most important of which was Dow's recent merger with Union Carbide.

To undergird its growth activities, Parker says Dow built a robust global information technology (IT) backbone, and a global enterprise resource planning system to support its business operations. It also instituted use of Strategic Six Sigma to help deploy its strategic blueprint, put in place in 1994. "That blueprint calls for four things," notes Parker:

> *First, set the competitive standard, business by business. Six Sigma will play a critical role with this by enabling us to become more competitive in everything we do. Second, productivity: Very clearly Six Sigma can play a key*

role in that because a lot of what we're doing today involves cost savings projects, finding the "hidden factory" [in our operations], and being able to create more capacity out of what we are thinking is a constrained system. Third, value growth: DFSS [is helping us] design processes so they can perform at high sigma levels at the beginning, not at three sigma. Fourth, culture change: [Six Sigma is helping us] develop a mind-set and intolerance for waste . . . it's going to create breakthrough thought in people as they do their everyday jobs . . ."[4]

The decision to adopt Six Sigma as part of the company's strategic planning and execution process was a natural, says Parker. After the company downsized and restructured in the early 1990s, it needed to find new ways to grow and become more customer responsive. "We realized that to continue our journey to getting better, and to actually help us with the challenge of getting bigger—whether from growing our established businesses, doing successful [M&A], or growing new businesses, we needed some different tools. We also needed a different mind-set and some different capabilities, and that's the reason why we started to think about Six Sigma as the way to go."[4]

Today, Dow is aggressively using Six Sigma methods not only to help it deploy its strategic blueprint, but to leverage specific, concrete benefits from completion of successful Six Sigma projects across all areas of the organization. Currently, the company has some 2,400 Six Sigma projects (both DMAIC and DFSS projects) under way. "More than 350 new projects have been leveraged from the existing pool of active projects across the organization," says Kathleen Bader, Dow's Business Group President of Styrenics and Engineered Products. "We're capitalizing on our global infrastructure—our

work processes and IT systems, to leverage the value of Six Sigma and incorporate best practices in our operations around the world." Echoing Parker, she says that Six Sigma is being used to accelerate the company's M&A activities, eliminate costs, deal with supply chain issues, reduce redundancies, and manage raw material supplies. "It is helping us take some of the subjectivity out of these processes," she says.[5]

Using Six Sigma to Accelerate M&A

Like Dow, Bombardier Transportation is also using Six Sigma practices to help support its globalization and M&A strategies. The global leader in the rail equipment, manufacturing, and service industry, Bombardier Transportation recently used Strategic Six Sigma concepts and tools to help accelerate and facilitate its 2001 acquisition of DaimlerChrysler Rail Systems (Adtranz.) "It's real impact has been in helping put the new organizational structure in place and mobilize the management team," says Desmond Bell, the company's vice president of Six Sigma. Bell says Six Sigma concepts and tools were used by the companies' management teams to evaluate key business processes in the two companies, identify key executive roles and responsibilities in the new organization, and to integrate the companies' operations by designing a new business process framework linking them together.[6]

Doing this at the outset of the integration "helped to embed process ownership in the new organizational structure," says Bell, and will help tremendously as the company extends itself more deeply into European and Far East markets.[6]

How Strategic Six Sigma Can Support Globalization and M&A Initiatives

We submit that Strategic Six Sigma practices and methods will increasingly play a role in global strategy development,

planning, and deployment. How? By helping companies and their leaders build an empirical foundation for decision making, and drive people, processes, and organizations toward common objectives—whether the goal is to articulate a new global vision, define and assess business opportunities in mature and emerging markets, build and protect global brands, or accelerate integration of global business operations in the wake of M&A.

➤ e-Business Planning and Implementation

Consider now how use of Strategic Six Sigma can help mitigate the risks—and enhance the market opportunities—associated with e-business planning and implementation. Today, the Internet and its associated technologies are spawning entirely new business models. Customer *pull* now defines what a company sells the marketplace; no longer can firms simply *push* generic products and services onto customers. Customers are in the driver's seat, telling companies what they want, and *how* and *when* they want it. Businesses are therefore scrambling to become more responsive to customers' needs on the web. They are creating new products, using customer information to ensure competitive advantage, and making strategic IT decisions to support their e-business ventures. Today, "[c]ompanies are working and spending hard to promote their relatively newfound capabilities on the Net. With 'e or be eaten' rapidly becoming both the common mantra and the bottom-line for many businesses," notes Sheelagh Whittaker, President and CEO of EDS Canada.[7]

But as the dot-com train wreck of the last two years illustrates, building web-based business models is fraught with challenges and difficulties. Not only are there issues of capitalization and the smooth integration of click-and-mortar

operations to consider, companies must also grapple with a dizzying array of technical concerns, including scalability, multiplatform integration, bandwidth, convergence, storage, and transactional protocols. "As enterprises embark on journeys into e-business waters, headlines over the next few years will be largely consumed with a series of business 'Mayday' distress signals," notes Don McCartney, a Pricewaterhouse Coopers (PwC) e-business expert. "Lying at the base of each distress signal will be one common theme: the failure to properly consider risk."[8] McCartney says, for example, that companies that fail to understand the IT failures of the past are likely to repeat them with their e-business ventures. "Long before e-business, IT projects commonly went astray as a result of project managers that failed to sufficiently define scope, outline change control procedures, and identify and mitigate potential risks."[8]

As companies plan and deploy increasingly sophisticated and complex e-business operations, there are critical strategic questions they must ask themselves to assure success. For example:

- In what ways are the critical customer requirements (CCRs) of e-customers different from those of traditional commercial or business customers, and how can such CCRs be effectively determined?
- How do we profile and segment customers appropriately, given that web-based business customer interactions are so different in nature and flow from traditional, face-to-face business transactions?
- In what ways can CCRs be used to optimally construct e-channels (web sites, portals, etc.) to meet the needs of web customers in both the business-to-business (B2B) and business-to-consumer (B2C) transaction space?

➤ How can a company align traditional brick-and-mortar and web-based business operations in optimal ways? How does this integration take place?

How Strategic Six Sigma Can Support e-Business Planning

As with globalization and M&A activities, we think using Strategic Six Sigma principles and best practices can be extremely valuable when incorporated into e-business planning, design, and implementation.

First, Strategic Six Sigma methods and approaches will prove very powerful in helping companies to profile and prioritize customers by segment, and then drill down to understand the critical customer requirements of each segment in turn. This will prove critical to the success of business web site operations, because customer behavior is markedly different on the web than in face-to-face business transactions, say e-business experts. (See the sidebar, "Using Six Sigma to Drive Web Design and E-Business Implementations.")

Second, Strategic Six Sigma methods and approaches can go far in mitigating the engineering and operational risks associated with the early-stage planning and launch of e-business initiatives. Companies can use methodologies such as DFSS or DFSS-@-e-speed approaches to accelerate and facilitate the design of e-business operations on the web; to drive new process design, and development of e-sales and marketing channels, logistics/distribution capabilities, customer service operations, and supplier interfaces.

Third, Strategic Six Sigma can be used to determine and allocate the appropriate capital and human resources (HR) requirements to e-business ventures. Because Strategic Six Sigma applies specific metrics, goals, and feedback systems to support business performance, it provides a common

USING SIX SIGMA TO DRIVE WEB DESIGN AND E-BUSINESS IMPLEMENTATIONS

Just how can Six Sigma methods be used to help companies launch e-business ventures? For starters, they can be very helpful to a firm when it comes to designing a web site, or making an existing web site easier to navigate. That's according to Six Sigma design expert and principal PwC consultant Peter Amico, who says that in the last couple of years, a lot of companies have experienced significant start-up pains with their e-business ventures, because they haven't had an accurate handle on customer requirements.*

A lot of the problem, says Amico, stems from the fact that numerous "demographic and psychographic" considerations have to be factored into understanding the needs of customers for web-based services—how a person's thinking processes work, (e.g., the specific kind of information they're looking for, and even whether they are left- or right-handed). Such behavioral traits, which aren't as critical to consider in other transaction environments, come into play on the web whether a company is operating a web site for retail consumers or trying to migrate heavy-volume commercial and industrial business users to the web. "Somewhere between sixty-seven and seventy-eight percent of buying behavior on the web is driven by behaviorially based buying traits, things that customers themselves can't articulate," says Amico.

For example, customers may like a certain web site because of its visual appeal, graphic design, or because it's intuitively easy to navigate. In other cases, a customer may choose (or not choose) to interact with a web site, based on ergonomic factors such as where a company locates an input or dialogue box, or how it words certain questions or statements to a web visitor.

Traditional voice-of-the-customer surveys or customer interviews are likely to miss what really motivates people to buy products from a certain site, or to use a certain company's online customer services. That's because they don't go deeply enough into analyzing psychographic and demographic data points, says Amico.

So how can Six Sigma help? Amico says a company can use

Strategic Six Sigma approaches to help it separate and prioritize customers by segment, and then drill down to understand the CCRs of each segment in turn. "A chemical company might have a web site where customers go to buy things, where company engineers go to look for technical background information, where procurement people go for pricing information, and where sales people go to get warranty information," he says. "You have to be able to customize a web site to meet the needs of a potentially diverse universe of users."

Though in many ways subtle, the design of a web site can make or break a business, says Amico. "A prospective customer may want to find out what products a company offers, but if the web site has been set up to display products and services by business unit, it may fail to meet that customer's need," he says. "The key thing on the web is that you only have one chance to do things right or people are going to click and go somewhere else. You've got to make your site sticky, so people keep coming back to it."

Design for Six Sigma (DFSS) methods and approaches, says Amico, can be very useful in helping a company delineate and differentiate one customer's needs from others. Of particular help, says Amico, is a Six Sigma methodology he has devised called *DFSS @ e-speed.* The measuring phase of this methodology is designed to probe deeply into customer user and buying preferences, not only through traditional voice-of-the-customer surveys and phone interviews, but also through actual observation of web users to understand their behavioral habits in front of a computer terminal.

By using the tools and techniques of *DFSS @ e-speed,* Amico says it's possible for companies to do an almost limitless amount of web site customization to accommodate the needs of different users. However, he says, as part of the web site design process, a company will typically conduct a cost-benefit analysis, prioritize customer requirements using specific *DFSS-@-e-speed* tools, then roll out periodic new releases of its web site as part of "a multi-generation approach to web design and development."—*The Authors*

*Peter Amico, Telephone interview with Richard Koonce, PricewaterhouseCoopers, Los Angeles, CA, 14 December 2001.

language and framework with which to set business goals and targets for e-ventures, and align employees [e.g., in research and development (R&D), sales and marketing, distribution, customer service, order fulfillment, and account management] to meet those goals.

Fourth, Strategic Six Sigma principles and methods will be employed to help companies form e-partnerships with one another. They will be used to develop clearly understood and mutually agreed-to levels of business performance, customer service, and process measurement and improvement to which all parties to such e-partnerships will agree. In so doing, they will help sustain high levels of product quality and service reliability.

Fifth, introduction of Strategic Six Sigma thinking and methods can help identify and codify e-business best practices, in everything from systems technology to security and strategy. The value of this is undeniable. Notes Cathy Neuman, PwC's deputy global e-business leader, "No one wants to slow down in the online industry, but the truth is that we've seen many companies—from start-up dot-coms to household names—trying to sprint ahead with their business plans when they haven't mastered their walking skills or in some cases, their crawling skills."[9] Neuman adds that given the risks involved with any e-business venture, it's critical that a company have frameworks in place so that a company's "progress can be measured, against its competitors, its markets and its industry, [and also] against the company's own expectations and those with whom it does business."[9]

Finally, the power of Strategic Six Sigma thinking and business practices to create synergy and focus among people in an organization (by defining goals and providing feedback mechanisms to monitor performance) will become increasingly important as companies' e-business models

mature and as customer needs become more complex. An example would be as a company moves from the relatively simple process of putting sales and marketing channels on the web to transforming its supply chain and managing strategic e-partnerships among customers, suppliers, financial institutions, and other parties to e-business transactions.

➤ Supply Chain Planning and Design

Still other environmental pressures are putting stress on companies today, forcing firms to continuously redesign their business models to keep costs in check, and to ensure sustained customer satisfaction and responsiveness. For example, in today's business environment where speed is everything, the design of responsive supply chains—those that either anticipate or quickly respond to the needs of customers and that create virtual, web-based networks of companies, customers, and suppliers—is becoming a priority for companies. One company we know, a worldwide provider of B2B Internet services, is pioneering the development of such supply chains. It links companies, their customers, and their suppliers together in a virtual worldwide web of interactive and interdependent relationships, with transaction speed being one of the key criteria of its business performance. It keeps track of this performance using a highly unique performance dashboard that incorporates use of Six Sigma principles to gauge business performance on a daily basis.

Other companies using Strategic Six Sigma practices to design (or redesign) their supply chains include 3M, under its new chairman and chief executive, Jim McNerney. In January 2001, McNerney, a GE veteran, told analysts that he expected Six Sigma to save 3M hundreds of millions of dollars through

better and more efficient materials sourcing. He also anticipated that Six Sigma would contribute $300 million to $450 million in pretax income in 2001.[10] Much of that, McNerney predicted, would come not just from slashing costs but also from boosting top-line revenue growth. "I've seen firsthand how Six Sigma can energize an organization, how it can lower costs, increase sales and cash flow, and satisfy customers by truly producing higher-quality products and faster response," he notes.[11]

Using Strategic Six Sigma to Facilitate Supply Chain Redesign

If implemented correctly at the leadership level and cascaded throughout all levels of an organization, Strategic Six Sigma methods and work practices can help streamline the design and operation of supply chains in *any* industry. They can

- Help link companies, customers, and suppliers together with a common set of metrics, operating parameters, and performance expectations
- Be used to align the organizational designs and priorities of different strategic e-partners to meet the needs of common customers
- Be used in other ways to integrate new and existing business processes (e.g., Lean Manufacturing, and sales and marketing), increase customer service levels, enhance inventory management, speed deliveries, reduce cycle times, and lower product and supply chain costs.

➤ Customer Relationship Management

In the words of Sergio Zyman, former Chief Marketing Officer of the Coca-Cola Company and author of *The End of Marketing*

as We Know It, the business marketplace today is a "consumer democracy," a place where consumers have a proliferating number of options for everything from toasters and computers to industrial machinery and the latest handheld technology. In such an environment, he says, marketing must be a "science." It must be about "experimentation, measurement, analysis, refinement, and replication."[12]

We argue that every process in business nowadays—from product development and sales to R&D, distribution, and customer care—needs to be viewed as a business science. What's more, every business process needs to be subjected to regular experimentation, measurement, analysis, and refinement. That's because companies can no longer rely on guesswork or intuition to help them design their processes or anticipate customer needs. Instead, businesses must be managed by fact, with a scrupulous and robust approach to ascertaining CCRs (regardless of the product or industry) and fulfilling those CCRs on a consistent basis. This, of course, is the very heart of what Six Sigma is about—reducing defects in processes—including a company's customer relationship management processes. Later in this book, we'll describe what companies like Dow Chemical, Johnson Controls, and Air Products and Chemicals are doing to forge strong bonds with their customers, using Strategic Six Sigma principles and practices as the basis for doing this.

Using Strategic Six Sigma to Support Customer Relationship Management

Suffice it to say here, however, that when they are applied systematically to the arena of customer relationship management, Strategic Six Sigma principles and practices can help companies to

- Define their customer strategies and better understand the nature and needs of individual customer or market segments
- Conduct market research that can be used for product enhancement or the creation of new products and services
- Create effective channel and product strategies (in other words, the means by which a company will deliver products and services cost effectively)
- Put the right infrastructure in place to support *all* dimensions of customer care: from new business development, market analysis, and segmentation, to the careful development and nurturing of key accounts and creation of long-term customer loyalty
- Create the ultimate in customized products and services
- Monitor conformance to customer requirements through real-time customer dashboards (see Chapter 6)

➤ National and Global Brand Building

Building (or revitalizing) a brand name is all about enhancing the goodwill and value that customers place on that name, so it's intimately related to customer satisfaction and loyalty. These factors, in turn, help determine the premium that the market will pay for a brand name that is immediately associated with quality, reliability, service, or integrity.

Driving customer brand name recognition to high levels is a two-edged sword. The Firestone brand is a household name in the United States. But after the American public was deluged with negative press coverage following the Ford Explorer/Firestone tire incidents, its market share suffered

terribly. And regardless of the final root cause analysis of those events, the Ford and Firestone names have been greatly tarnished.

Notwithstanding that, the tremendous market success of other companies with household names (e.g., IBM, McDonald's, Intel, and Dell) proves that there is tremendous market leverage to be gained from a well-known name and a reliable brand. Consider the example of ServiceMaster, a home services company built on the acquisition of numerous recognizable names including Terminix, TruGreen ChemLawn, TruGreen LandCare, American Residential Services, Rescue Rooter, American Mechanical Services, ServiceMaster Clean, American Home Shield, AmeriSpec, Merry Maids, Furniture Medic, and The ServiceMaster Home Service Center. Recently, the company embraced Six Sigma as part of a multidimensional strategy to enhance market recognition of the ServiceMaster name as a provider of high-value multiple household services and products. The first waves of Six Sigma projects the company undertook focused on identifying CCRs for each customer base within ServiceMaster's various brands, and on improving customer satisfaction while gaining efficiencies. These projects "are proving to us that Six Sigma principles and practices can be readily applied to our business operations quickly, generating concrete and measurable results," notes Patricia Asp, ServiceMaster's Senior Vice President, and one of the company's executive Six Sigma Sponsors.[13]

Asp says that ServiceMaster is committed to building a high-quality national home services brand that can be leveraged successfully in every regional market. As Six Sigma projects are launched and generate results, "building a common umbrella brand around delivering high customer serv-

ice levels across our many service offerings will be one of the key outcomes of the company's Six Sigma efforts," she says.[13] Indeed, Asp and other ServiceMaster executives recognize that the measurement and continuous improvement dimensions of Strategic Six Sigma will act to drive customer satisfaction levels continuously higher.

➤ New Product Development

In today's business environment, a company's ability to develop and flight-test new products in less time and for less money has become a critical element in remaining competitive. Dow Chemical, for example, has successfully used Six Sigma principles and methods to significantly reduce the time required to grow transgenic cotton, genetically altered cotton that is resistant to pests and certain herbicides.

Shrinking the product development cycle (and at the same time, the corporate learning cycle) is also a huge issue in the pharmaceuticals industry. There, the average R&D time from invention of a new drug through clinical trials, Food and Drug Administration (FDA) approval, and market introduction can run upward of 10 years or more. It requires enormous capital outlays on the part of pharmaceutical manufacturers, with no assurance that their efforts will not be thwarted by some competitor moving faster, who gets the product to market sooner. Issues of long product development cycles are also significant in the aviation and aerospace industries, and in many other areas of the defense establishment. Consequently, a major pharmaceutical company we work with is using Six Sigma to help it prioritize areas for clinical R&D, and to help it design, develop, and field-test new drugs in less time than in the past. In so doing, it is learning and quantifying the effects from the key decisions it

makes as part of the pharmaceutical R&D process. This is extremely valuable information for a company to capture and leverage as it makes key decisions about the allocation of people, capital, and resources.

Strategic Six Sigma practices can be of enormous benefit in supporting R&D and new product introductions in many industries. They can

- ➤ Accelerate a company's learning cycle
- ➤ Help product development teams do field research more quickly and with more quantification and consistency
- ➤ Speed the redesign of initial product designs
- ➤ Ensure rapid information exchange among manufacturers, customers, and suppliers.

How GE Pioneered the Use of Six Sigma for New Product Development

General Electric started using Six Sigma in 1996, and that same year started using Six Sigma statistical tools to fix and design new products. Nowhere did this prove to be more important than in power systems, notes former GE CEO Jack Welch. "In the mid-1990s, when demand for power plants was modest, we were having forced outages in our newly designed gas turbine power plants. Rotors were cracking due to high vibration. A third of the 37 operating units in the installed base had to be removed in 1995."[14] Using Six Sigma methods, however, vibrations were reduced by 300 percent and the problem was totally fixed in late 1996.[14]

In 1998, GE's Medical Systems group introduced a $1.25 million diagnostic scanner, the first GE product ever produced from concept to finish using Six Sigma principles. The scanner, called the Lightspeed, was the end result of some

200 GE employees spending 3 years of work and almost $50 million to run 250 separate Six Sigma analyses. While one team troubleshot the reliability of measurement devices, another team was trying to figure out how to extend the scanner's product life, while still another was "dissecting image quality into factors that could be massaged to filter out picture-blurring electronic noise."[15]

The development of the Lightspeed could not have been accomplished in the absence of a marriage between high-speed computers and Six Sigma quality design methods. The marriage of the two enabled GE's R&D process to conduct thousands of development tests that in the past would not have been humanly feasible. "In Six Sigma analyses, there are thousands of permutations and combinations—probably too many for the human mind to fathom, although easy enough for even a moderately speedy computer," writes *New York Times* business writer Claudia Deutsch, ". . . [M]odern information technology has made Six Sigma a practical way to identify the optimum configuration of most products or processes."[15]

Between 1998 and 2000, GE Medical launched 22 new Six Sigma–designed products, according to Welch, and in 2001, 51 percent of that division's overall revenues were anticipated to come from Six Sigma designs.[14]

GE's Lightspeed project (and others like it) highlight the ways that the strategic use of Six Sigma practices and thinking doesn't just speed up the product development cycle in a company but can also enhance team cohesiveness and organizational alignment in the process. "Six Sigma gets people from all over the organization to work together on improving the end product, not just their individual piece of it," notes Six Sigma consultant Frank Jones.[15]

Other Applications of Strategic Six Sigma Thinking and Methods

There are still other areas of business focus and priority today, where the use of Strategic Six Sigma thinking and best practices can help companies boost business performance and pursue new business strategies.

➤ Sustainable Growth

One of the most interesting and promising new applications of Strategic Six Sigma thinking and business practices is in the chemical and pharmaceutical industries. In the September 2001 issue of *Harvard Business Review,* Du Pont CEO Chad Holliday outlines the way in which Six Sigma, in tandem with other approaches, is being used today, not only to accelerate Du Pont's globalization efforts, but also to help it be a responsible global citizen. "At Du Pont, we have set various stretch goals for 2010, including a reduction of greenhouse gas emissions by two-thirds while holding our energy use flat (using 1990 as a base year). We also plan to increase our use of renewable resources to 10% of our global energy needs," he writes.[16]

How will Du Pont achieve these goals? In big part it will be through a strategy of productivity improvement that includes Six Sigma. Holliday describes how Six Sigma, as a component of Du Pont's productivity improvement efforts, improved the productivity of a plant in Buffalo, New York, by 10 percent without the need for any capital outlays. At this plant, which manufactures Corian, an acrylic-based material used for solid surfaces such as kitchen and bath countertops, a project team discovered that it could accelerate manufacturing lines by boosting the concentration of a

catalyst used to make Corian products. The result was $26 million in added revenue in 2000. This figure might not seem too significant for a company with $30 billion sales, notes Holliday. He adds however, that Du Pont has thousands of such projects underway and is adding 200 new ones each month. "Altogether, our projects using [Six Sigma] methodology are responsible for savings of more than $1 billion a year, and these efforts to improve productivity invariably result in less waste, both in energy and raw material."[16]

Taking a Strategic Approach to Operational Improvement

The Six Sigma projects under way today at Du Pont are all part of a strategic approach to operational improvement that's intended not just to create leaner, more efficient processes but also robust, top-line growth as well. The company's focus on business improvement "elevates productivity from an operational to a more central, strategic level. Many companies consider productivity to be a cost-saving operational issue. We at Du Pont have elevated productivity to the strategic level because we believe that it is central to our efforts in sustainability."[16]

➤ Thinking Big: Using Strategic Six Sigma to Manage Innovation and Assess Emerging Technologies

Traditionally, discussion of disruptive new technologies has been limited to the ways that communications, computer, and information processing technologies either accelerate or otherwise change the nature of business transactions and companies' business models. Certainly, the Internet has played a central role in recent years, not only as a disruptive new technology in its own right, but also as an enabler of

other technologies. For that reason, as Grady Means and company point out in *Wisdom of the CEO,* the management of technical change has joined the management of capital to define the context of competition for twenty-first-century firms and markets.

In light of this statement, however, we believe the definition of *disruptive technologies* itself needs to be expanded. It needs to include not just technologies of business transaction (computers, networks, telecom links, etc.), but also new technologies born of continuing scientific discoveries and technological breakthroughs. New scientific breakthroughs and technological advances often create unexpected inflection points in the lives of businesses by spawning the development of new products, disrupting the marketplace balance of power among competitors, and causing the fortunes of some companies to soar, while putting others out of business.

Think of how the introduction of the automobile displaced the need for buggy whip manufacturers, for example, and of how VHS tape products are now being rapidly displaced by CD and DVD technologies. More to our point here, consider the commercial and financial implications that may eventually flow from increased emphasis on stem cell research (new drugs and new drug therapies). Or, the likely impact that advances in the manufacture of microchips is likely to have on competition in the computer industry.

A single newspaper article, culled from the oceans of business newsprint generated in the world every day, provides a snapshot of how scientific and technological breakthroughs can, in many cases, have enormous downstream business and commercial implications. An August 27, 2001, article in the *New York Times* outlined how, in a bid to move beyond silicon-based computers, IBM recently built a

computer circuit out of a single thread of carbon. The development signifies a significant breakthrough in molecular electronics, the article noted, and a potential inflection point in the life of the computer industry. It holds the promise of enabling IBM to use nanotubes in computer processors, packing up to 10,000 times more transistors into the same amount of space as today's computers do.[17] This could potentially increase the processing power of computer chips exponentially—far beyond anything we know today. In so doing, it could reposition IBM as the sole provider of this new microtechnology to the marketplace!

Using Six Sigma Principles and Practices to Monitor and Manage the Emergence of New Technologies

Increasingly, disruptive new technologies aren't just changing the dynamics of business competition. They are also overturning old, capital-intensive models of business operations and organization, and changing the nature of customer and supplier relationships. In a Darwinian sort of way, they're even responsible, in many cases, for determining which companies become critical business players in rapidly morphing industries. For all these reasons, companies need to be able to tap a host of environmental scanning, strategic planning, measurement, and evaluative tools and techniques that will allow them *with their customers* to understand the potential market impact of new technologies, identify new market opportunities, and create new value propositions.

Given its emphasis on collecting facts from customers and the marketplace, and using that data to drive decision making, Strategic Six Sigma principles and practices hold the promise of helping companies and their customers nurture innovation, assess the viability of emerging technolo-

gies, leverage marketplace disruptions, and build new strategic partnerships as never before. Doing this will create new and exciting business opportunities for companies at the nexus of customer need and technological feasibility. (See also the earlier section, "New Product Development.") Once these opportunities are identified, Strategic Six Sigma principles can be used to bring them to the marketplace faster and more effectively.

➤ Managing Business Risk

As we said at the outset of this chapter, no discussion of Strategic Six Sigma would be complete today without mentioning its myriad uses in mitigating business risk, especially in the wake of the financial collapse of companies like Enron and Global Crossing, and the events of September 11. Business risk today takes many forms, of course: capital exposure, market exposure, exposure of individuals to hazardous situations, potential disruption of Internet and local area network operations, potential disruption of corporate intranet networks, failures of computer security and electronic exchange protocols, cyberespionage, computer hacking, and other forms.

In the wake of the World Trade Center and Pentagon terrorist tragedies of last year, however, discussion of business risk takes on a new meaning—and a new urgency. The events of September 11 brought home the tragic fact that our world is not nearly as secure as we thought. Consequently, we must give more strategic thought to the importance of security and safety issues as part of designing, building, and operating airlines, airports, buildings, and computer systems to eliminate problems that lead to security and safety lapses.

As all businesses today become more global, the business risks associated with operating in a global environment escalate exponentially. "Protecting data and systems worldwide involves far more than technology. Companies are finding it necessary to understand foreign cultures, navigate myriad legal systems, and manage unfamiliar business practices, all the while acknowledging the differences between securing national and international operations," notes technology writer Erik Sherman in the summer 2001 issue of *Catalyst*.[18] Sherman points out that when it comes to managing technology risks, many companies ignore the implications of the weakest-link theory of security. "A company's infrastructure is only as secure as the most vulnerable point of access, including foreign offices and international partners."[18]

Strategic Six Sigma thinking and business practices will no doubt be of great help to companies as they assess the weakest links in their computer, IT, and telecommunications systems; as they brainstorm worst-case business scenarios, develop fail-safe disaster recovery plans, and work to ensure the security of airport and airline customers, tenants of large buildings, and computer and Internet users. All of this has been necessitated as our society comes to grips with operating in a new global environment where customer care strategies, antiterrorism approaches, and high-tech security planning will all need to be considered within the same strategic business context.

■ CONCLUSIONS

As this chapter has shown, Strategic Six Sigma thinking is emerging today as a powerful vehicle that companies can use to operationalize their global strategies, deal with business challenges, and accelerate the achievement of their

business goals. Because Strategic Six Sigma emphasizes the use of data (management by fact) and root cause analysis to drive decision-making, it can invigorate the strategic planning and visioning processes of any company. It can help to foster strong organizational alignment and create leadership focus and commitment around critical business goals and objectives.

Most important, of course, Strategic Six Sigma thinking and best practices can be used in powerful ways to help companies become more customer-centric in everything they do—whether their customers are retail or commercial, in heavy industry, transportation, defense, aerospace, pharmaceuticals, petrochemicals, entertainment, home services, or high tech. Becoming customer-centric is the best edge that any company can develop today, not just to ensure its business survival, but also to guarantee its success in a boisterous new business marketplace. That new marketplace is one in which customers are increasingly in the driver's seat, and where market dominance is determined not by pushing products, but by a firm's ingenuity, agility, and responsiveness in meeting critical customer requirements.

Many years ago, legendary management consultant and author Peter Drucker remarked that the purpose of business is to "create a satisfied customer." This book is designed to show how, by adopting Strategic Six Sigma practices and principles within your organization, you can do exactly that—and create robust quality systems in the process.

But implementing Strategic Six Sigma thinking and methods into an organization is no easy task. It takes strong commitment from the top of an organization, and a clear realization by an organization's top leaders of its potential value to the health and vitality of a company. What's more, implementing successful Strategic Six Sigma initiatives

requires a keen understanding of the dynamics of organizational change, and especially the intangible soft sides of managing people as part of that process.

In Chapter 2, we examine the reason that some Six Sigma initiatives fail to achieve their goals, or fail at least to live up to their full billing. We also suggest ways that any Six Sigma initiative can be effectively implemented and sustained, if a strategic point of view is taken to its implementation, and if people *at all levels* of the organization are engaged to make such initiatives succeed.