The Certified Manager of Quality/ Organizational Excellence Handbook

Third Edition

Also available from ASQ Quality Press:

ASQ Foundations in Quality Self-Directed Learning Series: Certified Quality Manager (CD)
ASQ and Holmes Corporation

The Quality Improvement Handbook
ASQ Quality Management Division and John E. Bauer, Grace L. Duffy, Russell T. Westcott, editors

Root Cause Analysis: Simplified Tools and Techniques
Bjørn Andersen and Tom Fagerhaug

Enterprise Process Mapping: Integrating Systems for Compliance and Business Excellence
Charles G. Cobb

Making Change Work: Practical Tools for Overcoming Human Resistance to Change
Brien Palmer

The Quality Toolbox, Second Edition
Nancy R. Tague

Quality Essentials: A Reference Guide from A to Z
Jack B. ReVelle

Simplified Project Management for the Quality Professional: Managing Small and Medium-Size Projects
Russell T. Westcott

The Path to Profitable Measures: 10 Steps to Feedback That Fuels Performance
Mark W. Morgan

Office Kaizen: Transforming Office Operations into a Strategic Competitive Advantage
William Lareau

Bringing Business Ethics to Life: Achieving Corporate Social Responsibility
Bjørn Andersen

Leadership for Results: Removing Barriers to Success for People, Projects, and Processes
Tom Barker

To request a complimentary catalog of ASQ Quality Press publications, call 800-248-1946, or visit our Web site at www.qualitypress.asq.org.

The Certified Manager of Quality/ Organizational Excellence Handbook

Third Edition

Russell T. Westcott, Editor

Quality Management Division
American Society for Quality

ASQ Quality Press
Milwaukee, Wisconsin

American Society for Quality, Quality Press, Milwaukee 53203

Printed in the United States of America
12 11 10 09 08 07 06 05 5 4 3 2 1

Library of Congress Cataloging-in-Publication Data

Certified manager of quality/organizational excellence handbook / Russell T. Westcott, editor.—3rd ed.
p. cm.
Rev. ed. of: The certified quality manager handbook. 2001.
Includes bibliographical references and index.
ISBN-13: 978-0-87389-678-8 (hardcover : alk. paper)
ISBN-10: 0-87389-678-5 (hardcover : alk. paper)
1. Total quality management—Handbooks, manuals, etc. I. Westcott, Russ, 1927– II. Certified quality manager handbook.

HD62.15.C42 2005
658.4'013—dc22 2005032872

ISBN-13: 978-0-87389-678-8
ISBN-10: 0-87389-678-5

Publisher: William A. Tony
Acquisitions Editor: Annemieke Hytinen
Project Editor: Paul O'Mara
Production Administrator: Randall Benson

ASQ Mission: The American Society for Quality advances individual, organizational, and community excellence worldwide through learning, quality improvement, and knowledge exchange.

Printed in the United States of America

Printed on acid-free paper

ASQ
AMERICAN SOCIETY FOR QUALITY

Quality Press
600 N. Plankinton Avenue
Milwaukee, Wisconsin 53203
Call toll free 800-248-1946
Fax 414-272-1734
www.asq.org
http://qualitypress.asq.org
http://standardsgroup.asq.org
E-mail: authors@asq.org

Table of Contents

List of Figures and Tables

Part III

Part IV

Part VI

Part VII

Preface to the Third Edition

Management of quality continues to play a significant role in organizations as they struggle to deal with ever increasing complexities and challenges in our fast-paced world. Business success depends on their ability to use a wide range of information to define, plan, implement, and control a variety of complex, interdependent tasks using a finite set of data and decreasing resources. Organizations must develop the critical knowledge, interpersonal skills, technical tools, and management techniques needed in today's evolving workplace environment.

Organizations look to ongoing training and certification to enable their employees. The value of certification has never been higher. Many senior leaders recognize that employee certification can improve their company's bottom line and enhance business processes due to increased efficiency.

The original *Certified Quality Manager Handbook* was developed by the Quality Management Division to provide a concise resource for preparing for the certification exam. Forty-four individuals contributed content for the first edition.

Every five years the Body of Knowledge for the Certified Quality Manager Exam is updated to reflect changes in the profession. When the Body of Knowledge was updated in 2000, two division members, Duke Okes and Russ Westcott, took on the project for the second edition. Their work resulted in a reorganization of the entire text and the addition of new material and case studies.

For this third edition, the title of the certification changed to *Certified Manager of Quality/Organizational Excellence.* This title change and the revised 2006 Body of Knowledge reflect the fact that the role of the quality function is continually evolving. Many of the responsibilities for the management of quality are being deployed throughout the organization into other functions. This now requires a much more comprehensive understanding of an organization as a system within the larger system of society. The range of tools and technologies that quality professionals are required to use and/or facilitate is also increasing. The ability to read, interpret, and use financial tools, as well as use the language of cost/profitability when talking to senior management, is more important than ever for quality professionals. A significant reorganization, rewriting, and creating of new content was needed. Once again the division was successful in having one of its members, Russ Westcott, accept the task.

This handbook will be a valuable resource for professionals for several reasons:

- It provides comprehensive guidance for process improvement.
- It describes tools and techniques to drive change.

- It emphasizes sound management principles that have relevance beyond the quality field.
- It is both a primer for new leaders and a go-to manual for experienced professionals.

G. Dennis Beecroft
Chair
Quality Management Division
American Society for Quality

Acknowledgments

To my loving wife, Jeanne Westcott, who has once again endured my grumbling and weird hours as this book has developed and finally gone to press.

To colleagues Duke Okes and Heather McCain, who have assisted me in this endeavor.

To the staff at ASQ Quality Press as well as the hard working copy and production editors who have ably corrected my grammatical goofs, and made valuable suggestions for improvement.

To the contributors to the first and second editions who laid the foundation for this edition.

Russ Westcott
Editor

Introduction

HISTORICAL PERSPECTIVE

In early agricultural situations, quality resulted largely from screening and culling inferior product, and grading the acceptable product. Careful selection of seed and breeding stock, attention to site, and good husbandry lowered the incidence of poor product, but did not eliminate the need to cull and grade. Farmers did their best, but their output was the result of natural processes mostly beyond their control. The "make it, then sort it" approach to quality is still prevalent in this industry.

Craft workers had somewhat more control over their inputs and processes. For example, potters recognized that their outputs varied depending on the type of clay, glaze, and the firing method used. Inherent (undetectable or uncontrollable) variations in materials and methods still limited their ability to make a uniformly high-quality product. Their best work was excellent, but consistency varied. This craft-like setup existed in the preindustrial era where sales, design, manufacturing, finance, and quality were integrated: one worker performed all these functions, perhaps with the help of an apprentice or family members.

This tradition persisted until the development of the factory system, in which supervisors were placed over workers. All employees were concerned with production, but only the supervisor judged quality. A distinction between making product and checking it had been introduced. Factories developed into highly organized enterprises, with much specialization of labor. Quality was still tested in, and the testers and inspectors became a separate, specialized group. Usually, this group was part of manufacturing, close to the point of production and familiar with the needs of other workers.

These assumptions are still made by many: we can only make so much, it will come out in various grades, and better product is rare, so high quality is opposed to high productivity. If quality and productivity are opposed, then it is a conflict of interest for quality control workers and production workers to report to the same managers. To get independent judgment, the quality organizations became autonomous, reporting to their own managers rather than to managers of manufacturing. This was also institutionalized in government contracts.

The foundations of modern quality control were developed by Walter Shewhart, who published *The Economic Control of Quality of Manufactured Goods* in 1931 based on his years of experience at Western Electric. This book advocated techniques better than "make a lot and sort out the good ones." The concepts of measuring and controlling the process, reducing the variation in the system, and

distinguishing between special causes and common causes contributed to a new approach to achieving quality.

During World War II (1940–1945), the military needed large quantities of highly uniform product. A three-second fuse needed to take exactly that long; the consequences of variation were quite unsatisfactory. The propellant charges for artillery shells had to be uniform to control trajectory. Tanks, airplanes, and other equipment had to have closely matched parts to function reliably. Thousands of personnel in the American war industries were trained in the practice of statistical process control (SPC).

For the most part, some engineers (not operators or statisticians) applied quality principles and technologies (especially SPC) and came to be called quality engineers. Because it was recognized that many of the problems experienced in production and service were due to design practices and decisions, a specialized group, reliability engineers, emerged. The experiences of the best-performing organizations made it clear that high levels of quality demanded careful planning, analysis, communication between functions, and close cooperation among all departments.

Modern, enlightened understanding recognizes that increased quality and productivity go hand in hand, so the need for independence and autonomy of the quality function is lessened. The enterprise is more integrated with the adoption of this new view. Each worker is responsible for work quality. Each worker must have the necessary tools and powers to perform work correctly. The production cycle is becoming similar to the days when each worker was master in the shop, dealing with customers, making the product, and checking its quality. Management of the total process or subprocess calls for many skills, requiring highly educated and extremely capable workers.

OBSERVATIONS ABOUT THE QUALITY FUNCTION

In a manufacturing environment, the quality function and manufacturing are often organized in parallel, whether by product or by process. How this is done depends on the size and complexity of the operation, the nature of the customers or markets served, the variety and quantity of products involved, and the variety of processes used. If A employs several dozen people at one site to produce one or two products that are distributed locally and B employs 10,000 people on four continents to make and support dozens of product lines, clearly their quality functions will be very different.

If various parts of the organization are very different, then it may be beneficial to have quality functions at each location. The intent is to have what is needed where it is needed.

The larger the organization, the easier it is to justify the costs of specialized groups located in one central place to serve other groups. Some common examples are laboratories, calibration facilities, auditors, and trainers. It is often more cost-effective to divide the expense of central shared services among many users than to divide the function.

The notion of critical mass says that a certain threshold in size and amount of activity is required for some functions to work well. For example, if equipment used in the quality function requires calibrating only a few times per year, then it

makes little sense to own all the necessary equipment and to have an underutilized expert in calibration. It might be better to make arrangements to outsource the activity. In some circumstances, the quality function might be distributed over many other internal functions.

When total quality management (TQM) has been successfully implemented, the distinctions between staff and line activities can become blurred as empowered teams become responsible for both plans and action when management layers decrease.

The role of the quality function may include:

- *Quality control (QC).* Providing techniques and performing activities that focus on controlling or regulating processes and materials to fulfill requirements for quality. The focus is on preventing defective products or services from being passed on.
- *Quality assurance (QA).* Planned and systematic activities necessary to provide adequate confidence that the product or service will meet the given requirements.
- *Quality management system (QMS).* Defining the structure, responsibilities, procedures, processes, and resources for implementing and coordinating the QMS.
- *Metrology.* Ensuring that the measurements used in controlling quality are meaningful and accurate. Ensuring that measurement equipment is calibrated and traceable to the National Institute of Standards and Technology (NIST).
- *Inspection.* Managing or overseeing the inspection activities.
- *Training.* Providing training and/or training subject matter that supports employee skills training and education in quality-related topics. May also include training for suppliers and for customers.
- *Auditing.* Managing or overseeing the activities involved with auditing products, processes, and the QMS to ensure that the organization's strategies, principles, goals, objectives, policies, and procedures relative to quality are followed.
- *Reliability engineering.* Working with design and production functions, determining the probability of a product performing adequately for a specified length of time under stated conditions with an aim of lowering total cost of ownership of the product and satisfying customers.
- *Initiate and/or participate on problem-solving teams.* Working where needed to apply expertise, such as the tools of quality control and root cause analysis.
- *Supplier quality.* Managing or overseeing the activities that ensure that high-quality suppliers are selected and that incoming purchased parts and materials are acceptable in grade, timeliness, and other characteristics.
- *Product/service design.* Working with sales, design, and other functions to ensure quality in products under development.

The priority (importance and authority) attributed to the quality function is not based on the size of the quality department (budget, head count, floor space, or location in the organization chart), but on consideration of a number of factors, including:

- Emphasis placed on quality goals and objectives
- Total costs of quality and the allocation to the types of costs, that is, prevention, appraisal, and failure costs
- Resources allocated and the time spent on quality by management at all levels, especially the higher levels
- Visible and personal involvement in quality efforts by senior leadership

The quality function is not:

- A prevention squad. When the quality department is viewed as the owner of quality, the rest of the organization abdicates its role and responsibility.
- Oriented toward defect detection.
- A screen or barrier to protect the customer from problems and defects. Advertisements may emphasize that the customer can be confident of satisfaction "because we have x number of inspectors and testers checking the product." This is an admission that an organization does not have dependable processes for making a good product.
- Just one more task among many. This occurs when managers and workers approach quality as another task on top of or after all the other tasks.

Quality is an extremely important function in an organization, but it is not the only important function. The quality function needs to practice humility in dealing with other functions within the organization. Quality is not alone in bringing about success for the organization and is not exempt from blunders, mistakes, poor judgment, or human error. There are good and bad ways to work for quality. Thus, the quality function should be scrutinized just as any other function is evaluated and continually improved.

BIG Q AND LITTLE q

Dr. Joseph M. Juran contrasted the difference between managing to achieve quality across the board, in all functions of the organization, and for all products and services (Big Q) with managing for quality on a limited basis (little q). Quality control activities are little q. Quality assurance may be little q or Big Q depending on how it functions within an organization.

LEVELS OF ORGANIZATIONAL MATURITY

To gain an overall perspective of the implications of applying quality principles and practices, scan Table I.1.

Table I.1 Levels of organizational maturity. What is your organization's level?

Level 1	Level 2	Level 3	Level 4	Level 5
Dysfunctional System	**Awakening System**	**Developing System**	**Maturing System**	**World-Class System**
Economy-of-scale focus with long runs preferred. Time-consuming change-overs are the norm. The customers' voice is rarely heard, and then only at the top.	Quality steering committee has been formed; quality systems are assessed; quality initiatives are planned. A customer focus is a goal.	Tested practices are deployed to all major areas of the factory. Customer involvement is sought.	Seeks out and learns about best practices. Adapts improved practices for all areas. Customers, suppliers, and employees are integrated into the systems.	Retaining satisfied customers is key. Plant uses single-piece flow with cellular techniques. Improved throughput achieved through reduction of bottlenecks.
Rigid plant layout; nonintegrated systems, erratic workflow prevalent. Buffer stock everywhere. All jobs are rush. Firefighting is the norm.	Applicable lean management practices have been identified. Training is being conducted.	Flexible production layouts and cells are introduced. Cleanliness and neatness of individual work areas is stressed.	Production system allows short runs, greater product mix, speedy introduction of new products, and shorter cycle times.	Plant layout is agile and clean. Workers are self-inspecting their work. Lean manufacturing tools and techniques are liberally applied.
Machinery runs at maximum speed without regard for its life or performance quality. Workplace is unorganized and unclean.	A small project is under way to implement and test improved quality management practices.	Pull-type production system under test in one area. Employee qualification system is in place.	Operating information is provided immediately with computerized displays. Errors are prevented with mistake-proofing devices.	Preventive maintenance ensures availability and optimizes quality, efficiency, and lifecycle cost.

Continued

Table I.1 Levels of organizational maturity. What is your organization's level? *(Continued)*

Level 1	Level 2	Level 3	Level 4	Level 5
Dysfunctional System	**Awakening System**	**Developing System**	**Maturing System**	**World-Class System**
No teamwork. Fiefdoms fiercely guarded from encroachment by other functions. No linkage between any overall strategy and production scheduling.	Bottlenecks and non-value-added functions in process flow are being examined. An equipment maintenance program is under development.	Cross-functional teams promote adherence to standards and ensure continuous improvement.	Teams, some self-managed, aid adherence to high standards, the focus on customers, and continual improvement.	Management is personally and visibly involved in continual improvement. Quality of information and decision making at all levels is exemplary.
Management by command. Poor workforce commitment and involvement.	A cross-functional team is being initiated to work on cycle-time reduction.	Systems are implemented to provide data for performance measurement, improvement.	An effective strategic planning process is instituted.	All employees are highly motivated, involved, and empowered.
Communication is one-way (downward) with few or no feedback loops.	Weekly production review meetings are held, chaired by the VP manufacturing.		Overall strategy is linked to production planning and process improvement.	Supplier relations are based on collaborative communication and partnerships.
Adversarial supplier relationships focus on price.	A supplier qualification approach is under study.	A supplier certification program is in place.	Plant benchmarked by others in industry.	Plant benchmarked by others outside industry.
Customers frequently get poor quality and delivery.	Overall performance remains below industry norm.	Overall performance is about equal to industry norms.	Performance is above industry norm.	Performance is world-class.

THINKING LIKE A QUALITY MANAGER

The roles and responsibilities of the quality manager and approaches toward quality management vary, depending on the type of industry or the size of the business entity. The Certified Manager of Quality/Organizational Excellence (CMQ/OE) Body of Knowledge (BoK) is a product of inputs from many sources and reflects areas of common interest and importance. The development of actual examination questions is intended to measure the level of knowledge and skill that a person possesses relative to each area of the BoK, regardless of each person's job, company culture, or industry practice.

For individuals planning to take the ASQ CMQ/OE examination, getting into the mind-set of the role for which the certification was designed is the key to a successful outcome. Some recommendations for establishing a successful mind-set in using this study guide and preparing for the examination include:

- Picture or think of yourself as a corporate director of quality for a multifacility organization. In reality, businesses in which products and services are not highly regulated by government legislation and in smaller business enterprises, the quality manager is less likely to have a support staff to perform quality engineering–related tasks and make day-to-day quality decisions. As a result, you might spend the majority of time acting in the capacity of an engineer and assume that mind-set in studying for and taking the exam. A broader mind-set needs to be established for exam purposes.

Individuals taking the CMQ/OE examination need to place themselves in the context of having to think strategically. For instance: after placing yourself in the role of a corporate director of quality for a multifacility business, envision addressing such questions as, "What can the quality function do to help the company identify or implement new initiatives that will enable it to break into new markets?"

- Think of yourself as having to integrate the needs of the quality assurance function with the needs of the management team and all other business processes. In addition to managing the quality department, the quality manager's role includes facilitating deployment of quality approaches in other functional areas, such as supplier quality in purchasing and customer satisfaction in marketing/sales.

- Think in the context of the plan–do–check–act (PDCA) model. Constructed response questions are purposely designed to assess the ability of the test taker to integrate and apply the Body of Knowledge from a broad perspective. Therefore, using PDCA to structure responses will often help ensure more complete answers to many of the described situations.

Keep uppermost in your mind that your role as test taker in answering constructed response questions is not to solve the problem, but to define a process, based on the principles of quality management, that would ensure that the issues presented are effectively addressed. The planning step of the PDCA cycle often also involves first assessing the current situation as well as past efforts before moving forward.

- Develop an understanding of how all the elements of the BoK are interrelated. A good way to practice the use of critical-thinking skills that will further aid

in answering constructed response questions is to select two elements or subelements of the BoK and consider how they are related, such as the linkages between leadership and strategy development/deployment.

A link in one direction is that leadership of the organization is ultimately responsible for both defining and carrying out the strategic management process. Viewed from the reverse direction, when defining strategy the characteristics and processes of leadership that currently exist in the organization should be considered in light of how they will support or block implementation.

STRUCTURE OF THIS HANDBOOK

The handbook follows the Body of Knowledge scheme as set forth in Appendix A. Throughout each section of this handbook, the pertinent BoK requirements associated with good quality management practices for that section are shown. These BoK requirements represent the range of content and the cognitive level to which multiple choice questions can be presented. Also, keep in mind that there is a separate BoK pertaining to constructed response questions in Appendix A.

There is some overlap of topics within the BoK. For example, reference to Six Sigma appears in three sections. An attempt has been made to cover a given topic in depth in one section and where necessary provide cross-references to that one explanation.

Each chapter ends with a list of additional resources. When a topic is new to a test preparer, or knowledge has faded, the test preparer is urged to seek more information from one or more of the resources listed. There is no way this single handbook can provide the depth and breadth of knowledge you should have on any given topic in the BoK. A few years back, one test preparer referred to the BoK as "a mile wide and an inch deep." The new 2006 BoK is even wider and somewhat deeper than before. On the subject of information reference material, do not forget the wealth of information available via the Internet—most of it free! That includes a sample test on the ASQ Web site, www.asq.org.

In order to provide a broad perspective of the BoK, this book has specifically been written to cover:

- Historical perspectives relating to the evolution of particular aspects of quality management, including recognized experts and their contributions
- Key concepts and terminology relevant in providing quality leadership, applying quality management principles, and communicating quality needs and results
- Benefits associated with the application of key concepts and quality management principles
- Best practices describing recognized approaches for good quality management
- Barriers to success, including common problems that the quality manager might experience when designing and implementing quality management, and insights as to why some quality initiatives fail

The original Certified Quality Manager Study Guide Committee and contributing authors, as well as the editors of the second and third edition, have strived to provide readers with a more holistic perspective of the quality manager's role within the context of the subject matter specified in the BoK. Not every quality manager equally possesses expertise in each subject area, but the content of this handbook can be used to help readers properly direct their study efforts.

TERMINOLOGY

The ISO 9000–2000 definition of *organization* includes terms such as: company, firm, enterprise, institution, charity, sole trader, association, or parts or combination thereof. Therefore, throughout the handbook these terms and others, including *business,* have been used interchangeably.

The ISO definition of *product* as "the result of a process" includes categories of hardware, software, services, and processed materials. The word *product* is therefore widely used throughout the handbook, with and without the accompanying clarification that it also applies to services. It is expected that the reader will have the flexibility to interpret the words in the context in which they were used and to substitute terms that are more apropos for their own industry or experiences where this will help clarify the material.

DISCLAIMER

The Body of Knowledge for the Certified Manager of Quality/Organizational Excellence (see Appendix A) is largely based on conceptual ideas and models rather than on exact mathematical formulas or tangible items that can be held up as correct. For some of the areas of the BoK, there could be multiple correct views because of differences in industry, organizational maturity, geographic location, competitors' strategies, and so on. Even the gurus of quality differ in their philosophies, priorities, and approaches to quality. For example, multiple-choice questions often may appear to have at least two right answers. It will be your task to choose the one answer that best applies to the content and context of the question.

Furthermore, you should know that ASQ policy maintains a strict separation between the people who prepare the examination, those who score the completed examination papers, and those who present material for test preparers. As a result of this separation, the content presented in this handbook may differ from the intent of the creators of the BoK and/or the writers of the examination questions. Therefore, any questions you may have regarding BoK intent or about answer scoring cannot be answered on behalf of the BoK drafters or the question writers.

Success as a quality manager requires experience and a mature understanding of the various concepts, as well as the specific knowledge obtained from this or any other source. The best to you in your quest to become a Certified Manager of Quality/Organizational Excellence. *Good luck!*

Russ Westcott, Editor

Part I

Leadership

1. *The only definition of a leader is someone who has followers.*
2. *An effective leader is not someone who is loved or admired . . . Popularity is not leadership.*
3. *Leaders are highly visible. They . . . set examples.*
4. *Leadership is not rank, privileges, titles, or money. It is responsibility.*

Peter F. Drucker

Leadership is not so much the exercise of power itself as the empowerment of others.

Warren Bennis and Burt Nanus

If you want one year of prosperity, grow grain.
If you want ten years of prosperity, grow trees.
If you want one hundred years of prosperity, grow people.

Chinese Proverb

Chapter 1

A. Organizational Structures and Culture

It's appropriate that a book on the management of quality begin with the subject of leadership. Perhaps no other factor has so much of an impact on an organization than how well it is led on both a strategic and an operational basis. Additionally, leadership is not solely the responsibility of those who reside at the higher levels of the hierarchy, but is instead an activity in which anyone involved in the success of an organization can take part.

Strategic leadership includes defining the structures to achieve the overall vision and mission of an organization and its strategies and systems. The culture that results from the manner in which work is carried out shapes the way members of an organization relate to each other and to the outside world.

1. ORGANIZATIONAL STRUCTURES

> Define and describe basic organizational designs: matrix, flat, parallel, etc., as well as the management hierarchy and its influence in an organization. (Understand)
>
> **CMQ/OE BoK**

Organizational Design

One of the major roles of leadership is to ensure that an organization is designed to carry out its mission, goals, and strategies. Understanding leadership requires

a fundamental understanding of organizations and the design factors that must be considered.

The design of an organization is the formal framework for communication and authority, and is determined by three major components:

- *Complexity.* The number of different entities (for example, job titles, reporting levels, functional departments, and physical work locations) that will exist in the organization.
- *Formalization.* How much the organization will rely on standard guidelines and procedures to instruct employee activities.
- *Centralization.*[1] Whether decision-making authority is located primarily at upper management levels or is delegated to lower levels.

These three aspects can be combined to create many different organizational designs. Some purposes of organizational design are to:

- Divide the total work required into logical functional groupings (for example, departments, work units) and the jobs within the functions.
- Assign specific tasks and responsibilities to each individual job.
- Allow better coordination of diverse organizational tasks.
- Establish relationships among individuals, work units, and functions.
- Establish formal lines of authority and decision making.
- Allocate and deploy organizational resources.

To create an appropriate design, a decision must be made as to how work activities will be organized both vertically and horizontally. The vertical structure typically categorizes positions as top managers, middle managers, first-line managers, and operations personnel. Creating the vertical structure includes determining these categories and defining the interaction among the levels by deciding who reports to whom, and who has the authority to make what types of decisions.

Vertical Organizational Design

One concept used in creating the vertical structure is *unity of command*, or the idea that a subordinate should be directly responsible to only one superior.[2] Although structures such as a matrix organization do not follow this rule, the basic intent of vertical design is to avoid conflicts, misunderstandings, or misuse of resources. Organizational designers also must determine the types and amount of authority and responsibility that organizational members will have. Authority refers to the rights inherent in a managerial position to expect orders to be followed and are related to the position, not the person. Traditionally, authority is delegated downward to subordinate managers, giving them certain rights while specifying limits within which to operate.

There are also different forms of authority: line and staff. *Line authority* is the superior–subordinate relationship extending from the top of the organization to its lowest levels (along a chain of command). A manager with line authority has

the right to direct the work of subordinates and to make certain decisions without consulting others. As organizations become larger and more complex, however, line managers may lack the time, expertise, or resources to do their jobs effectively. In response they create staff functions such as human resources (see Chapter 8, Section 4) that have the authority to support and advise.

Organizations now recognize that one does not have to be a manager to have influence, nor is influence always correlated to organizational level. Authority is an important concept in organizations, but focusing exclusively on authority produces a narrow, unrealistic view of sources of influence in organizations. Today authority is recognized as one aspect of the larger concept of power.[3] For example, some individuals in an organization may have considerable informal authority due to their knowledge or personality.

Span of control is another design factor and refers to how many subordinates a manager can effectively and efficiently supervise. Although no consensus exists on an ideal number, many managers favor small spans—typically no more than six—in order to maintain close control.[4] The level at which this decision is targeted affects this number. As managers rise in the organizational hierarchy, they deal with a greater variety of complex and ill-structured problems, so top executives typically have a smaller span of control than do middle managers, and middle managers require a smaller span than do supervisors. Therefore, to a large degree the span of control determines the number of levels and managers in an organization. Other things being equal, the wider or larger the span of control, the more efficient the organizational design.

Today, many organizations have reduced the number of managerial positions through restructuring while increasing the spans of control. The optimum span of control is increasingly determined by issues such as:

- Amount of employees' training and experience
- Similarity of subordinate tasks
- Complexity of the tasks
- Physical proximity of subordinates
- Degree to which standardized procedures are in place
- Sophistication of the organization's management information and internal communication systems
- Strength of the organization's culture
- Preferred style of the manager[5]
- Employee turnover
- Available resources
- Financial and competitive pressures
- Organizational beliefs and values

Horizontal Design

In addition to a vertical dimension, an organization's design also has a horizontal dimension that determines how work activities are organized at each level of the organization. This involves answering questions such as, "How will work activities be divided?" or "What form of departmentalization will work best?"

Division of labor means that rather than an entire job being performed by one individual, it is broken down into a number of steps, with separate individuals completing each step. In essence, individuals specialize in doing part of an activity rather than the entire activity. Assembly-line production, in which each worker repeatedly does a standardized task, is an example of division of labor. Fast-food companies use the concept of division of labor to standardize the process of taking a customer's order and filling it quickly and properly.

Because some tasks require highly developed skills, while unskilled workers can perform others, division of labor makes efficient use of the diverse skills and capabilities of employees. If all workers in an organization were engaged in each step of the production process, every worker would need the skills to perform both the most demanding and the least demanding jobs. The result would be that, except when performing the most highly skilled or highly sophisticated tasks, employees would be working below their skill levels. Because skilled workers are paid more than unskilled workers and their wages tend to reflect their highest level of skills, paying highly skilled workers to do easy tasks would be an inefficient use of resources.

Historically, management has viewed the division of labor as an unending source of increased productivity. Eventually, certain drawbacks of division of labor exceed the economic advantages, including problems such as boredom, job stress, low productivity, poor quality, increased absenteeism, and high turnover. Organizations have discovered that by giving employees a variety of activities to do, allowing them to do a whole and complete piece of work, and putting them together into teams, jobs are more interesting and higher quality often results.

Centralization/Decentralization

Centralization/decentralization refers to how much decision-making authority has been delegated to lower management levels. Few organizations could function effectively if all decisions were made by a select group of top managers, nor could they do so if all decisions were delegated to the lowest levels of the organization. Fayol lists centralization as one of his 14 principles of management and notes that the proper amount of centralization or decentralization depends on the situation.[6]

Organizations have traditionally been structured as pyramids, with authority and power concentrated at the top and relatively centralized decision making. As organizational environments became more complex and dynamic, however, many organizations began to decentralize decision making. Many executives now believe that decisions should be made by those people with the best information to make the decisions, regardless of their level in the organization.

More decentralization might be needed under one or more of the following conditions:

- The environment is complex or uncertain.
- Lower-level managers are capable and experienced at making decisions.
- Lower-level managers want a voice in decisions.
- Decisions are relatively minor.
- Corporate culture is more open to allowing managers to have a say in what happens.
- The organization is geographically dispersed.
- Effective implementation of the organization's strategies depends on managers having more involvement and flexibility to make decisions.

Organizational designers should select the amount of centralization/decentralization that best allows management to implement goals and strategies. What works in one situation might not be best for another.

Types of Organizational Structures

In deciding issues such as distribution of authority, reporting relationships, span of control, and centralization/decentralization, the structure of the organization will result. It is worth noting that the current tendency is to move to flatter organizations having fewer hierarchical levels and more flexible reporting arrangements. Although a flatter organizational structure implies a wider span of control, information technologies have greatly simplified the processes of communication and decision making, allowing authority to be more widely dispersed.

Organizations are becoming managed more as horizontal processes (for example, as a part of the supply chain or value chain), rather than vertical hierarchies. A *matrix structure* is one way of formalizing a structure that provides both effective horizontal, operational decision making as well as allowing development of functional specialties. Another structure often used when an organization desires to implement a significant change is to create a *temporary parallel* or *collateral organization*, which consists of a group of employees (often a diagonal slice of the organization) who meet on a regular basis in order to guide the change process. Once the organization has made the transition, the parallel structure is dissolved.

Earlier, some of the aspects that affect organizational design, such as division of labor, distribution of authority, span of control, and employee knowledge and experience were discussed. Many different structures can result from these decisions, and which one an organization selects is also impacted by larger factors, both internal and external.

Each organization has its one way of grouping work activities (departmentalization). Groupings may be according to the:

- Work functions being performed
- Product or service being provided

- Customer being served
- Geographic area or territory covered
- Product–customer processs flow

The method(s) used should reflect the grouping that would best contribute to the attainment of the organization's strategic goals and objectives as well as the objectives of individual units. Following is a discussion of each of these structures, plus additional forms in which boundaries are more fluid.

- *Functional.* One of the most frequent ways to group activities is by the function being performed. A manufacturing plant might be organized by separating engineering, accounting, manufacturing, human resources, and purchasing specialists into departments as shown in Figure 1.1. Functional departmentalization can be used in all types of organizations, with the name of the functions changed based on the types of skills required to achieve organizational objectives. For example, a university hospital might have departments devoted to health research, patient care, facilities management, and finance.

- *Product.* Figure 1.2 illustrates the product departmentalization structure. Each major product group is placed under the authority of an executive who specializes in and is responsible for all aspects of that product line. A clothing retailer also uses

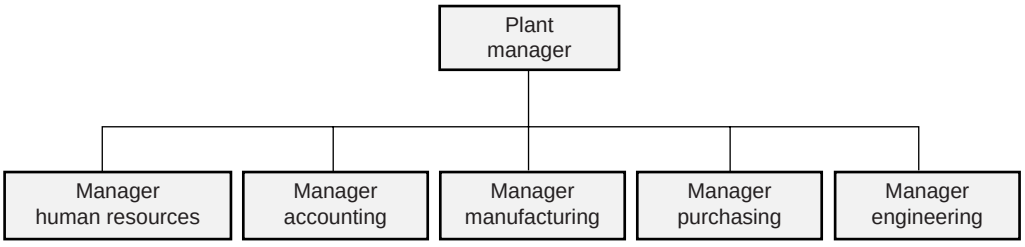

Figure 1.1 Functional departmentalization.

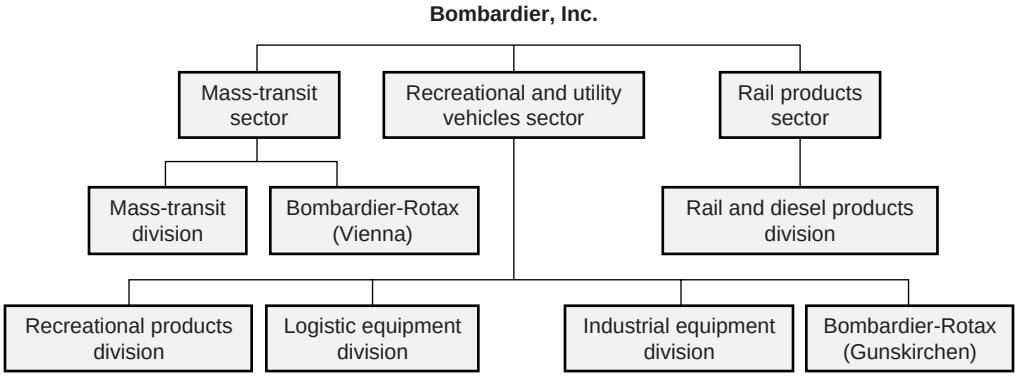

Figure 1.2 Product departmentalization.

product departmentalization, basing its structure on its varied product lines, such as women's and men's footwear and apparel and accessories. This type of structure allows portions of the organization to focus on a particular type of product, allowing greater expertise to be gained of the market and product technology.

• *Customer.* The particular type of customer an organization seeks to serve can also be used to define structure. The sales activities shown in Figure 1.3 for an office supply firm can be broken down into three departments: those serving retail, wholesale, and government customers. Textbook publishers often organize by customer, such as those serving primary levels, secondary levels, and college or university levels. The assumption underlying customer-stratified organizations is that customers in each grouping have a common set of problems and needs that will best be met by specialists who can focus on their needs.

• *Geographic.* Another way to organize is by geography or territory. An organization's sales function might have western, southern, midwestern, and eastern regions, as shown in Figure 1.4. A large school district might have six high schools to serve each of the geographical territories within its district. Geographic organization is valuable when an organization's customers are scattered over a large area, allowing the specific needs of the territory to be addressed as well as reducing business costs such as logistics.

• *Process.* A flow form of departmentalization is shown in Figure 1.5, which illustrates the various production departments in an aluminum extrusion processing plant. Each department specializes in one specific phase (or subprocess) in

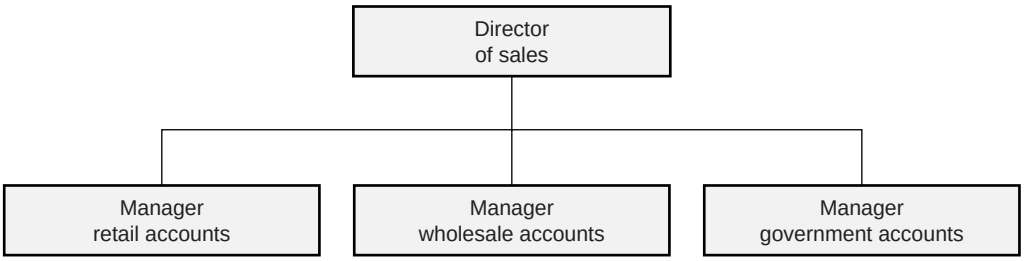

Figure 1.3 Customer departmentalization.

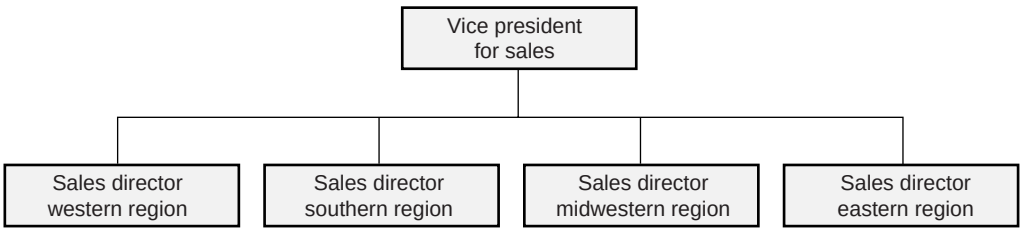

Figure 1.4 Geographic departmentalization.

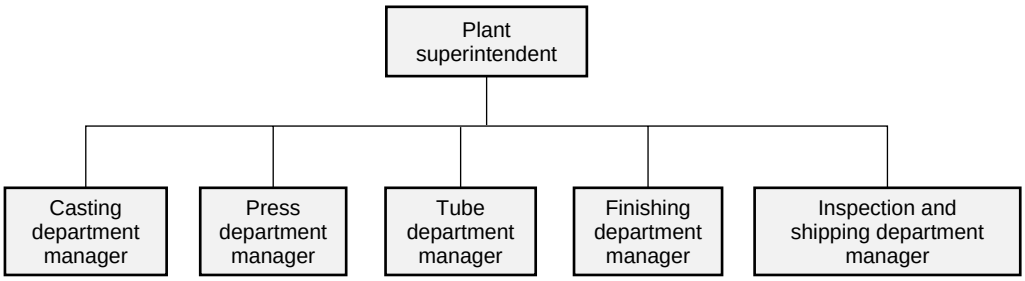

Figure 1.5 Process departmentalization.

the production of aluminum tubing. The metal is cast in huge furnaces and sent to the press department, where it is extruded into aluminum pipe. It is then transferred to the tube mill, where it is stretched into various sizes and shapes of tubing. It then moves to finishing where it is cut and cleaned, and finally arrives in the inspect, pack, and ship department.

• *Team.* The competitive drive for improvement has made organizing by teams more common. This structure often overlays or replaces the rigid boundaries of departmentalization, bringing together individuals with needed specialties for a particular mission. In a team-based structure, the entire organization consists of work groups or teams that perform the organization's work. Employee empowerment is crucial because no rigid line of managerial authority flows from top to bottom. Team members are free to design work in the way they think best and are held responsible for all work activity and performance results in their areas. For example, an insurance company reorganized its customer representatives into eight-person teams trained to expedite all customer requests. Rather than switching customers from one specialist to another, a team now takes care of every aspect of a customer request.

• *Matrix.* A matrix structure assigns specialists from different functional departments to work on one or more projects led by a project manager. This arrangement was developed in the 1960s by the U.S. aerospace industry to cope with the demands of managing a number of concurrent projects. Figure 1.6 shows a sample matrix organizational structure. In a typical matrix organization, specialists report to a line or project manager to integrate their expertise with those of other specialists. They also report to a functional manager responsible for departmental human resource issues such as hiring, skill development, assignments to line or project units, and performance reviews.

• *Cells.* Parts of an organization may be structured in manufacturing or work cells. A *cell* is a self-contained unit dedicated to perform all the operations to complete a product or major portion of a product. (See Chapter 14, Section 3 and Figure 14.11, page 402.)

• *Boundaryless.* A different view of organizational structure is called the boundaryless organization (also referred to as a *network organization, modular corporation,* or *virtual corporation*). It is not defined by, or limited to, the boundaries

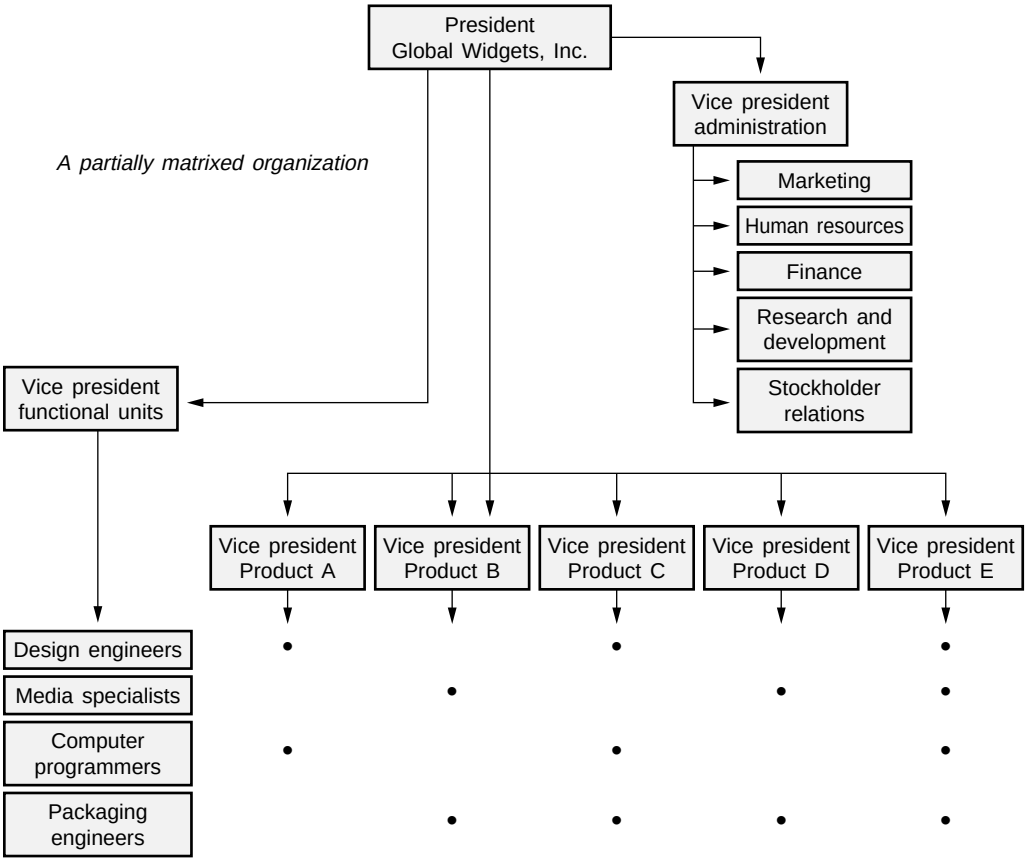

Figure 1.6 Matrix organization example.

imposed by a predefined structure. The boundaryless organization breaks down the artificial boundaries created by a design such as departmentalization and hierarchies, and the external boundaries separating the organization from its suppliers, customers, and other stakeholders. (See virtual teams in Chapter 3.)

Many factors have contributed to the rise of the boundaryless organization. One is the need to respond to rapidly changing, highly competitive global markets. Another factor is new technology, such as computers and telecommunications, that permits organizations to work more effectively. For example, a world leader in credit card authorization systems has no corporate headquarters, secretaries, or paper mail. The chief executive officer calls his organizational structure the "blueberry pancake model, very flat, with all blueberries equal."[7] Employees have a vast amount of information at their fingertips through the company's e-mail network.

The authors of *The Boundaryless Organization: Breaking the Chains of Organizational Structure* discuss the means for structuring a boundaryless organization tuned to the needs for integrating resources to serve the customer, strengthening

the value chain, and crossing geographic boundaries.[8] Authors of *The Virtual Corporation* focus on the powers of information, new technologies, and the new kind of worker.[9]

Beyond the ways an organization groups its work activities, there are other factors to consider. They are:

• *Strategy.* Since organizational structure will impact the ability to achieve organizational objectives, structure should, of course, be based on the organization's strategy (see Chapter 5). This means that if the strategy significantly changes, structure will likely need to be modified to support the change. A low-cost provider strategy may utilize a functional structure sharing the same support resources with many facilities (for example, centralized purchasing, human resources, and engineering), while a strategy to develop close, long-term customer relationships would call for a more decentralized structure (for example, sales offices for each major customer or geographic location).

• *Size.* The size of the organization affects structure due to the fact that a larger organization will tend to have more specialized and diverse activities needing to be managed. This increased differentiation can easily lead to narrowly focused or transactional management, although this may be mediated by where the company's product is in its lifecycle. For example, a company that has grown large as a result of gaining a significant market share in a new product line may find a need for transformational management as the product enters the mature, low-growth stage.

• *Technology.* Another factor affecting structure is the range of technologies used by the organization. Every organization uses various forms of technology to convert inputs into outputs, and the type of technology will impact organizational structure. For example, a chemical firm using continuous-flow processes will be organized differently than a hospital or a law firm. The management styles are also likely to differ, since professionals in a hospital or law firm are knowledge workers who would expect a freer reign than employees whose job is to load and unload railcars of raw material and finished goods.

• *Core competencies.* Organizations can be structured to focus on the core competencies that differentiate the organization from its competitors. Core competencies may consist of unique capabilities of its workforce, the knowledge and experience of its management, track record for innovation, world-class service policies and practices, a unique niche the organization's products and services fulfill, and so on.

• *Regulatory, legal, and other requirements.* Constraints and mandates due to regulations, laws, and standards may influence organizational structure. For example, ISO 9001 registrar organizations must clearly separate their registration auditing organization and services from their consulting services organization. Certain customers may specify that the products they purchase be produced in facilities and by workers separate from products their supplier produces for other customers to protect proprietary designs and processes. Because of potential contamination, laws may prohibit the commingling of production of certain products, for example, food products and chemicals. The types and levels of security

mandated for certain industries, for example, products and services for the U.S. military, will influence organizational structure. Regulations governing occupational health and safety affect organizational structure, and laws governing allowable emissions are critical to certain industries.

- *Union.* Employees represented by a union are a kind of parallel organization within an organization. In an ideal situation, the top person from the union membership participates with top management of the organization in strategy development as well as decisions affecting the ongoing business of the organization. In the more traditional situation, and sadly still the more prevalent situation, the union and organization management coexist in an adversarial relationship.

  Union leadership may influence organization structure and reporting relationships, job design, work standards and practices, compensation and benefits, purchasing decisions, supplier selection, employee disciplinary actions, facility expansion or closure, blockage of process improvement initiatives, and so on. Disagreement over the terms of the labor–management contract can result in production slowdown or strike.

- *Competition.* The competitive environment in which the organization operates will also affect organizational structure, as a higher pace of change requires a more flexible organizational design that can quickly adapt to new market opportunities. In this environment a team structure and participative style (see Chapter 8) are more likely to succeed than a functional structure with autocratic management.

- *Workforce issues.* Availability of sufficient workers and/or of skilled workers is a factor affecting organizational design. All of the considerations necessary to attract and retain the workforce are factors, for example: availability of housing, transportation, schools, religious entities, shopping, entertainment, and adequate community infrastructure.

- *Facilities.* The present and future availability of land, buildings, utilities, rail service, roadways, airport, and so on, are important considerations.

- *Other environmental factors.* The prevailing weather patterns, the political climate, and the relative absence of crime all are factors.

- *Combinations.* Most large organizations will utilize a combination of methods of organization and management. At the local facility level they might be organized in teams or in functional or process groups, and at the division level organized by product. At higher levels there may be a geographic structure that allows focusing on a particular part of the world (for example, United States versus Europe versus Asia).

Management Hierarchy and Influence on the Organization

To ensure that an organization achieves its desired outcomes, someone must plan, allocate resources, and monitor results. These are major activities for which management personnel have responsibility. Top management (also called senior management or executive management) is responsible for providing direction through defining the vision, mission, strategies, goals, structures, policies, systems,

and objectives. These managers are also responsible for managing the boundaries between the organization and its major stakeholders, such as investors and business partners.

Middle managers are responsible for carrying out the policies and procedures necessary for achieving the mission, goals, and strategic objectives. Their role is more operationally than strategically oriented, playing a key role in day-to-day communication and decision making. Middle management's role also parallels that of top management in the sense of being responsible for leadership of a particular part of the organization.

First-level supervision is responsible for overseeing the workforce assigned to produce the products and/or services for which the organization is designed. Supervisors, while usually considered to be part of management, have the difficult role of thinking and behaving like a manager and at the same time dealing empathetically with the concerns and problems related to the workers. In this role, supervisors must communicate downward the strategic objectives of the organization, take the actions necessary for their work unit to respond appropriately to those objectives, monitor and maintain the processes and people under their supervision, and be accountable for the quality and quantity of product and service required. How effectively supervision establishes a motivational environment has a direct effect on the stability of the workforce and the outcomes achieved by the organization.

In some structures, a quasi-supervisory role exists: the lead operator. Not an official member of management, the lead operator is often charged with the resonsibility for some scheduling, instructing, and inter–work unit liaison activities in addition to performing production work

The role of supervisor, and to some extent the middle manager, may not be needed in some types of organizational structures. For example, where teams are the predominant structural element in a virtual organization, or when information technology has adequately bridged the gap between the workers and management.

2. ORGANIZATIONAL CULTURE

> Define and describe characteristics of an organization that determine or underlie its culture. (Understand)
>
> **CMQ/OE BoK**

An organization is the integration of two major systems:

- The technical system, which defines how products and services are to be realized (and includes the equipment, work processes and procedures, and human resources to carry out the processes).

- The social system, consisting of how people communicate, interrelate, and make decisions. A manifestation of the social system is called *culture,* which is evidenced by employee behaviors.

Culture is a function of the values, norms, and assumptions shared by members of the organization. It can, therefore, be shaped by communicating what standards of behavior are expected and ensuring that policies, procedures, promotions, and day-to-day decisions are appropriately aligned. Culture is manifest in ways such as:

- How power is used or shared
- The organization's orientation toward risk or safety
- Whether mistakes are punished, hidden, or used to guide future learning
- How outsiders are perceived and treated
- Vision, mission, principles, policies, protocols, procedures, and practices
- Artifacts, layout, and amenities (for example, furnishings, artwork, open versus closed work spaces, employee time-out spaces, signage, and so on)

Members new to an organization are soon acclimated to the culture through training and both formal reinforcement and peer influence.

The design of the organization has an impact on culture. If a hierarchical structure restricts cross-functional communications, then close relationships between interrelated functions will be more difficult. Similarly, in a unionized organization the relationship between organization management and union management will set the stage for how cooperatively people are able to work together toward common goals.

Culture can obviously have a significant impact on quality and is shaped by the words and actions of leadership, how work systems are designed, and what gets rewarded. If the culture is not proactive, is not focused on customers, and does not use data to guide decision making, the organization is not likely to be highly successful in the continual improvement of quality.

Visible artifacts and the metaphors used to describe an organization are often good superficial indicators of culture. For example, a company that talks of "killing the competition" and creates a graphic display showing competitors being "wiped out" would convey a focus on competitors rather than on customers.

Examining the beliefs and values espoused by members of the organization requires deeper probing than just observing artifacts. For example, in a family-owned business, the predominant values are often those of the founder(s). Those values may persist long after the death of the founding individual(s).

At an even deeper level are the shared tacit assumptions of which the organization's members may not be consciously aware. Failure to surface and consider these assumptions can result in serious blunders. For example, a failure to understand the mutual level of demonstrated trust needed for management to introduce major change in a unionized organization where an adversarial relationship persists.

Juran lists five steps for changing to a quality culture:

1. Create and maintain an awareness of quality.
2. Provide evidence of management leadership on quality.
3. Provide for self-development and empowerment.
4. Provide participation as a means of inspiring action.
5. Provide recognition and rewards.[10]

Changing an organization's culture is difficult and requires time. Fear of change must be removed, poor labor–management relations must be resolved, and the company's focus must change from the status quo.[11] Employees should be convinced of the benefits that a quality management approach will provide and should buy in to the changes. This often means that employees at all levels will need to change behaviors or perform tasks in a different manner. If strong leadership, motivation, and enthusiasm are lacking, frustration and stress will result.

Additional Resources

Adizes, I. *Corporate Lifecycles: How and Why Corporations Grow and Die and What to Do About It.* Paramus, NJ: Prentice Hall, 1988.

Ashkenas, R., D. Ulrich, T. Jich, and S. Herr. *The Boundaryless Organization: Breaking the Chains of Organizational Structure.* San Francisco: Jossey-Bass, 1995.

Clippinger III, J. H., ed. *The Biology of Business: Decoding the Natural Laws of Enterprise.* San Francisco: Jossey-Bass, 1999.

Davidow, W. H., and M. S. Malone. *The Virtual Corporation: Structuring and Revitalizing the Corporation for the 21st Century.* New York: HarperCollins, 1992.

Hesselbein, F., and P. M. Cohen, eds. *Leader to Leader: Enduring Insights on Leadership from the Drucker Foundation's Award-Winning Journal.* San Francisco: Jossey-Bass, 1999.

Hesselbein, F., M. Goldsmith, and R. Beckhard, eds. *The Leader of the Future: New Visions, Strategies, and Practices for the Next Era.* San Francisco: Jossey-Bass, 1996.

———. *The Organization of the Future.* San Francisco: Jossey-Bass, 1997.

Juran, J. M., and A. B. Godfrey, eds. *Juran's Quality Handbook,* 5th ed. New York: McGraw-Hill, 1999.

Schein, E. H. *The Corporate Culture Survival Guide.* San Francisco: Jossey-Bass, 1999.

Notes

1. S. P. Robbins and M. Coulter, *Management,* 5th ed. (Upper Saddle River, NJ: Prentice-Hall, 1996).
2. H. Fayol, *Industrial and General Administration* (Paris: Dunod, 1916).
3. D. Kipnis, *The Powerholders* (Chicago: University of Chicago Press, 1976).
4. L. Urwick, *The Elements of Administration* (New York: Harper & Row, 1944): 52–53.
5. D. Van Fleet, "Span of Management Research and Issues," *Academy of Management Journal* 26, no. 9 (1983): 546–52.
6. Fayol, 19–42.
7. T. Peters, "Successful Electronic Changeovers Depend on Daring," *Springfield Business Journal* (August 8, 1994): 15.

8. R. Ashkenas, D. Ulrich, T. Jick, and S. Kerr, *The Boundaryless Organization: Breaking the Chains of Organizational Structure* (San Francisco: Jossey-Bass, 1995).
9. W. H. Davidow and M. S. Malone, *The Virtual Corporation* (New York: Edward Burlingame Books/HarperBusiness, 1992).
10. J. M. Juran and A. B. Godfrey, eds., *Juran's Quality Handbook,* 5th ed. (New York: McGraw-Hill, 1999): 22.65.
11. S. P. Robbins and M. Coulter, *Management,* 5th ed. (Upper Saddle River, NJ: Prentice-Hall, 1996).

Chapter 12

E. Quality Models and Theories

Throughout this book, information is presented identifying central themes and principles of total quality that provide the foundation for achieving customer satisfaction. An organization needs a well-structured system that identifies, documents, coordinates, and maintains key quality-related activities throughout all operations. Feigenbaum defined a total quality system as "the agreed companywide and plantwide operating work structure, documented in effective, integrated technical and managerial procedures, for guiding the coordinated actions of the workforce, the machines, and the information of the company and plant in the best and most practical ways to assure customer quality satisfaction and economical costs of quality."[1]

The process of implementing a system for quality is somewhat simplified if organizations have a model for guiding design and implementation of quality-related processes, and a means of assessing how well actions are carried out. Awards and certification programs provide tested organizational models as well as a basis for assessing progress, achievement, and conformance. The most widely used models for quality management are the United States' Baldrige National Quality Program (BNQP), Japan's Deming Prize, and the worldwide ISO 9000 Series standards. In addition, many states, municipalities, industry groups, and even large corporations have developed significant quality awards, thereby widening the range of organizations eligible for recognition.

1. BNQP CRITERIA FOR PERFORMANCE EXCELLENCE

Define and describe how the Malcolm Baldrige National Quality Award (MBNQA) criteria are used as a management model in support of performance excellence. (Apply)

CMQ/OE BoK

In October 1982, recognizing that U.S. productivity was declining, President Ronald Reagan signed legislation mandating a national study/conference on productivity. The American Productivity Center (now the American Productivity and Quality Center) sponsored seven computer networking conferences in 1983 to prepare for an upcoming White House conference on productivity. The final report from these conferences recommended that "a National Quality Award, similar to the Deming Prize in Japan, be awarded annually to those firms that successfully challenge and meet the award requirements." The MBNQA was signed into law (Public Law 100-107) on August 20, 1987, and is named after President Reagan's secretary of commerce, who was killed in an accident shortly before the Senate acted on the legislation.

A total quality management (TQM) business approach is the basis for the MBNQA (now BNQP), an annual award to recognize U.S. companies for business excellence. In 1999, the criteria for performance excellence expanded to create separate but parallel criteria for education and healthcare organizations. The BNQP promotes an understanding of the requirements for performance excellence and fosters sharing information about successful performance strategies and the benefits derived from using these strategies. The Baldrige criteria are presented from a systems perspective. Figure 12.1 shows the interrelationship of each of the seven categories. Customer- and market-focused strategy and action plans serve as the umbrella.

Category Descriptions

An overview of the BNQP criteria categories includes:[2]

Preface: organizational profile. This is a snapshot of the applying organization, the key influences on how it is operated, and the key challenges that are faced. The preface calls for a description of the organization's business environment and key relationships with customers, suppliers, partners, and stakeholders. It includes descriptions of the main products and services offered, the organizational culture, the employee profile, major technologies, equipment, and facilities, and the regulatory environment under which the organization operates. The preface also calls for a description of the organization's structure and governance system, the key customers and stakeholder groups and applicable market segments, the role of suppliers and distributors, and key supplier and customer partnering relationships.

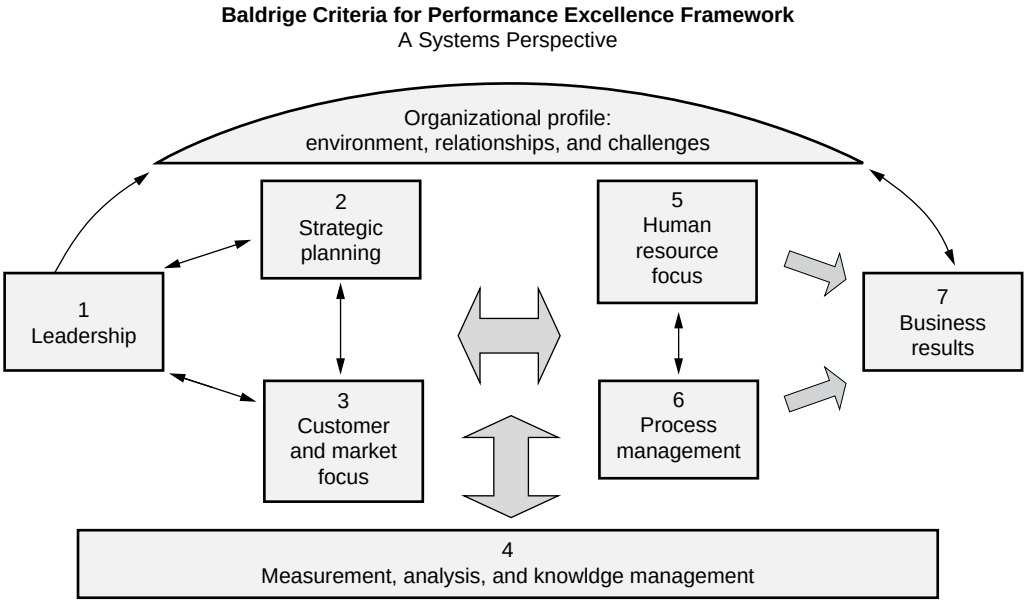

Figure 12.1 Baldrige criteria for performance excellence framework.

1. *Leadership.* This category examines how the organization's senior leaders guide and sustain the organization. Also examined are the organization's governance and how the organization addresses its ethical, legal, and community responsibilities.

2. *Strategic planning.* This category examines how the organization develops strategic objectives and action plans. Also examined is how the chosen strategic objectives and action plans are deployed and changed if circumstances require, and how progress is measured.

3. *Customer and market focus.* This category examines how the organization determines the requirements, expectations, and preferences of customers and markets. Also examined is how the organization builds relationships with customers and determines the key factors that lead to customer acquisition, satisfaction, loyalty and retention, and to business expansion and sustainability.

4. *Measurement, analysis, and knowledge management.* This category examines how the organization selects, gathers, analyzes, manages, and improves its data, information, and knowledge assets. Also examined is how the organization reviews its performance.

5. *Human resource focus.* This category examines how the organization's work systems and employee learning and motivation enable employees to develop and utilize their full potential in alignment with the organization's overall objectives, strategy, and action plans. Also examined are the organization's efforts to build and maintain a work environment and employee support climate conducive to performance excellence and to personal and organizational growth.

6. *Process management.* This category examines the key aspects of the organization's process management, including key product, service, and business processes for creating customer and organizational value and key support processes. This category encompasses all key processes and all work units.

7. *Business results.* This final category examines the organization's performance and improvement in key business areas—product and service outcomes, customer satisfaction, financial and marketplace performance, human resource results, operational performance, and leadership and social responsibility. Performance levels are examined relative to those of competitors.

Using the BNQP Criteria As a Management Model

The BNQP criteria are designed to help organizations improve the value of what they offer to their customers and market, and improve their overall organizational performance. Criteria are specifically worded, using nonprescriptive statements of requirements, to allow for different interpretations. It is up to the organization to develop its approach to satisfy the criteria requirements that will best suit its needs. A quality management system can be designed simply by using the seven categories, although for more complex systems, the criteria identify items within the seven categories and numerous areas within the items.

The Baldrige criteria can be used as a model for planning and implementing quality management. Figure 12.1 is an example.

- Senior leaders (category 1) identify the value of their products and services to their current customers and potential customers in their market.
- Key participants develop a strategy (category 2) to satisfy the requirements and expectations of customers and markets (category 3).
- Strategic objectives from planning are turned into action plans to track the movement of the organization from where it currently is in the market to where it wants to be.
- Measurement and analysis is accomplished to recognize achievement of planned activities or to stimulate improvement opportunities (category 4).
- Employees are trained, educated, and developed (category 5) to prepare for the organization's transition from where it is to where it needs to be relative to skills and knowledge of their products and services.
- Processes are managed (category 6) to ensure that performance expectations are effective and efficient, and will satisfy the expectations and requirements of customers, markets, and regulatory agencies.
- Business results (category 7) are reported and analyzed (category 4) to determine the achievement and/or opportunity for improvement to expected outcomes as identified in strategy and action plans.

The BNQP criteria are designed to serve three puposes in building and strengthening U.S. competitiveness:

1. Help improve organizations' performance practices, capabilities, and results
2. Facilitate communication and sharing of best-practices information among U.S. organizations of all types
3. Serve as a tool for organizations' understanding and managing performance, as well as for guiding organizational planning and opportunities for learning

As with any model for management of business, success is not a guarantee. The use of Baldrige criteria as a management model will only increase the probability of achieving expected performance outcomes. Detailed examples of how the Baldrige criteria can be applied to an organization are available in the form of case studies used by examiners for the BNQP and many state quality award programs. Case studies can be obtained for a fee from ASQ.

Individual copies of the Baldrige criteria booklets may be obtained free of charge from Baldrige National Quality Program, National Institute of Standards and Technology, Administration Building Room A600, 100 Bureau Drive Stop 1020, Gaithersburg, MD 20899-1020. Phone: (301) 975-2036. Fax: (301) 948-3716, e-mail nqp@nist.gov.

Other Quality Awards

Many states and some localities levels offer Baldrige-criteria type awards. A number of larger organizations have established their own internal Baldrige-type awards.

The European Quality Award was initiated in 1991. This award is similar to the BNQP award in that it, too, is nonprescriptive. It is offered to four sectors: large business, operational units within companies, public-sector organizations, and small and medium-size enterprises.

A Japanese award for excellence in TQM is the *Deming Prize.* It was established in 1951 to encourage and recognize quality improvement.

The Shingo Prize for Excellence in Manufacturing was established in 1988 to promote lean manufacturing concepts and reduction of waste.

2. ISO AND OTHER THIRD-PARTY STANDARDS

> Define and describe how ISO Standards can be used to support quality management systems. (Understand)
>
> **CMQ/OE BoK**

ISO 9000:2000 Series

The ISO 9000 series of quality management system standards and guidelines assists an organization in developing, implementing, registering, and sustaining

an appropriate quality management system that functions independent of the specific product and/or service. They are different from the traditional notion of a standard, for example, engineering standards for measurement, terminology, test methods, or product specifications. They are based on the premise that a well-designed and carefully managed quality management system can provide confidence that the product or service produced by the quality management system will meet customer expectations and requirements. Certification of the quality management system, however, does not certify or guarantee the quality of the product or service produced.

ISO 9000 includes eight principles that when followed should improve organizational performance. The essence of these principles is:

- The organization has a focus on meeting customers' requirements and exceeding customers' expectations.
- The organization's leadership develops and sustains a working environment in which people become involved in helping the organization meet its objectives.
- Throughout the entire organization, the people are enabled to utilize their abilities for the mutual benefit of the organization and themselves.
- The inputs, resources, and outputs pertaining to the organization's activities are managed as a process.
- Within the organization, relationships among the processes are managed as a system, a system that supports organizational effectiveness and efficiency in meeting objectives.
- The organization fosters continual improvement in everything it does.
- The organization's people make fact-based decisions.
- Supplier relationships are mutually beneficial and value enhancing.

The basic ISO 9000:2000 series consists of three booklets.[3] They are:

- ANSI/ISO/ASQ Q9000-2000: *Quality management systems—Fundamentals and vocabulary,* which covers fundamentals of quality management systems and terms and definitions.
- ANSI/ISO/ASQ Q9001-2000: *Quality management systems—Requirements* (the auditable standards against which certification may be obtained) covers terms and definitions, general requirements, and model for the quality management system (specifically management's responsibility, management of resources, planning and management of processes, and measurements, analyses, and improvement).
- ANSI/ISO/ASQ Q9004-2000: *Quality management systems—Guidelines for performance improvements,* which contains a comprehensive checklist of techniques, tools, and methodology for enhancing the quality management system, self-assessment guidelines, and steps to take for continual improvement.

The ISO 9001 standard lays out requirements in broad, general terms. Each company must interpret them within the context of its own business and develop its own QMS to comply. A brief outline of key requirements follows.

Quality management system addresses:

- Identifying and sequencing processes
- Monitoring, measuring, and analyzing processes
- Documenting the QMS: quality manual, procedures, instructions, records
- Controlling documents and records

Management responsibility addresses:

- Top management's evidence of commitment to the QMS: communicating, quality policy, quality objectives, management reviews, availability of resources
- Top management's support of a customer focus
- Quality planning
- Responsibility of a management representative

Resource management addresses:

- Providing resources
- Ensuring competence, awareness, and training of human resources
- Providing suitable infrastructure and work environment

Processes for producing products and services (product realization) addresses:

- Planning for product realization
- Requirements for customer-related processes
- Requirements for designing and developing product
- Purchasing processes
- Controlling production and service
- Controlling devices used for monitoring and measuring

Processes for measurement, analysis, and improvement addresses:

- Monitoring and measuring relative to satisfaction of customers, auditing the QMS, and monitoring, measuring and controlling product
- Analyzing data
- Continually improving (corrective and preventive action)

When using ISO 9001 as a systems management model, remember the following things:

- Eight quality management principles are the basis for the standard: customer focus, leadership involvement, involvement of people at all levels, process management, system approach to managing, continual improvement, fact-based decisions, and mutually beneficial supplier relationships.

- Recognize that customer requirements must drive transformation activities. This is important if an organization wants to retain customers. Management is responsible for identifying what the organization is going to do in the future and for establishing a policy for quality and the direction of the organization. Many organizations do this by creating a mission and vision statement, and a quality policy.

- An organization must obtain information from the customer as to how well it has done at meeting the needs of the customer. This can be done in at least two ways. The first is to follow up with customers to see how well the organization performed. The second is to ensure that customer requirements are documented prior to the delivery of the product. When the product/service is delivered, the organization does not need to ask the customer how it did because it is already known. The problem with this is that it is sometimes difficult to stay on top of changing customer requirements.

- To create the capability to meet the customers' needs, the organization must have resources available to perform tasks. This includes raw materials, skills, knowledge, talents, money, time, and space. Processes are developed and documented as to how resources are to be planned, allocated, and managed.

- After planning activities ensure that resources are available for required activities, production processes are identified and documented to ensure effective and efficient utilization of the resources and product/service conformance to requirements. Contributing activities of suppliers and partners are included in the controlling of production activities. Inasmuch as an ISO 9001–certified QMS does not guarantee that the quality system works as designed, there must be some form of feedback mechanism indicating the quality of the output. In-process and final inspections and tests are conducted to determine the effectiveness of the inspection and test criteria, as well as to verify the conformance to customer requirements of the product/service.

- Information from production output activities and feedback from customers provide indicators of whether the system for managing quality is working as planned. Management reviews the effectiveness and efficiency of the quality system by reviewing measurements, audits, analysis, and improvement information.

- The cycle repeats itself. Results from the management review are integrated into the management of resources, production activities, or measurement activities.

- The ISO 9001 standard is considered a minimum requirement for an effective quality management system (QMS). ISO 9004 provides guidelines to expand the potential to achieve maximum benefits (and ROI) from the QMS implementation.

There are, of course, many benefits from implementation and certification of an ISO 9001 QMS. Some common ones are:

- Reduction in waste, rework, and redundancy
- Reduction in potential for external failures
- Cost reductions
- Increased productivity
- Improved performance
- More orderly method of doing business
- Improved customer satisfaction
- Reduction in number of on-site customer-ordered audits
- Marketing edge over suppliers that do not have a certified QMS
- Increased employee pride in organization and work they do

Some of the comments and criticisms of the ISO 9000 series include:

- There is a tendency to overdo the quantity and complexity level of procedures.
- The standard makes no assurances about a company's products.
- Confusion often exists as to what should be included in the quality manual.
- Understanding the difference between *objective evidence* and *records* is confusing. Also, realizing that an unfilled printed form may be a procedure or work instruction, but when filled out may become a record.
- Failing to realize that product realization processes are different than quality management system processes.
- Confusion occurs when attempting to determine what quality plan means for the organization designing a QMS: What should be included? Who will use it? How will it be used? What level of detail? What format/medium should be used?
- Confusion often exists over what constitutes design and development and how it should be treated.
- Lack of understanding as to the difference between monitoring versus measuring.
- Confusion occurs when determining what needs to be calibrated, when, by whom, to what standards, and what to do if an instrument is not conforming.
- Widespread misunderstanding prevails about what is a correction versus corrective action versus preventive action.

- ISO 9004 is grossly misunderstood and largely ignored by many organizations. It is the key to unlock the real potential of a QMS to produce a measurable return on investment.
- The standards do not specifically address other measures such as cycle time and inventory.
- Registration (precertification audits, certification audits, and surveillance audits, costs for consultants, employee time, and documentation) can amount to a significant cost (or investment, depending on the value placed on continual improvement and compliance with customers' requirements).

Other Pertinent ISO 9000–Related Standards

This section contains a list of other important ISO 9000–related standards.[4]

ANSI/ISO/ASQ Q190115-2004: *Guidelines for Quality and/or Environmental Management Systems Auditing*—This is the U.S. version with supplemental guidance added.

QS-9000—This is an automotive industry standard developed by the Big Three automotive manufacturers (Chrysler, Ford, GM). QS-9000 incorporates the requirements of ISO 9001:1994 and additional requirements for quality management system attributes of business planning, advanced product quality planning, satisfaction, and continuous improvement. An international standard (ISO/TS 16949) for the automotive industry is replacing QS-9000.

ISO/TS 16949:2002: *Quality Management Systems*—This contains particular requirements for the application of ISO 9001:2000 for automotive production and relevant service part organizations.

IWA-1:200: *Quality Management Systems: Guidelines for Process Improvements in Health Service Organizations.*

SAE AS9100:2001: *The International Aerospace Quality System Standard.*

ISO TR 10014:1998: *Guidelines for Managing the Economics of Quality.*

ANSI/ISO/ASQ Q10015-2001: *Quality Management—Guidelines for Training.*

ISO 10006:2003: *Quality Management Systems—Guidelines for Quality Management in Projects.*

ANSI/ISO/ASQ E14001-2004: *Environmental management systems*—Contains requirements with guidance for use.

ISO 13485:2003: *Medical devices: Quality management systems*—Contains requirements for regulatory purposes.

TL 9000 Quality Management System Requirements Handbook, Book 1, Release 3.0—The hardware, software, and services quality systems requirements specific to the global telecommunications industry.

ISO/IEC 90003:2004: *Software engineering—Guidelines for the application of ISO 9001:2000 to computer software.*

ISO 6385:2004: *Ergonomic principles in the design of work systems.*

ISO 10001: *Quality management: Customer satisfaction—Guidelines for codes of conduct.*

ISO 10002: *Quality management: Customer satisfaction—Guidelines for complaints handling in organizations.*

ISO 10003: *Quality management: Customer satisfaction—Guidelines for external customer dispute resolution.*[5]

ISO 22000: *Food safety management systems—Requirements for organizations throughout the food chain.*[6]

Examples of Other Standards

Other organizations have issued standards, such as:

• *JCAHO.* Joint Commission on Accreditation of Healthcare Organizations (JCAHO) was created to empower a formal accreditation process for assuring safety and integrity of healthcare. During the late 1990s, the commission realized the value in adapting the criteria outlined for the Malcolm Baldrige National Quality Award. To date, each update of the Joint Commission standards has shown a closer linkage to the Baldrige criteria.

• *NCQA.* The National Committee for Quality Assurance (NCQA) is a not-for-profit organization that assesses and reports on the quality of managed care and health maintenance organizations. To earn this seal of approval, an organization must meet rigorous standards of confidentiality, access, customer service, and quality improvement. The mission of NCQA is to provide information about managed healthcare organizations, enabling users to make better decisions about plans based on quality.

• *CE mark.* An abbreviation of a French phrase (*conformité Européenne*), the CE mark on a product asserts that the manufacturer's product complies with the essential/safety requirements of relevant European regulations.[7]

• *Good manufacturing practices (GMP).* There are variations in the requirements for GMP, for example, medical device manufacturing and pharmaceuticals in the United States, EU directives in Europe, and others. In the United States, the U.S. Food and Drug Administration (FDA) monitors medical device problem data and inspects the operations and records of device developers and manufacturers to determine complicance with GMP.

• *SA 8000.* Social Accountability, an international management system standard developed to address the labor, workplace, and safety practices of organizations and their suppliers worldwide.[8]

• *TickIT*. TickIT is a certification of quality management systems that conform to the requirements of the ISO 9001 standard, specifically pertaining to the software development sector.[9]

• *SEI capability maturity model.* This model is used to determine current process capabilities and identify critical software issues for improvement. Assessments/appraisals are used to evaluate the software process of an organization to determine whether the organization follows a stable, predictable software process.[10]

3. OTHER QUALITY METHODOLOGIES

Describe and differentiate programs such as total quality management (TQM), continuous quality improvement (CQI), six sigma, benchmarking, etc. (Apply)

CMQ/OE BoK

Total Quality Management

Total quality management (TQM) is a term initially coined by the Naval Air Systems Command to describe its Japanese-style management approach to quality improvement. TQM is an umbrella methodology drawing on a knowledge of the principles and practices of the behavioral sciences, the analysis of quantitative and nonquantitative data, economics theories, and process analysis to continually improve the quality of all processes.

The principles and tools of TQM were developed over a long period of time. Some of the first seeds of quality management were planted in the 1920s, as the principles of scientific management swept through U.S. industry. At that time businesses clearly separated the processes of planning and carrying out the plan, and union opposition arose as workers were deprived of a voice in the conditions and functions of their work. The Hawthorne experiments in the late 1920s showed how worker productivity could be impacted by participation.

In the 1930s Walter Shewhart developed the methods for statistical analysis and control of quality. In the 1950s, W. Edwards Deming taught these methods to Japanese engineers and executives, while Joseph M. Juran taught the concepts of controlling quality and managerial breakthrough.

Armand V. Feigenbaum's 1950's book *Total Quality Control* is a forerunner for the present understanding of TQM. Likewise, Philip B. Crosby's promotion of zero defects paved the way for quality improvement in many companies.

The Japanese approach toward quality management, influenced by Deming, Juran, and Feigenbaum, was promoted under several names. In 1968, the Japanese named their approach to total quality *companywide quality control.* Kaoru Ishikawa's synthesis of the philosophy contributed to Japan's ascendancy as a quality leader.

TQM is the name for the philosophy of a broad and systemic approach to managing organizational quality. Quality standards such as the ISO 9000 series

and quality award programs such as the Deming Prize and the Baldrige National Quality Program (BNQP) specify principles and processes that comprise TQM.

Primary Elements of TQM

The philosophy of TQM can be summarized as a management system for a customer-focused organization that involves all employees in continual improvement of all aspects of the organization. It is an integrative system that uses strategy, data, and effective communications to integrate the quality discipline into the culture and activities of the organization.

- *Customer-focused.* It is fundamental to understand that the customer ultimately determines the level of quality. No matter what an organization does to foster quality improvement—training employees, integrating quality into the design process, upgrading computers or software, or buying new measuring tools—the customer ultimately determines whether the efforts were worthwhile. Chapters 16 and 17 provide further information on customer focus.

- *Total employee involvement.* Total employee involvement refers to participation of all employees in working toward common goals. Total employee commitment can only be obtained after fear has been driven from the workplace, when empowerment (see Chapter 2) has occurred, and management has provided the proper environment. High-performance work systems integrate continuous improvement efforts with normal business operations. Self-managed work teams (see Chapter 3) are one form of empowerment often used.

- *Process-centered.* A fundamental part of TQM is a focus on process thinking. A process is a series of steps that take inputs from suppliers (internal or external) and transforms them into outputs that are delivered to customers (again, either internal or external). The steps required to carry out the process are defined, and performance measures are continuously monitored in order to detect unexpected variation (see Chapter 15).

- *Integrated system.* Although an organization may consist of many different functional specialties often organized into vertically structured departments, it is the horizontal processes interconnecting these functions that are the focus of TQM. Micro-processes add up to larger processes, and all processes aggregate into the business processes required for defining and implementing strategy. Everyone must understand the vision, mission, and guiding principles as well as the quality policies, objectives, and critical processes of the organization. Business performance must be monitored and communicated continuously. An integrated business system may be modeled after the BNQP criteria and/or incorporate the ISO 9000 standards. Every organization has a unique work culture, and it is virtually impossible to achieve excellence in its products and services unless a good quality culture has been fostered. Thus, an integrated system connects business improvement elements in an attempt to continually improve and exceed the expectations of customers, employees, and other stakeholders.

- *Strategic and systematic approach.* A critical part of the management of quality is the strategic and systematic approach to achieving an organization's vision,

mission, and goals. This process, called *strategic planning* or *strategic management,* includes the formulation of a strategic plan that integrates quality as a core component (see chapters 5, 6, and 7).

- *Continual improvement.* A major thrust of TQM is continual process improvement. Continual improvement drives an organization to be both analytical and creative in finding ways to become more competitive and more effective at meeting stakeholder expectations.

- *Fact-based decision making.* In order to know how well an organization is performing, data on performance measures are necessary. TQM requires that an organization continually collect and analyze data in order to improve decision-making accuracy, achieve consensus, and allow prediction based on past history. (See Chapter 15.)

- *Communications*. During times of organizational change, as well as part of day-to-day operation, effective communications plays a large part in maintaining morale and in motivating employees at all levels. Communications involve strategies, method, and timeliness (see Chapter 9).

These elements are considered so essential to TQM that many organizations define them, in some format, as a set of core values and principles on which the organization is to operate. For example, the Baldrige criteria defines a set of core values and concepts that define behaviors in high-performing organizations.

Benefits of TQM

Following are some of the direct and indirect benefits that may result from TQM:

- Strengthened competitive position
- Adaptability to changing or emerging market conditions and to environmental and other government regulations
- Higher productivity
- Enhanced market image
- Elimination of defects and waste
- Reduced costs and better cost management
- Higher profitability
- Improved customer focus and satisfaction
- Increased customer loyalty and retention
- Increased job security
- Improved employee morale
- Enhanced shareholder and stakeholder value
- Improved and innovative processes

TQM Implementation Approaches

No one solution is effective for planning and implementing TQM in all situations. Each organization is unique in terms of the culture, management practices, and the processes used to create and deliver its products and services. The TQM strategy will then vary from organization to organization; however, the key elements just mentioned should be present in some format. Following is a generic model for implementing TQM:

1. Top management learns about and decides to commit to TQM. TQM is identified as one of the organization's strategies.
2. The organization assesses current culture, customer satisfaction, and quality management systems.
3. Top management identifies core values and principles to be used, and communicates them.
4. A TQM master plan is developed on the basis of steps 1, 2, and 3.
5. The organization identifies and prioritizes customer demands and aligns products and services to meet those demands.
6. Management maps the critical processes through which the organization meets its customers' needs.
7. Management oversees the formation of teams for process improvement efforts.
8. The momentum of the TQM effort is managed by the steering committee.
9. Managers contribute individually to the effort through hoshin planning, training, coaching, or other methods.
10. Daily process management and standardization take place.
11. Progress is evaluated and the plan is revised as needed.
12. Constant employee awareness and feedback on status are provided and a reward/recognition process is established.

Following are five different strategies that might be used to develop the TQM process:

• *Strategy 1: The TQM element approach.* The TQM element approach takes key business processes and/or organizational units and uses the tools of TQM to foster improvements. This method was widely used in the early 1980s as companies tried to implement parts of TQM as they learned them. Examples of this approach includes quality circles, statistical process control, Taguchi methods, and quality function deployment.

• *Strategy 2: The guru approach.* The guru approach uses the teachings and writings of one or more of the leading quality thinkers as a guide against which to determine where the organization has deficiencies, then makes appropriate

changes to remedy those deficiencies. For example, managers might study Deming's 14 points and seven deadly diseases, or attend the Crosby College. They would then work on implementing the approach learned.

• *Strategy 3: The organization model approach.* In this approach, individuals or teams visit organizations that have taken a leadership role in TQM and determine their processes and reasons for success. They then integrate these ideas with their own ideas to develop an organizational model adapted for their specific organization. This method was used widely in the late 1980s and is exemplified by the initial winners of the MBNQA (now BNQP).

• *Strategy 4: The Japanese total quality approach.* Organizations using the Japanese total quality approach examine the detailed implementation techniques and strategies employed by Deming Prize–winning companies and use this experience to develop a long-range master plan for in-house use. This approach was used by Florida Power and Light—among others—to implement TQM and to compete for and win the Deming Prize.

• *Strategy 5: The award criteria approach.* When using this model, an organization uses the criteria of a quality award, for example, the Deming Prize, the European Quality Award, or the BNQP, to identify areas for improvement. Under this approach, TQM implementation focuses on meeting specific award criteria. Although some argue that this is not an appropriate use of award criteria, some organizations do use this approach and it can result in improvement.

Common TQM Implementation Problems

Organizations can encounter a number of difficulties in implementing TQM. Some common roadblocks are:

• *Lack of management commitment.* When management talks TQM, but its actions fail to support the effort, it will ultimately fail to meet expectations. The result is cynicism and mistrust—and difficulty launching another attempt. For implementation to succeed, management must clearly and frequently communicate the reason for adopting TQM, be consistent in their application of TQM principles, and not approach TQM as if it is another fad.

• *Changing organizational culture.* Changing an organization's culture is extremely difficult and time-consuming. Fear of change must be addressed, past labor–management conflicts must be resolved, and the organization's focus must change from maintaining the status quo. Most employees will need to be convinced of the benefits that a TQM program will provide to buy in to the changes. This often means that employees need to change behaviors or perform tasks in a different way than before TQM. If motivation is lacking, frustration and stress are likely. And trust is a must!

• *Preparation.* Before implementing TQM, management should strive for an organizationwide commitment, clearly communicate the organization's vision, mission, and goals, and foster open communication about the organization's changed focus.

- *Use of data.* TQM relies on data-based decision making. To succeed in building and sustaining a TQM environment, data must be accurate, timely, and reliable. The measurement process used must be valid and consistent, and data access should be efficient. Decision makers must be trained in data analysis and interpretation.

Other problems, many of which fall under the four previous categories, include, but are not limited to:

- Lack of strategic direction
- Lack of shared vision, mission, or guiding principles
- Lack of cooperation and teamwork among different work groups
- Focus on short-term profits rather than on long-term goals
- Failure to understand what teamwork entails
- Failure to focus on customers' needs and expectations
- Lack of mutual trust and respect among levels of employees
- Insufficient resources or lack of sustained commitment of those resources
- Lack of continual and effective training and education
- Management's failure to recognize and/or reward achievements

TQM, as a term, is not used as widely in the United States as it once was. Most of the concepts, principles, and methodology have been subsumed under the term *quality management*.

Continuous Quality Improvement (CQI)

The concept of companywide continuous improvement originated with American companies (National Cash Register, Lincoln Electric Company) dating as far back as 1894. Gradually the momentum changed from improving the workplace environment to an emphasis on productivity improvement and work simplification. Japanese companies began development of continuous quality improvement programs in the early 1950s (Toshiba, Matsushita Electric, and Toyota).

The ISO 9001:2000 standard requires continual quality improvement. The term changed from *continuous* (implying non-stop) to *continual* (meaning recurring often).

Kaizen. *Kaizen* is a Japanese word meaning incremental and orderly continuous improvement and is often considered the single most significant contributor to Japanese success in the marketplace.[11] The kaizen philosophy embraces all business areas and processes. The focus is on improving the quality of people, which leads to quality of product and service.

Workers are given the quality improvement tools to expose opportunities for improvement and reduce waste. Top management supports the efforts, allocates resources, and provides reward programs that encourage improvement. Workers participate in suggestion systems and group activities. They receive training in

problem solving and quality tools. Japanese organizations expect and receive an extremely large quantity of suggestions per employee, most of them small incremental improvements costing little to implement.

A *kaizen event* is typically a five-day, highly intensive activity that may target eliminating waste, improving the work environment (especially safety), and reducing costs. It involves a team of workers focused on a specific opportunity for increased effectiveness and efficiency. Importantly, the result is not only a process improvement, but also the development of a new or revised work standard (without which the benefit of the improvement might soon dissipate). A structured approach is used for the five-day event.

A cycle-time reduction team is a team comprised of workers involved with a given process. They meet periodically, for example, once a week, to study the process and create innovative methods and/or tools for shortening the process cycle time. Examples are: single minute exchange of dies (SMED) and other ways to reduce setup time, cellular processing, and single-piece flow (see Chapter 14, Section 3 for more on lean tools).

Six Sigma. Six Sigma: A statistical term? A methodology? A breakthrough strategy? A philosophy? It's all of these. The objective of Six Sigma is to reduce variation and produce the product or service outputs consistently within customers' requirements. See Chapter 13, Section 3 for more on Six Sigma.

Benchmarking. Benchmarking is a process for identifying, comprehending, and adapting knowledge of exemplary practices and processes from organizations worldwide to assist an organization in improving its process or product performance. Best-in-class organizations use benchmarking as a key activity in setting goals as well as in determining how to meet them. Benchmarking assures management that chosen goals and objectives are competitive and attainable. Benchmarks are the measures of a best-in-class process.

Benchmarking involves identifying potential sources of best practices. First, however, it requires gaining a complete understanding of one's own process as it is impossible to do an accurate comparison to others without such an understanding. This requires knowing the boundaries of the process to be studied, the steps involved (as identified through a process map), and the current performance level of the process.

Benchmarking levels include:

1. Internal benchmarking: comparing a process in one function with that of another function or comparing the same process across locations. Data are fairly easy to collect; however, focus is limited and possibly biased.
2. Competitive benchmarking: comparing with direct competitors, either locally, nationally, or worldwide. The organization may not be viewed as a competitor when comparing with other organizations outside the local market area. In this case, the data can be more relevant, but difficult to collect. Typically, there will be resistance from a local direct competitor. Also, ethical and legal issues can be a concern.
3. Functional benchmarking: comparing processes to other organizations with similar processes in the same function, but outside the industry.

4. Generic benchmarking: finding organizations that have best-in-class processes and approaches from which one may learn and translate to improvements at one's own organization. When you think outside the box, there is a high potential for discovering innovative practices and usually little resistance to partnering with a noncompetitor (see Table 12.1). There can be problems and high costs in translating practices learned to one's own work environment.

Many organizations conduct benchmarking studies at all four levels. Typical steps in benchmarking are:

1. Review, refine, and define existing process to be benchmarked.
2. Determine what to benchmark.
3. Form a benchmarking team.
4. Identify benchmark partners.
5. Collect and analyze benchmarking information.
6. Evaluate organization's performance versus benchmark partner.
7. Determine how upgrading practices will impact the organizations.
8. Establish new strategic targets.
9. Implement improvements and a system to monitor progress.
10. Do it all over again.

Sources of organizations with which to partner in a benchmarking study can be found by examining trade publications listing companies deemed best in their industries, perusing best-practices databases available from major consulting firms, or talking with award-winning companies or others from whom it is expected that significant learning can occur. The Internet is a widely used resource for benchmarking, although the reliability of the information should be confirmed (see Figure 12.2).

If process results or outcomes are all that are to be benchmarked, then available performance figures might be sufficient and no further analysis necessary. If the process that achieves those results is to be benchmarked, however, then a visit to the benchmarking partner can be arranged. Once performance data have been analyzed, the project team can determine how the partner is achieving that performance and then set objectives and an action plan to achieve similar or greater success.

The process of benchmarking can become so large that it becomes an entity in its own right. Before using it as a key decision-making tool, an organization should determine whether benchmarking is the best use of its resources. A benchmarking effort might initially be limited to discovering whether anyone has overcome the same or similar constraints. If so, the benchmarking team can decide whether benchmarking is required to replicate the success. When process benchmarking is to be done, sponsorship from management is mandatory.

Table 12.1 Who should you benchmark?

Industry	Area—Process Improvement	Possible Benchmarks
Airline	Changeover planes quickly	Auto racing pit crews
Bandage manufacturer	Convert material to product	Auto manufacturer
Education	Teach/train students	Industry trainers
Hospital	Bill and collect payments	Credit card companies
Pizza delivery	Deploy personnel rapidly	Military, hospital emergency room
Shell casing manufacturer	Make smooth cylinders	Lipstick manufacturer
Municipal government	Pothole repairs—time and material	Electric or gas utility
Hotel	Maintenance of public spaces	Gambling casino
Professional Association	Book and product sales	Internet-based book company
On-call TV repair service On-call plumber Cable TV service Public Utility	Truck-stock replenishment or selection of on-board tools and equipment	Fire department Ambulance service Police department
Urban transit company	Bus/trolley car maintenance	Interstate truck stop service center
Sports arena	Processing mailed-in ticket sales	Commercial mail-order company
Metal stamping manufacturer (job shop)	Time to changeover dies for new order	Aircraft carrier—mounting weapons/ammunition on planes
Bank	Handling cash transactions	Sports arena
Assembly plant	Restocking parts just-in-time	Supermarket
Aerospace manufacturer	Large-project management	Major commercial building construction firm
Printer of continuous web paper products	Improving operating performance	Manufacturer of rolled metal products
Large hi-tech electronics manufacturing and assembly	Establishing customer/public tours and information center	NASA Large public utility

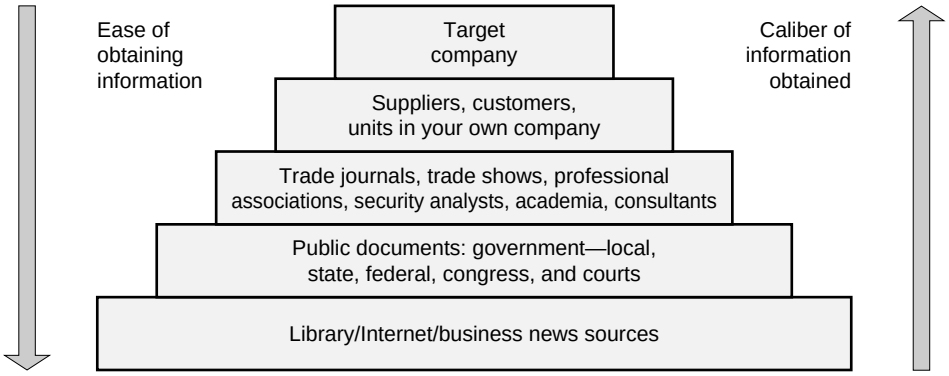

Figure 12.2 Sources of benchmarking information.

When done correctly, benchmarking offers many benefits. It allows the team to look beyond its own organization and even its industry. Looking beyond normal, everyday boundaries allows new ideas to occur. In addition, a successful relationship with a benchmark partner can create a mutually beneficial sales tool for both companies. Significant research and development resources can be saved when mistakes are avoided. Finally, benchmarking can allow an organization to gain ground on the competition in a very short time.

Successful benchmarking includes:

- Having the right people on the team
- The ability to successfully break a process into its components
- Avoiding taking on too large a process
- A long-term management commitment
- Focusing on process rather than on just metrics
- Integrating the benchmarking criteria with broader goals
- Realizing that differences in culture, the portfolio of processes, and skill levels will likely make copying a process from one organization into another ineffective

See Figure 12.3 for a benchmarking code of conduct.

Organizations that already have effective quality systems in place and are among the high-end profit producers for their size and type of business will probably benefit most from benchmarking. Mid-level profit producers can gain valuable insights, but may get a better return on their investment by first getting their own organization's processes in better shape. Lower-level profit producers, with little or no quality systems in place, may become frustrated with the gap between their practices and a best-in-class producer (also, a benchmark partner expects new partners to share something).

Preamble—To guide benchmarking encounters and enhance the professionalism and effectiveness of benchmarking many organizations have adopted this common Code of Conduct. All organizations are encouraged to abide by this Code of Conduct. Adherence to these principles will contribute to efficient, effective, and ethical benchmarking.

1. *Principle of Legality.*
   - If there is any potential question on the legality of an issue, don't do it.
   - Avoid discussions or actions that could lead to or imply an interest in restraint of trade, market, and/or customer allocation schemes, price fixing, dealing arrangements, bid rigging, or bribery. Don't discuss costs with competitors if costs are an element of pricing.
   - Refrain from the acquisition of trade secrets from any means that could be interpreted as improper, including the breach or inducement of a breach of any duty to maintain secrecy. Do not disclose or use any trade secret that may have been obtained through improper means or that was disclosed by another in violation of a duty to maintain secrecy or limit its use. Do not, as a consultant or client, extend one benchmarking effort's findings to another company without first obtaining permission from the parties of the first effort.
2. *Principle of Exchange.*
   - Be willing to provide the same type and level of information that you request from your benchmarking partner to your benchmarking partner.
   - Communicate fully and early in the relationship to clarify expectations, avoid misunderstanding, and establish mutual interest in the benchmarking exchange. Be honest and complete.
3. *Principle of Confidentiality.*
   - Treat benchmarking interchanges as confidential to the individuals and companies involved. Information must not be communicated outside the partnering organizations without the prior consent of the benchmarking partner who shared the information.
   - A company's participation in a study is confidential and should not be communicated externally without its prior permission.
4. *Principle of Use.*
   - Use information obtained through benchmarking only for purposes of formulating improvement of operations or processes, within the companies participating in the benchmarking effort.
   - The use or communication of a benchmarking partner's name with the data obtained or practices observed requires the prior permission of that partner.
   - Do not use benchmarking as a means to market or sell.
5. *Principle of First-Party Contact.*
   - Initiate benchmarking contacts, whenever possible, through a benchmarking contact designated by the partner company.
   - Respect the corporate culture of partner companies and work within mutually agreed upon procedures.
   - Obtain mutual agreement with the designated benchmarking contact on any hand-off of communication or responsibility to other parties.
6. *Principle of Third-Party Contact.*
   - Obtain an individual's permission before providing his or her name in response to a contact request.
   - Avoid communicating a contact's name in an open forum without the contact's permission.
7. *Principle of Preparation.*
   - Demonstrate commitment to the efficiency and effectiveness of benchmarking by completing preparatory work prior to making an initial benchmarking contact and follow a benchmarking process.
   - Make the most of your benchmarking partner's time by being fully prepared for each exchange.
   - Help your benchmarking partners prepare by providing them with an interview guide or questionnaire and agenda prior to benchmarking visits.

(Continued)

Figure 12.3 Benchmarking Code of Conduct.

Source: American Society for Quality, Quality Management Division, Benchmarking Committee. See the fall 1997 issue of *The Quality Management Forum* for additional information on ethics and etiquette and benchmarking protocol.

(Continued)

8. *Principle of Completion.*
   - Follow through with each commitment made to your benchmarking partners in a timely manner.
   - Complete each benchmarking effort to the satisfaction of all benchmarking partners, as mutually agreed.
9. *Principle of Understanding and Action.*
   - Understand how your benchmarking partners would like to be treated.
   - Treat your benchmarking partners in the way that you would like to be treated.
   - Understand how each benchmarking partner would like to have the information he or she provides handled and used, and handle and use it in that manner.

Figure 12.3 Benchmarking Code of Conduct.

Source: American Society for Quality, Quality Management Division, Benchmarking Committee. See the fall 1997 issue of *The Quality Management Forum* for additional information on ethics and etiquette and benchmarking protocol.

Examples of how to select what to benchmark include systems, processes, or practices that:

- Incur the highest costs
- Have a major impact on customer satisfaction, quality, and cycle time
- Strategically impact the business
- Have the potential of high impact on competitive position in the marketplace
- Present the most significant area for improvement
- Have the highest probability of support and resources if selected for improvement

Examples of some of the areas for which benchmarking studies have been done include:

- Accounting systems
- Compensation systems
- Purchasing practices, for example, supplier selection
- Manufacturing and distribution processes
- Customer service practices
- Customer database design
- Cost of quality
- Capital investments, for example, selection criteria
- Techniques and tools
- Facility size, layout, decor

- Staffing practices, for example, size of departments, hiring criteria, training programs
- Employee involvement, empowerment, and recognition
- Marketing and promotion practices
- Knowledge management approaches
- Innovative usage of information technology
- Services and products offered
- Customer acquisition and retention approaches
- Customer satisfaction practices
- Overall operation, for example, building the organization's image, hours of operation
- Special practices and incentives

It is crucial to understand that benchmarking *is not:*

- Industrial spying
- Competitive analysis
- Industrial tourism
- Focused only on numbers, but also on the processes that produce the numbers
- Effectively planned and initiated unless there are significant potential gains expected
- A quick or inexpensive process, if properly executed
- For organizations that are unwilling to make the effort to learn and measure what they are presently doing
- Appropriate without proper protocol and legal considerations
- Worth initiating unless your organization is prepared to make changes resulting from what's learned
- Easily accomplished if you have nothing to trade in your partnering arrangement
- Usually a one-shot process

In a 1944 interview, Juran told about German generals in the early 1900s who came to the United States to follow an American circus around.[12] The circus performed in tents, monstrous things to set up and take down. The circus moved from city to city on very short notice, which was a complicated process involving animals, people, equipment, food, and housing. To do this they had special railway cars designed. They were very proficient at handling every little detail.

The generals had a situation, but one which seemed to be far from that of a circus, or so they thought until they looked at the similarities. They had people,

horses, ammunition, food for both humans and animals, and tons of equipment. And, they, too, were faced with the need for setting up and dismantling their camps on very short notice. These generals learned about deployment from observing a circus, which, at first, appeared to have no relation to their army. This was a classical case of functional benchmarking.

4. QUALITY PHILOSOPHIES

> Define and describe the basic methodologies and theories proposed by quality leaders such as Deming, Juran, Crosby, Feigenbaum, Ishikawa, and others. (Apply)
>
> **CMQ/OE BoK**

Theories of Major Contributors to Quality

Many theorists contributed to the philosophies and methods supporting TQM. Following are brief summaries of some of the more widely known quality gurus.

Philip B. Crosby. Crosby defines quality as conformance to requirements; therefore, quality is measured by the cost of nonconformance. Using this approach means that one arrives at a performance goal of zero defects. Quality management means prevention, so inspection, testing, checking, and other nonpreventive techniques have no place in quality management. Crosby believes that statistical levels of compliance set up people for failure.

Crosby defines what he called absolutes of quality management:

1. Quality means conformance not elegance.
2. There is no such thing as a quality problem.
3. There is no such thing as the economics of quality; it is always cheaper to do the job right the first time.
4. The only performance measurement is the cost of quality.
5. The only performance standard is zero defects.[13]

He maintains that absolutely no reason exists for having errors or defects in any product or service, and that companies should adopt a quality "vaccine" to prevent nonconformance. The three ingredients of this vaccine are determination, education, and implementation. Quality improvement is a process, not a program; it should be permanent and lasting. He also has 14 steps he believes necessary for improvement:

1. Make it clear that management is committed to quality.

2. Form quality improvement teams with representatives from each department.
3. Determine how to measure where current and potential quality problems lie.
4. Evaluate the cost of quality and explain its use as a management tool.
5. Raise the quality awareness and personal concern of all employees.
6. Take formal actions to correct problems identified through previous steps.
7. Establish a committee for the zero defects program.
8. Train all employees to actively carry out their part of the quality improvement program.
9. Hold a zero defects day to let all employees realize that there has been a change.
10. Encourage individuals to establish improvement goals for themselves and their groups.
11. Encourage employees to communicate to management the obstacles they face in attaining their improvement goals.
12. Recognize and appreciate those who participate.
13. Establish quality councils to communicate on a regular basis.
14. Do it all over again to emphasize that the quality improvement program never ends.

W. Edwards Deming. Deming saw quality as the primary driver for business and societal success, and communicated the philosophy as a chain reaction. The premise is that if one improves quality, then costs will be lowered and resources better utilized. This increase in productivity will then allow the company to capture market share due both to higher quality and lower price, which will allow the organization to stay in business and to provide more jobs.

Deming's best known contribution was his 14 points for transformation of Western management:

1. Create constancy of purpose for improvement of product and service.
2. Adopt the new philosophy.
3. Cease dependence on mass inspection.
4. End the practice of awarding business on the price tag alone.
5. Improve constantly and forever the system of production and service.
6. Institute training.
7. Adopt and institute leadership.

8. Drive out fear.
9. Break down barriers between staff areas.
10. Eliminate slogans, exhortations, and targets for the workforce.

11a. Eliminate numerical quotas for the workforce.

11b. Eliminate numerical goals for people in management.

12. Remove barriers that rob people of pride of workmanship.
13. Encourage education and self-improvement for everyone.
14. Take action to accomplish the transformation.

Deming also defined *seven deadly diseases* that he believed to be the major barriers to business success:

1. *Lack of constancy of purpose.* A company without constancy of purpose has no long-range plans for staying in business. Management is insecure, and so are employees.
2. *Emphasis on short-term profits.* Looking to increase the quarterly dividend undermines quality and productivity.
3. *Evaluation by performance, merit rating, or annual review of performance.* The effects of these are devastating—teamwork is destroyed, rivalry is nurtured. Performance ratings build fear and leave people bitter, despondent, and beaten. They also encourage defection in the ranks of management.
4. *Mobility of management.* Job-hopping managers never understand the companies they work for and are never there long enough to follow through on long-term changes that are necessary for quality and productivity.
5. *Running a company on visible figures alone.* The most important figures are unknown and unknowable—the multiplier effect of a happy customer, for example.
6. *Excessive medical costs for employee healthcare.* These increase the final costs for goods and services.
7. *Excessive costs of warranty.* These are often fueled by lawyers who work on the basis of contingency fees.

Deming emphasized that transformation of organizations begins with the individual and that this comes from gaining a different understanding of self and the world in which he or she lives. This will require understanding the system of profound knowledge, which consists of four major components:

1. *Appreciation for a system.* An organization is a system of interrelated components with a common purpose. Changing one part of the system affects other parts.

2. *Knowledge about variation.* Everything varies, but understanding whether the variation is due to chance cause or random cause will change what action should be taken, if any.
3. *Theory of knowledge.* No learning has occurred if there is no theory that allows prediction. Operational definitions are necessary in order to allow theories to be useful to many.
4. *Psychology.* We all want to be appreciated. People have different needs, however, and what will make one happy might negatively impact another.[14]

Deming adapted Shewhart's plan–do–check–act cycle to plan–do–study–act (with proper attribution to Shewhart) to better reflect the actions of this process. PDCA is the term more often used and often incorrectly attributed to Deming.

Armand V. Feigenbaum. Total quality control uses quality as a strategic business tool that requires awareness by everyone in the organization (just as cost and schedule are regarded in most companies). Quality reaches far beyond defect management on the shop floor: it is a philosophy and commitment to excellence.

Quality is a way of corporate life—a way of managing. Total quality control has an organizationwide impact that involves implementation of customer-oriented quality activities. This is a prime responsibility of general management as well as marketing, engineering, production, industrial relations, finance, and service, and of the quality function itself. Feigenbaum defines total quality control as excellence driven rather than defect driven, and suggests that the quest consists of three elements: quality leadership, quality technology, and organizational commitment.

Continuous leadership emphasis must be placed on quality, which must be thoroughly planned in specific terms. The establishment of a quality circle program or a corrective action team is not sufficient for ongoing success.

The traditional quality department cannot resolve 80 percent to 90 percent of quality problems. In a modern setting, all members of the organization must be responsible for the quality of their product or service. This means integrating office staff into the process as well as engineers and shop floor workers. Error-free performance should be the goal. New techniques must be evaluated and implemented as appropriate. What might be an acceptable level of quality to a customer today might be unacceptable tomorrow.

For quality to be achieved, continuous motivation is required. Training that is specifically related to the task at hand is of paramount importance. Quality should be considered a strategic element of business planning.

Feigenbaum defined four management fundamentals of total quality:

1. Competition means there's no such thing as a permanent quality level. Continuous improvement is necessary if one is to stay competitive.
2. Good management involves personally leading the effort by mobilizing the organization's quality knowledge, skill, and attitudes such that everyone realizes that improvement in quality makes everything better.

3. Successful innovation requires high quality to support it, especially where it enables new products to be designed and launched quicker and more effectively.
4. Cost and quality are complementary rather than conflicting objectives.[15]

Kaoru Ishikawa. Ishikawa was an early student of Deming and a member of the Union of Japanese Scientists and Engineers (JUSE). He authored the *Guide to Quality Control* to help training of foremen and middle managers in Japan for the operation of quality circles. In his book *What Is Total Quality Control? The Japanese Way,* he defines total quality control in the following ways:

- Quality control (QC) is the responsibility of all workers and all divisions.
- Total quality control (TQC) is a group activity and cannot be done by individuals. It calls for teamwork.
- TQC will not fail if all members cooperate, from the president down to line workers and sales personnel.
- In TQC, middle management will be frequently talked about and criticized—be prepared.
- QC circle activities are a part of TQC.
- Do not confuse objectives with the means to attain them.
- TQC is not a miracle drug; its properties are more like those of Chinese herb medicine.

To achieve total quality control, a thought revolution must occur:

- Quality first—not short-term profit first.
- Consumer orientation—not producer orientation. Think from the standpoint of the other party.
- The next process is your customer—break down the barrier of sectionalism.
- Use facts and data to make presentations—utilize statistical methods.
- Respect for humanity as a management philosophy—full participatory management.
- Cross-function management.

Ishikawa advocated four types of audits:

1. Audit by the president
2. Audit by the head of the unit (for example, division head or branch office manager)
3. QC audit by the QC staff
4. Mutual QC audit

The concept of quality circles is attributed to Ishikawa. He also introduced the cause-and-effect diagram and variations of the check sheet.[16]

Joseph M. Juran. Joseph M. Juran pursued a varied career as an engineer, executive, government administrator, university professor, labor arbitrator, corporate director, and consultant. Specializing in managing for quality, he is the editor of *Juran's Quality Handbook* (with Blanton Godfrey).[17]

Juran defines quality as consisting of two different, but related concepts:

1. One form of quality is income oriented and consists of those features of the product that meet customer needs and thereby produce income. In this sense, higher quality usually costs more.
2. A second form of quality is cost oriented and consists of freedom from failures and deficiencies. In this sense, higher quality usually costs less.

He defined three basic managerial processes required for quality, called the Juran Trilogy. The processes are quality planning, quality control, and quality improvement, which, he noted, parallel the processes traditionally used to manage finance.

Juran's quality planning road map consists of the following steps:

- Determine quality goals.
- Identify customers.
- Discover customers' needs.
- Translate from customer language to products having desired features.
- Develop processes able to produce the product.
- Transfer the process, with appropriate controls, to operations.

Control takes place at all levels, from the CEO down to the workers, and all use the same feedback loop, which is the following:

- Measure performance of the process.
- Compare performance to the goal.
- Take action if there is a gap.

The goal of management should be to achieve what Juran calls self-control in all processes, wherein the person doing the process is capable of making all adjustments necessary to maintain control. Planning for control is part of the function of designing the process.

Juran presented a structured approach for improvement in his book *Managerial Breakthrough* (1964) and included a list of responsibilities that upper managers should not delegate:

- Create awareness of the need and opportunity for improvement.
- Make quality improvement a part of every job description.

- Create an infrastructure—a quality council who selects projects for improvement and established teams.
- Provide training in quality improvement methods.
- Regularly review improvement progress.
- Give recognition to improvement teams.
- Use the results to spread the word on the power of the efforts.
- Revise the reward system to enforce the rate of improvement.
- Maintain momentum by enlarging the business plan to include goals for quality improvement.

Juran also defines three levels of quality management:

1. Strategic quality management, which concerns itself mostly with policies
2. Operational quality management, which concerns itself with process management
3. The workforce, which concerns itself with specifications and work procedures

Juran defines TQM as a collection of certain quality-related activities:

- Quality becomes a part of each upper management agenda.
- Quality goals enter the business plan.
- Stretch goals are derived from benchmarking: focus is on the customer and on meeting competition, and there are goals for annual quality improvement.
- Goals are deployed to the action levels.
- Training is done at all levels.
- Measurement is established throughout.
- Upper managers regularly review progress against goals.
- Recognition is given for superior performance.
- The reward system is revised.

Juran expressed what he termed a universal sequence, described in two journeys. A *diagnostic journey* goes from symptom to cause. This includes analyzing symptoms, theorizing causes, testing theories, and establishing causes. A *remedial journey* covers cause to remedy. The activities included are: developing remedies, testing remedies, proving remedies under operating conditions, dealing with resistance to change, and establishing controls to maintain the gains.

Walter A. Shewhart. Shewhart is referred to as the father of statistical quality control because he brought together the disciplines of statistics, engineering, and economics. Shewhart worked at Bell Laboratories, which pioneered the quality

discipline and gave the profession some of its most capable experts. A mentor of both Juran and Deming, Shewhart did extensive research in statistics and probability. He described the basic principles of the new discipline in his book *Economic Control of Quality of Manufactured Product,* the first statistics text focused on quality.

In his book he first proposed that there are two types of variation in a process—chance causes and assignable causes—and pointed out that assignable causes can be searched out and removed. He then presented a theory of charting data from the process, using statistically based control limits as a means of differentiating between the two types of causes. The use of lot-by-lot inspection and understanding the relationship between process variation and specifications were also spelled out. Shewhart's focus was on finding economic ways to reduce costs by identifying problems sooner in the process and by reducing the cost of inspection. See Chapter 15 for more on statistical techniques.

Shewhart created the concept of plan–do–check–act, which Deming later adapted.

Genichi Taguchi. Taguchi is best known in the United States for the Taguchi methods, which involve the efficient use of design of experiments for identifying the major contributors to variation (parameter design), for setting tolerances based on inherent statistical variation (tolerance design), and for designing robust products and processes. Taguchi maintains that the goal is the most robust combination of product and process. That is, the product that best meets the customers' requirements by being most consistently produced by the process.

He defines quality of a product as "the (minimum) loss imparted by the product to society from the time the product is shipped." From this, he designed the Taguchi loss function, which translates any deviation of a product from its target parameter into a financial measure (see Figure 12.4). The Taguchi loss function is a driver for continuous improvement.

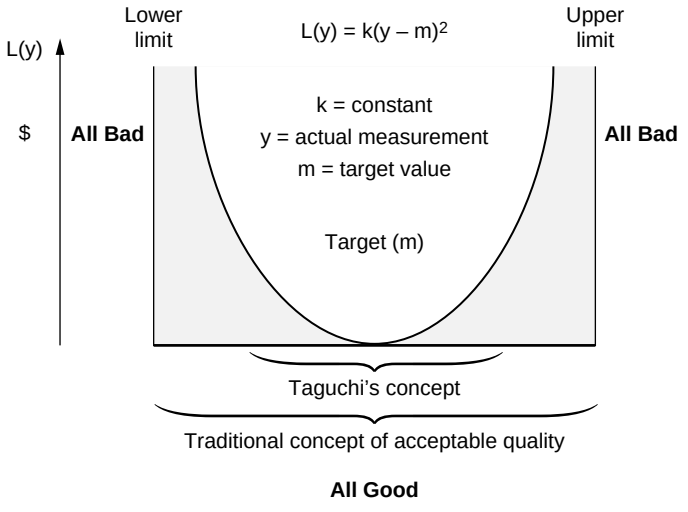

Figure 12.4 The Taguchi loss function.

Additional Resources

Blazey, M. L. *Insights to Performance Excellence: An Inside Look at the 2005 Baldrige Award Criteria.* Milwaukee: ASQ Quality Press, 2005.

Brown, M. G. *Baldrige Award Winning Quality: How to Interpret the Baldrige Criteria for Performance Excellence,* 14th ed. New York: Productivity Press, 2005.

Byrnes, M. A., and J. C. Baxter. *There Is Another Way! Launch a Baldrige-Based Quality Classroom.* Milwaukee: ASQ Quality Press, 2005.

Cianfrani, C. A., J. J. Tsiakais, and J. E. West. *The ASQ ISO 9000:2000 Handbook.* Milwaukee: ASQ Quality Press, 2002.

Creech, B. *The Five Pillars of TQM*. New York: Truman Talley/Dutton, 1994.

Crosby, P. B. *Quality Is Free*. New York: Mentor Books, 1979.

Deming, W. E. *The New Economics,* 2nd ed. Cambridge, MA: MIT Center for Advanced Educational Studies, 1994.

———. *Out of the Crisis.* Cambridge, MA: MIT Center for Advanced Engineering Study, 1986.

Evans, J. R., and W. M. Lindsay. *The Management and Control of Quality,* 5th ed. Cincinnati, OH: South-Western, 2002.

Feigenbaum, A. V. *Total Quality Control,* 3rd ed. New York: McGraw-Hill, 1991.

Imai, M. *KAIZEN: The Key to Japan's Competitive Success.* New York: Random House Business Division, 1986.

Ishikawa, L. *Guide to Quality Control.* Tokyo: Asian Productivity Organization, 1982.

Juran, J. M., ed. *A History of Managing for Quality: The Evolution, Trends, and Future Directions of Managing for Quality.* Milwaukee: ASQC Quality Press, 1995.

Juran, J. M., and A. B. Godfrey, eds. *Juran's Quality Handbook.* New York: McGraw-Hill, 1999.

Juran, J. M., and F. M. Gryna. *Quality Planning and Analysis,* 3rd ed. New York: McGraw-Hill, 1993.

Monnich, H. C., Jr. *ISO 9001:2000 for Small and Medium Sized Businesses.* Milwaukee: ASQ Quality Press, 2001.

Peach, R. W., B. Peach, and D. S. Ritter. *The Memory Jogger 9000/2000.* Salem, NH: GOAL/QPC, 2000.

Russell, J.P. *ISO 9004 Assessment Criteria Checklist for Performance Improvement (CD-ROM).* Milwaukee: ASQ Quality Press, 2004.

———. *Continual Improvement Assessment Guide.* Milwaukee: ASQ Quality Press, 2004.

———. *The Internal Auditing Pocket Guide.* Milwaukee: ASQ Quality Press, 2003.

Stamatis, D. H. *Integrating ISO 9001:2000 with ISO/TS 16949 and AS9100.* Milwaukee: ASQ Quality Press, 2004.

Taguchi, G. *Introduction to Quality Engineering.* Dearbon, MI: American Supplier Institute, 1986.

West, J. E., and C. A. Cianfrani. *Unlocking the Power of Your QMS: Keys to Business Performance Improvement.* Milwaukee: ASQ Quality Press, 2005.

Westcott, R. T. *Stepping Up to ISO 9004:2000: A Practical Guide for Creating a World-Class Organization.* Chico, CA: Paton Press, 2003.

Zahran, S. *Software Process Improvement*. Reading, MA: Addison-Wesley, 1998.

Notes

1. A. V. Feigenbaum, *Total Quality Control,* 3rd ed. (New York: McGraw-Hill, 1991).
2. The content wording of the BNQP criteria is subject to change from year to year. Also, the wording in the criteria for education and for healthcare differs from the "all other" criteria shown here, taken from year 2005.

3. The ISO 9000:2000 series (three booklets) is available through ASQ (800) 248-1946.
4. Excepting QS 9000, these standards may be obtained through ASQ (800) 248-1946 or the Quality Press Bookstore at www.asq.org.
5. Under development
6. Under development
7. P. Brooks, "The Global Marketplace and CE Marking: If You Want to Sell in Europe, Here's What You Need to Know," *Quality Digest* (July 2002): 44–47.
8. CEPAA—Council on Economic Priorities Accreditation Agency. e-mail CEPAA.org
9. The National Computing Centre Limited, Manchester, M1 7ED, United Kingdom. Phone: +44 (0) 161 228 6333.
10. Developed by the Software Engineering Institute, a federally funded research and development center affiliated with Carnegie Mellon University in Pittsburgh, PA.
11. M. Imai, *KAIZEN: The Key to Japan's Competitive Success* (New York: Random House Business Division, 1986).
12. J. M. Juran, ed., *A History of Managing for Quality* (Milwaukee: ASQC Quality Press, 1995).
13. P. B. Crosby, *Quality Is Free* (New York: Mentor Books, 1979).
14. W. E. Deming, *The New Economics,* 2nd ed. (Cambridge, MA: MIT Center for Advanced Educational Studies, 1994).
15. A. V. Feigenbaum, *Total Quality Control,* 3rd ed. (New York: McGraw-Hill, 1991).
16. L. Ishikawa, *Guide to Quality Control* (Tokyo: Asian Productivity Organization, 1982).
17. J. M. Juran, *Juran's Quality Handbook* (New York: McGraw-Hill, 1999).

Index

Page numbers in italics refer to illustrations

D

G

H

I

Q