

# THE MANAGEMENT AND CONTROL OF QUALITY

FIFTH EDITION

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# PREFACE

Has quality lost its importance? The December 18, 2000 issue of *Business Week* includes an editorial entitled "The War for Better Quality Is Far From Won" written by Jeffrey E. Garten, Dean of the Yale School of Management. He observes: "Whatever happened to the hoopla surrounding quality control in Corporate America? Has the issue slipped from the front page because the war against big-time defects has been won? Or could Corporate America be deluding itself into thinking that quality no longer is the huge problem it once was?" Dean Garten points to the Firestone tire fiasco, recalls of circuit boards by Intel, automobile recalls, poor customer service quality, the lack of a quality framework for e-business, and the need for higher quality standards in biotechnology as reminders that quality problems still abound.

We agree completely—the war for better quality must continue. Today's business and non-profit organizations need to capitalize on the tremendous progress that has been made, particularly with respect to the Malcolm Baldrige National Quality Award. Recently, that award has been expanded to include nonprofit education and health care sectors, and there is increased use of the Baldrige Criteria for Performance Excellence for self-assessment among organizations in all economic sectors.

The Baldrige Criteria continues to evolve as it reflects the most effective management practices that lead to world-class performance. Solectron Corporation and The Ritz-Carlton Hotel Company have received second Baldrige Awards under significantly different criteria than when they initially won the Award, while at the same time expanding their operations globally. In short, the interest in and practice of high-performance quality management principles remains high. Comments from previous Baldrige recipients include: "The Baldrige Award truly embodies the American spirit . . . the Malcolm Baldrige National Quality Award has played a vital role in energizing U.S. companies, helping them gain a competitive edge in the emerging global marketplace. For each of us, the application process uncovered significant opportunities for improving efficiency and customer and employee satisfaction. The recognition of actually receiving the Award reinforced the need to continue improving performance in a marketplace that becomes more competitive every day." This book is intended to reflect and support these remarks.

## CHANGES IN THE FIFTH EDITION

The fifth edition of *The Management and Control of Quality* continues to embrace the fundamental principles and historical foundations of total quality, and to promote high performance management practices that are reflected in the Baldrige Criteria. Several very positive changes have been made to allow for greater instructor flexibility and an improved focus on contemporary thinking.

### Software Supplements

- We are very proud to announce a significant expansion in learning resources permitted through the use of new technology. The textbook now contains a CD-ROM that provides complete Baldrige case studies and features new multimedia cases with QuickTime™ videos, web links to organizations that are tied to each chapter, and a Glossary of terms from the textbook. All this that can be accessed using a Web browser such as Internet Explorer or Netscape.
- In addition, the CD includes The Quality Gamebox, developed by PQ Systems in Dayton Ohio. It is a collection of simulations for teaching concepts of variability, some of which are used in Chapter 9. The CD-ROM also contains all of the major spreadsheet templates used in quantitative examples in Part 3. These files are saved in Microsoft® Excel 2000, 97 and 95 workbook formats and should be accessible to current systems.

### Continuing Our Contemporary Focus

- All chapters have been updated to reflect the most current thinking in the profession. Many new examples, Quality Profiles of all Baldrige winners to date, and new or revised Quality in Practice cases, questions, problems, and end-of-chapter cases are included. A new section, "Projects, Etc.," that provides ideas for student projects and practical field investigation has been added to most chapters.
- New cases and additional examples from organizations around the world emphasize the increasing importance of quality in the global economy. In addition, the increasingly important role of quality in e-commerce has been introduced in many chapters.

### Chapter Reorganization to Increase Flexibility

- Several chapters from the fourth edition have been reorganized and streamlined resulting in a net reduction of one chapter. Our goal was to include an earlier treatment of TQ principles—particularly the notion of process thinking—in Chapter 1: This allows the instructor the flexibility to move directly to Part 3, Technical Issues in Quality, after covering just the first three chapters. Chapter 2 introduces systems thinking as a fundamental concept of total quality, and expands significantly the discussion of quality in health care and education. Chapter 3 now covers both traditional philosophies and contemporary award frameworks (including ISO 9000:2000) in an integrated fashion.
- Chapters 4 through 8 support the Baldrige Criteria and include updated examples of how organizations might respond on a Baldrige-based award application or self-assessment process. These examples use portions of a recent national examiner training case, which is provided on the CD-ROM included in this

book. All of these chapters have been revised to conform closely to the spirit and content of the latest Criteria for Performance Excellence and recent research and practice. We have included new or updated descriptions of leadership theories, high-performance work design, motivation theories, cycle time reduction, the balanced scorecard, design of performance measurement systems, and measuring the return on quality.

- The technical chapters have been reorganized to focus on contemporary thinking and techniques. Chapter 9 is essentially new, and is devoted to statistical thinking and statistical tools. Included is a new and expanded section on experimental design and its application in quality. Chapter 10 focuses on tools for quality improvement, with particular emphasis on Six-Sigma methodology and applications. Chapter 11 includes a new section on the HACCP process and the role of quality control in food processing.
- We combined the two chapters on statistical process control from the fourth edition into one chapter plus an appendix. This provides a more integrated treatment of SPC concepts while still providing theoretical statistical topics in an optional appendix.
- The chapter on Building and Sustaining Total Quality Organizations is now the final chapter, and can be used as a capstone chapter whether the instructor chooses to emphasize the management issues in Part 2 or the technical issues in Part 3.

## OVERVIEW OF THIS BOOK

Part 1 provides an introduction to quality management principles. Chapter 1 introduces the notion of quality, its history and importance, definitions, basic principles, and its impact on competitive advantage and financial return. Chapter 2 explores the role of total quality in all key economic sectors: manufacturing, service, health care, education, and the public sector. The philosophical perspectives supporting total quality, chiefly those of Deming, Juran, and Crosby, as well as award frameworks and ISO 9000 are presented in Chapter 3. This chapter also describes the Malcolm Baldrige National Quality Award and the Criteria for Performance Excellence as a framework for management planning and action to achieve TQ, and forms the basis for Part 2.

Part 2 focuses on the management system, which is concerned with planning to meet customers' needs; arranging to meet those needs through leadership and strategic planning; and accomplishing goals through the actions of people and work processes. All of this is done with an eye toward continuous improvement; and using data and information to guide the decision-making process. In Chapter 4, the focus is on understanding customers and their needs, and practices to achieve customer satisfaction. Leadership and strategic planning are the focus of Chapter 5. This chapter includes a discussion of quality and organizational structure and the Seven Management and Planning Tools, with an application to strategic planning. Chapter 6 deals with human resource practices, specifically, the design of high performance work systems and the management of human resources in a TQ environment. Chapter 7 outlines the scope of process management activities, including design, production and delivery, and supplier and partnering processes; and the philosophy of continuous improvement. In Chapter 8, the focus is on the use of data and information to measure and manage organizational performance. This chapter includes discussion

of the linkage of measurement with strategy, the cost of quality, and measuring the return on quality.

Part 3 focuses on basic technical issues, tools, and techniques. Chapter 9 provides a general introduction to statistical thinking and the role of statistical tools and methodology in quality assurance, including experimental design and process capability. Chapter 10 focuses on quality improvement, including management models such as the Deming Cycle, Six-Sigma programs, and the Seven QC tools. Chapter 11 deals primarily with the design of the quality control system and metrology. Chapter 12 introduces statistical process control, focusing on the construction and use of control charts for both variable and attributes data. An optional appendix to Chapter 12 addresses some statistical issues associated with control charts. Chapter 13 addresses reliability in design and production.

Part 4 houses the final chapter of the book, which deals with building and sustaining quality organizations. Coverage includes building a quality infrastructure, understanding and sharing best practices, implementing a TQ strategy, and sustaining it in the midst of change.

### Features and Pedagogy

Each chapter includes Review Questions, which are designed to help students check their understanding of the key concepts presented in the chapter. The management-oriented chapters also include Discussion Questions that are open-ended or experiential in nature, and designed to help students expand their thinking or tie practical experiences to abstract concepts. Most chapters have a section entitled Projects, Etc., which suggests projects that involve field investigation or other types of research. The technical chapters, as well as Chapter 7, Process Management, include Problems designed to help students develop and practice quantitative skills. Finally, each chapter includes several Cases, which are designed to help students apply the concepts to **unstructured or more-comprehensive** situations.

Throughout the book, "Quality Profiles" provide background, important practices, and results for organizations that embrace TQ principles, most of whom are Baldrige winners. At the end of each chapter, "Quality in Practice" case studies are presented that describe real applications of the chapter material. These cases reinforce the chapter concepts and provide opportunities for discussion and more practical understanding. Many of the cases are drawn from real, published, or personal experiences of the authors.

### Possible Course Outlines

Because the textbook material is comprehensive, it normally cannot be covered fully in one course. The textbook is designed to be flexible in meeting instructor needs. We have used it in both undergraduate courses in operations management and in **managerially oriented MBA** electives.

We believe that undergraduate majors in industrial or operations management are best served by developing hands-on knowledge that they will be able to use in their entry-level jobs. Thus a typical course for these undergraduate students might be slanted toward the material in Parts 1, 3, and 4, with some overview of the topics in Part 2. For MBAs, coverage of most of the first 8 to 10 chapters along with Chapter 14 would be more appropriate.

### Note on Company References and Citations

In today's ever-changing business environment, many companies and divisions are being sold or divested, resulting in name changes. For example, Texas Instruments Defense Systems & Electronics Group was sold to Raytheon and is now part of Raytheon Systems Company, and AT&T Universal Card Services was bought by CitiBank. Although we have made efforts to note these changes in the book, others will undoubtedly occur after publication. In citing applications of total quality in these companies, we have generally preserved their original names to clarify that the practices and results cited occurred under their original corporate identities.

### INSTRUCTOR'S SUPPORT MATERIAL

The following support material is available from <http://www.swcollege.com> or the Thomson Learning Academic Resource Center at 800-354-9706. All of these instructor supplements are combined in the **Instructor's Resource CD** (ISBN: 0-324-06683-X).

- **The Instructors' Manual**—Prepared by author William Lindsay, contains teaching suggestions and answers to all end-of-chapter questions, exercises, problems, and cases.
- **Power Point™ presentation slides**—Prepared by author Jim Evans for use in lectures.
- **Test Bank and Exam View® & Exam View® Pro**—Prepared by Matthew Ford of Northern Kentucky University, the Test Bank includes true/false, multiple choice, and short answer questions for each chapter. ExamView computerized testing software allows instructors to create, edit, store, and print exams. ExamView Pro provides online (computer-based or Internet-based) testing.

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**We will continue to do our best to improve this book in our quest for quality and to spread what we truly believe is a fundamentally important message to future generations of business leaders. We encourage you to contact us at our e-mail addresses shown below with any comments or improvement suggestions that you may have.**

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# THE QUALITY SYSTEM

Unless you live in Webster, New York, you probably have never heard of Trident Precision Manufacturing, Inc. The privately held company was formed in 1979 with three people. By 1996 it had grown to 167 people with revenues of \$14.5 million. Rates of return on assets consistently exceed industry averages, customers rate the quality of Trident's products at 99.8 percent or better, and the company has never lost a customer to a competitor. In 1996 Trident received the Malcolm Baldrige National Quality Award, the United States' highest recognition for performance excellence.

How did Trident achieve such success? When CEO Nicholas Juskiw wrote his vision statement he said:

*My Vision for Trident is one in which each of us shares in the responsibility, growth, and benefits of becoming a world-class organization. How will we, as a team, achieve this? Through quality! Not just the quality of each individual part but through Total Quality—in everything we say and do. . . . As a strong team, with each headed in the same direction, we can become the unquestionable leader that our Customers, Industry, and Community look up to.*

Trident's total quality quest began in 1988, when Juskiw attended a symposium offered by Xerox Corporation—one of the first U.S. companies to embrace the quality concept—about its Leadership Through Quality strategy. During the 1980s and 1990s, quality was a common buzzword from CEOs down to workers on the shop floor. Attention to quality revitalized many companies in the United States and many other nations, helped contribute to global trade, and increased the value of goods and services that all consumers purchase. During this time, quality became the feature article of every major business magazine and metropolitan newspaper.

Today, we hear much less about quality in business, except when things go wrong. As the *Los Angeles Times* reported, for example, "In the early 1990s government auditors found that McDonnell Douglas employees performed slipshod work, used out-of-date blueprints and improperly inspected parts—all as the financially troubled company was scrambling to keep planes rolling off the assembly line." Some have suggested that these flaws were tied to the January 31, 2000, crash of an Alaskan Airlines jet that killed 88 people, which had been delivered during that period of time.<sup>1</sup> And the Census Bureau mailed 120 million misaddressed letters for the 2000 census, described as a "regrettable mistake" that should have been caught by the government's quality control procedures.<sup>2</sup>

We believe that less attention is paid to quality today as the result of two forces—a “good-news, bad-news” type of story. The good news is that the principles of quality that were new to many organizations in the early 1980s have become a common part of routine management practice; in other words, quality is so ingrained in the cultures of many organizations that managers and employees need not consciously think about it. The bad news is that for many other organizations, quality was viewed as a short-term fix; when the hype and rhetoric passed, so did their quality efforts. Quality often still takes a backseat to economic pressures. Nevertheless, quality has not faded away, and will not fade away, simply because *it works*, with clear evidence that it improves the bottom line. Quality efforts are alive and well, perhaps under a different moniker in some organizations, and will remain an important part of a continual quest for improving performance across the globe.

Joseph Juran, one of the most respected leaders of quality in the twentieth century, suggested that the past century will be defined by historians as the century of productivity. He also stated that the next century has to be the century of quality. “We’ve made dependence on the quality of our technology a part of life.”<sup>3</sup> As a member of the emerging generation of business leaders, you have an opportunity and a responsibility to improve the quality of your company and society, not just for products and services, but as Trident’s vision states, in everything you say and do.

Part 1 introduces the basic concepts of quality. Chapter 1 discusses the history, definition, basic principles of quality, and the impact of quality on competitive advantage and business results. Chapter 2 describes the role of total quality in different types of organizations—manufacturing, service, health care, education, and government—and stresses the importance of taking a systems perspective of quality throughout an organization. Chapter 3 introduces the management philosophies on which modern concepts of quality are based, and managerial frameworks—particularly the Malcolm Baldrige Criteria for Performance Excellence—that guide today’s organizational approaches to improvement and performance excellence. These topics provide the foundation for the key quality principles and practices that are the subject of the remainder of the book.

# CHAPTER 1

## INTRODUCTION TO QUALITY

### OUTLINE

#### THE HISTORY AND IMPORTANCE OF QUALITY

- The Age of Craftsmanship
- The Early Twentieth Century
- Post-World War II
- The U.S. Quality Revolution

#### QUALITY PROFILE: Xerox Corporation

- Business Products and Systems

#### QUALITY PROFILE: AT&T Power Systems

- From Product Quality to Performance Excellence
- Current and Future Challenges

#### DEFINING QUALITY

- Judgmental Criteria
- Product-Based Criteria
- User-Based Criteria
- Value-Based Criteria
- Manufacturing-Based Criteria
- Integrating Perspectives on Quality
- Customer-Driven Quality

#### QUALITY AS A MANAGEMENT FRAMEWORK

- Principles of Total Quality
- Infrastructure, Practices, and Tools

#### QUALITY AND COMPETITIVE ADVANTAGE

- Quality and Business Results

#### QUALITY PROFILE: Globe Metallurgical, Inc.

#### THREE LEVELS OF QUALITY

- Quality and Personal Values

#### QUALITY IN PRACTICE: The Xerox

- Transformation

#### QUALITY IN PRACTICE: Building Trust

- Through Quality at Gerber

#### SUMMARY OF KEY POINTS

#### REVIEW QUESTIONS

#### DISCUSSION QUESTIONS

#### PROJECTS, ETC.

#### CASES A Tale of Two Restaurants

- A Total Quality Business Model

- Deere & Co.

Quality is not a new concept in modern business. In October 1887, William Cooper Procter, grandson of the founder of Procter & Gamble, told his employees, “The first job we have is to turn out quality merchandise that consumers will buy and keep on



buying. If we produce it efficiently and economically, we will earn a profit, in which you will share."

Mr. Procter's statement addresses three issues that are critical to managers of manufacturing and service organizations: *productivity*, *cost*, and *quality*. Productivity (the measure of efficiency defined as the amount of output achieved per unit of input), the cost of operations, and the quality of the goods and services that create customer satisfaction all contribute to profitability. Of these three determinants of profitability, the most significant factor in determining the long-run success or failure of any organization is quality. Good quality of goods and services can provide an organization with a competitive edge. Good quality reduces costs due to returns, rework, and scrap. Good quality increases productivity, profits, and other measures of success. Most importantly, good quality generates satisfied customers, who reward the organization with continued patronage and favorable word-of-mouth advertising. Quality has even become a focal point for industry-union cooperation. In working with Chrysler Corporation (now Daimler-Chrysler) to improve quality, a vice president of the United Auto Workers (UAW) succinctly stated the importance of quality: "No quality, no sales. No sales, no profit. No profit, no jobs."

In this chapter we examine the notion of quality. We discuss its history, its importance in business, and its role in building and sustaining competitive advantage.

## THE HISTORY AND IMPORTANCE OF QUALITY

In a broad sense, **quality assurance** refers to any action directed toward providing consumers with products (goods and services) of appropriate quality. Quality assurance, usually associated with some form of measurement and inspection activity, has been an important aspect of production operations throughout history.<sup>1</sup> Egyptian wall paintings circa 1450 B.C. show evidence of measurement and inspection. **Stones for the pyramids were cut so precisely that even today it is impossible to put a knife blade between the blocks.** The Egyptians' success was due to the consistent use of well-developed methods and procedures and precise measuring devices.

### The Age of Craftsmanship

During the Middle Ages in Europe, the skilled craftsperson served both as manufacturer and inspector. "Manufacturers" who dealt directly with the customer took considerable **pride in workmanship**. **Craft guilds, consisting of masters, journeymen, and apprentices, emerged to ensure that craftspeople were adequately trained.** Quality assurance was informal; every effort was made to ensure that quality was built into the final product by the people who produced it. These themes, which were lost with the advent of the Industrial Revolution, are important foundations of modern quality assurance efforts.

During the middle of the eighteenth century, a French gunsmith, Honoré Le Blanc, **developed a system for manufacturing muskets to a standard pattern using interchangeable parts.** Thomas Jefferson brought the idea to America, and in 1798 the new U.S. government awarded Eli Whitney a contract to supply 10,000 muskets to the government in two years' time. The use of interchangeable parts necessitated careful control of quality. Whereas a customized product built by a craftsperson can be tweaked and hammered to fit and work correctly, random matching of mating parts provides no such assurance. The parts must be produced according to a carefully designed standard. Whitney designed special machine tools and trained unskilled workers to make parts following a fixed design, which were then measured and compared to a model. But he underestimated the effect of variation in production

processes (an obstacle that continues to plague companies to this day). Because of the resulting problems, Whitney needed more than 10 years to complete the project. Nonetheless, the value of the concept of interchangeable parts was recognized, and it eventually led to the Industrial Revolution, making quality assurance a critical component of the production process.

### The Early Twentieth Century

In the early 1900s the work of Frederick W. Taylor, often called the father of Scientific Management, led to a new philosophy of production. Taylor's philosophy was to separate the planning function from the execution function. Managers and engineers were given the task of planning; supervisors and workers, the task of execution. This approach worked well at the turn of the century, when workers lacked the education needed for doing planning. By segmenting a job into specific work tasks and focusing on increasing efficiency, quality assurance fell into the hands of inspectors. Manufacturers were able to ship good-quality products, but at great costs. Defects were present, but were removed by inspection. Plants employed hundreds, even thousands, of inspectors. Inspection was thus the primary means of quality control during the first half of the twentieth century.

Eventually, production organizations created separate quality departments. This artificial separation of production workers from responsibility for quality assurance led to indifference to quality among both workers and their managers. Concluding that quality was the responsibility of the quality department, many upper managers turned their attention to output quantity and efficiency. Because they had delegated so much responsibility for quality to others, upper managers gained little knowledge about quality, and when the quality crisis hit, they were ill-prepared to deal with it.

Ironically, one of the leaders of the industrial revolution, Henry Ford, Sr., developed many of the fundamentals of what we now call "total quality practices" in the early 1900s. This approach was discovered when Ford executives visited Japan in 1982 to study Japanese management practices. As the story goes, one Japanese executive referred repeatedly to "the book," which the Ford people learned was a Japanese translation of *My Life and Work*, written by Henry Ford and Samuel Crowther in 1926 (New York: Garden City Publishing Co.). "The book" had become Japan's industrial bible, and Ford Motor Company had strayed from its principles over the years. The Ford executives had to go to a used bookstore to find a copy when they returned to the United States.

The Bell System was the leader in the early modern history of industrial quality assurance.<sup>2</sup> It created an inspection department in its Western Electric Company in the early 1900s to support the Bell operating companies. Even though the Bell System achieved its noteworthy quality through massive inspection efforts, the importance of quality in providing telephone service across the nation led Bell to research and develop new approaches. In the 1920s employees of Western Electric's inspection department were transferred to Bell Telephone Laboratories. The duties of this group included the development of new theories and methods of inspection for improving and maintaining quality. The early pioneers of quality assurance—Walter Shewhart, Harold Dodge, George Edwards, and others including W. Edwards Deming—were members of this group. It was here that the term *quality assurance* was coined. These pioneers developed many useful techniques for improving quality and solving quality problems. Thus, quality became a technical discipline of its own.

The Western Electric group, led by Walter Shewhart, ushered in the era of statistical quality control (SQC). SQC is the application of statistical methods for controlling qual-

ity. SQC goes beyond inspection; it is focused on identifying and eliminating the problems that cause defects. Shewhart is credited with developing control charts, which became a popular means of identifying quality problems in production processes and ensuring consistency of output. Others in the group developed many other useful statistical techniques and approaches.

During World War II the U.S. military began using statistical sampling procedures and imposing stringent standards on suppliers. The War Production Board offered free training courses in statistical methods that had been developed within the Bell System. The impact on wartime production was minimal, but the effort developed quality specialists, who began to use and extend these tools within their organizations. Thus, statistical quality control became widely known and gradually adopted throughout manufacturing industries. Sampling tables labeled MIL-STD, for military standard, were developed and are still widely used today. The discipline's first professional journal, *Industrial Quality Control*, was first published in 1944, and professional societies—notably the American Society for Quality Control (now called the American Society for Quality, <http://www.asq.org>)—were founded soon after.

### Post-World War II

After the war, during the late 1940s and early 1950s, the shortage of civilian goods in the United States made production a top priority. In most companies, quality remained the province of the specialist. Quality was not a priority of top managers, who delegated this responsibility to quality managers. Top management showed little interest in quality improvement or the prevention of defects and errors, relying instead on mass inspection.

During this time, two U.S. consultants, Dr. Joseph Juran and Dr. W. Edwards Deming, introduced statistical quality control techniques to the Japanese to aid them in their rebuilding efforts. A significant part of their educational activity was focused on upper management, rather than quality specialists alone. With the support of top managers, the Japanese integrated quality throughout their organizations and developed a culture of continuous improvement (sometimes referred to by the Japanese term *kaizen*, pronounced ki-zen). Back in 1951, the Union of Japanese Scientists and Engineers (JUSE) instituted the Deming Prize (see Chapter 3) to reward individuals and companies who meet stringent criteria for quality management practice.

Improvements in Japanese quality were slow and steady; some 20 years passed before the quality of Japanese products exceeded that of Western manufacturers. By the 1970s, primarily due to the higher quality levels of their products, Japanese companies had made significant penetration into Western markets. One of the more startling facts was reported in 1980 by Hewlett-Packard. In testing 300,000 16K RAM chips from three U.S. and three Japanese manufacturers, Hewlett-Packard found that the Japanese chips had an incoming failure rate of zero failures per 1,000 compared to rates of 11 and 19 for the U.S. chips. After 1,000 hours of use, the failure rate of the U.S. chips was up to 27 times higher. In a few short years, the Japanese had penetrated a major market that had been dominated by U.S. companies. The automobile industry is another, more publicized, example. The June 8, 1987, *Business Week* special report on quality noted that the number of problems reported per 100 domestic new car models in the first 60 to 90 days of ownership averaged between 162 and 180. Comparable figures for Japanese and German automobiles were 129 and 152, respectively. The U.S. steel, consumer electronics, and even banking industries also were victims of global competition. U.S. business recognized the crisis.

### The U.S. Quality Revolution

The decade of the 1980s was a period of remarkable change and growing awareness of quality by consumers, industry, and government. During the 1950s and 1960s, when "made in Japan" was associated with inferior products, U.S. consumers purchased domestic goods and accepted their quality without question. During the 1970s, however, increased global competition and the appearance of higher-quality foreign products on the market led U.S. consumers to consider their purchasing decisions more carefully. They began to notice differences in quality between Japanese- and U.S.-made products, and they began to expect and demand high quality and reliability in goods and services at a fair price. Consumers expected products to function properly and not to break or fail under reasonable use, and courts of law supported them. Extensive product recalls mandated by the Consumer Product Safety Commission in the early 1980s and the intensive media coverage of the Challenger space shuttle disaster in 1986, in which the Challenger exploded shortly after takeoff killing all seven astronauts, increased awareness of the importance of quality. Consequently, consumers are more apt than ever before to compare, evaluate, and choose products critically for total value—quality, price, and serviceability. Magazines such as *Consumer Reports*, newspaper reviews, and the Internet make this task much easier.

Obviously, the more technologically complex a product, the more likely it is that something will go wrong. Government safety regulations, product recalls, and the rapid increase in product liability judgments have changed society's attitude from "let the buyer beware" to "let the producer beware." Businesses have seen that increased attentiveness to quality is vital to their survival. Xerox (see *Quality Profile*) discovered that its Japanese competitors were selling small copiers for what it cost



### QUALITY PROFILE

#### XEROX CORPORATION BUSINESS PRODUCTS AND SYSTEMS

Xerox Business Products and Systems (BP&S), headquartered in Stamford, Connecticut, employs more than 50,000 people at 83 U.S. locations. It manufactures more than 250 types of document-processing equipment and generates more than half of the corporation's domestic revenues. Copiers and other duplicating equipment account for nearly 70 percent of BP&S revenues. The company attempts to define quality through the eyes of the customer. By analyzing a wide variety of data gathered by exhaustive collection efforts, including monthly surveys of about 40,000 equipment owners, the company identifies important customer requirements. This information is used to develop concrete business plans with measurable targets for achieving the quality improvements necessary for meeting

customers' needs. Xerox measures its performance in approximately 240 key areas of product, service, and business performance relative to world leaders, regardless of industry.

In the five years of continuous improvement culminating in the firm's winning the Malcolm Baldrige National Quality Award in 1989, defects per 100 machines were decreased by 78 percent, unscheduled maintenance was decreased by 40 percent, and service response time was improved by 27 percent. These successes seem to affirm the Xerox Quality Policy statement that "Quality is the basic business principle at Xerox."

Source: Malcolm Baldrige National Quality Award Profiles of Winners, National Institute of Standards and Technology, Department of Commerce.

Xerox to make them. A Westinghouse (now CBS) vice president of corporate productivity and quality summed up the situation by quoting Dr. Samuel Johnson's remark: "Nothing concentrates a man's mind so wonderfully as the prospect of being hanged in the morning." Quality excellence became recognized as a key to worldwide competitiveness and was heavily promoted throughout industry.<sup>3</sup> Most major U.S. companies instituted extensive quality improvement campaigns, focused not only on improving internal operations, but also on satisfying external customers.

One of the most influential individuals in the quality revolution was W. Edwards Deming. In 1980 NBC televised a special program entitled "If Japan Can . . . Why Can't We?" The widely viewed program revealed Deming's key role in the development of Japanese quality, and his name was soon a household word among corporate executives. Although Deming had helped to transform Japanese industry three decades earlier, it was only then that U.S. companies asked for his help. From 1980 until his death in 1993, his leadership and expertise helped many U.S. companies—such as Ford Motor Company, General Motors, and Procter & Gamble—to revolutionize their approach to quality.

As business and industry began to focus on quality, the government recognized that quality is critical to the nation's economic health. In 1984 the U.S. government designated October as National Quality Month. In 1985 NASA announced an Excellence Award for Quality and Productivity. In 1987 the Malcolm Baldrige National Quality Award (see Chapter 3), a statement of national intent to provide quality leadership, was established by an Act of Congress. The Baldrige Award has become the most influential instrument for creating quality awareness among U.S. businesses. In 1988 President Reagan established the Federal Quality Prototype Award and the President's Award for governmental agencies.

From the late 1980s and through the 1990s, interest in quality grew at an unprecedented rate, fueled in part by publicity from the Malcolm Baldrige National Quality Award. Companies made significant strides in improving quality. In the automobile industry, for example, improvement efforts by Chrysler, General Motors, and Ford reduced the number of problems reported per 100 domestic cars in the first 60 to 90 days of ownership from about 170 in 1987 to 136 in 1991. The gaps between Japanese and U.S. quality began to narrow, and U.S. firms regained much of the ground they had lost.

By 1989 Florida Power and Light was the first non-Japanese company to be awarded Japan's coveted Deming Prize for quality; AT&T Power Systems (see *Quality Profile*) was the second in 1994. Quality practices expanded into the service sector and into such nonprofit organizations as schools and hospitals. By 1990, quality became the principal driver in nearly every organization's quest for success. By the mid-1990s thousands of professional books had been written, and quality-related consulting and training had blossomed into an industry. Companies began to share their knowledge and experience through formal and informal networking. New quality awards were established by the federal government under the Clinton administration. The majority of states in the United States developed award programs for recognizing quality achievements in business, education, nonprofits, and government. In 1999, Congress added nonprofit education and health care sectors to the Baldrige Award.

### From Product Quality to Performance Excellence

Although quality initiatives focused initially on reducing defects and errors in products and services through the use of measurement, statistics, and other problem-solving tools, organizations began to recognize that lasting improvement could not



## QUALITY PROFILE AT&T POWER SYSTEMS

AT&T Power Systems, based in Mesquite, Texas, employs 2,400 people and makes electrical power systems for telecommunications equipment. Although the company won Japan's Deming Prize in 1994, it set out on its quality journey in 1990 to improve its business, not to win an award. The objective was to improve quality without building extensive bureaucracy—a problem that had arisen at Florida Power and Light.

In early 1992 AT&T Power Systems worked with the Union of Japanese Scientists and Engineers (JUSE) consultants to implement total quality management processes. In mid-1993 they invited JUSE experts back to assess their quality systems. The consultants provided extensive feedback and indicated that the firm's performance could make it a contender for the Deming Prize.

In pursuing the award, the company submitted a 400-page application and subjected its managers to four days of questioning by Japanese examiners. All managers were called upon to describe their responsibilities in three minutes and to answer detailed questions, backed up by documentation, for the rest of an hour. (The Deming Prize is discussed in greater detail in Chapter 3.) Since beginning its push for quality, the company has increased its customer base sixfold and cut its inventories in half. It relies on more than 250 employee teams to identify and implement improvements.

Sources: "Bugs Deming, Baldrige on Same Day," and "Deming Legacy Gives Firms Quality Challenge," © USA Today, 19 October, 1994, 1B, 2B. Reprinted with permission.

be accomplished without significant attention to the quality of the management practices used on a daily basis. Managers began to realize that the approaches they use to listen to customers and develop long-term relationships, develop strategy, measure performance and analyze data, reward and train employees, design and deliver products and services, and act as leaders in their organizations are the true enablers of quality, customer satisfaction, and business results. In other words, they recognized that the "quality of management" is as important as the "management of quality." As organizations began to integrate quality principles into their management systems, the notion of total quality management, or TQM, became popular. Quality took on a new meaning of organization-wide performance excellence rather than an engineering-based technical discipline.

Unfortunately, with all the hype and rhetoric (and the unfortunate three-letter-acronym, "TQM"), companies scrambled to institute quality programs. In their haste, many failed. As a result, TQM met some harsh criticism. In reference to Douglas Aircraft, a troubled subsidiary of McDonnell Douglas Corporation, *Newsweek* stated, "The aircraft maker three years ago embraced 'Total Quality Management,' a Japanese import that had become the American business cult of the 1980s. . . . At Douglas, TQM appeared to be just one more hothouse Japanese flower never meant to grow on rocky ground."<sup>4</sup> Other articles in *The Wall Street Journal* ("Quality Programs Show Shoddy Results," May 14, 1992) and the *New York Times* ("The Lemmings Who Love Total Quality," May 3, 1992) suggested that total quality approaches were passing fads and inherently flawed. *Business Week* commentator John Byrne pronounced TQM "as dead as a pet rock" (June 23, 1997, p. 47). However, reasons for TQM failures usually are rooted in poor organizational approaches and management systems, and not in the foundation principles of quality management. In fact, *Business Week's*