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THE ASQ CERTIFIED MANAGER OF QUALITY/ ORGANIZATIONAL EXCELLENCE HANDBOOK

Fifth Edition

Sandra L. Furterer and Douglas C. Wood, Editors

Contributors
Bill Craddock, Denis Devos, Grace Duffy,
Sandra L. Furterer, Susan Gorveatte, Jeff Israel,
Tim King, Jd Marhevko, Heather McCain, Eileen Serrano,
Joe Wojniak, Douglas C. Wood

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Preface to the Fifth Edition

QUALITY MANAGEMENT—AN EVOLVING REQUISITE OF SOCIETY

We know the scope of quality management principles has evolved over the past four decades to much more than the control of manufacturing processes. Quality management tools and techniques are used for any process in any organization. We have seen the integration of organizational excellence models, various international systems standards, lean principles, and Six Sigma tools into the daily operations of an organization. For the most part, quality management professionals have led these efforts.

It is hard to grasp the amount of data available today and the speed at which they are delivered. Advances in technology within Industry 4.0, big data, and the internet of things have opened new opportunities to gain insights into what our customers/clients are thinking and how our processes are performing. Technology has profoundly changed the way we communicate with each other, allowing teams to effectively function globally. The rate of change only accelerates over time. Today's quality management professional must understand the impact of these changes and be able to apply the plethora of tools and techniques available to them in new ways. To remain relevant in society requires a broad understanding of the tools available and innovative thinking about how they are applied. The ASQ Certified Manager of Quality/Organizational Excellence (CMQ/OE) body of knowledge identifies the knowledge required to be successful. It knows not only what tools to use but also how to apply them to meet an organization's strategic needs in an ever-changing business environment.

The fifth edition of *The ASQ Certified Manager of Quality/Organizational Excellence Handbook* takes a fresh look across the broad range of current quality management practices while providing insight into new applications for these tools and techniques to meet the challenges of today's society.

CONTINUOUS LEARNING—PERSONAL EXCELLENCE AS A BASIS FOR ORGANIZATIONAL EXCELLENCE

ASQ's CMQ/OE certification recognizes an individual not only for a broad knowledge of quality management and organizational excellence principles but also for a deep understanding of the complex issues facing organizational performance. The CMQ/OE is a professional designation with rigorous prerequisite requirements in order to sit for an equally rigorous exam. It is the pinnacle of ASQ's professional accreditations.

The CMQ/OE exam body of knowledge is refreshed about every five years. This refresh starts with a job analysis survey of hundreds of quality management professionals around the world in order to capture current practices in the field. From there, teams of CMQ/OE thought leaders go through various workshops, from setting test specifications to item pool maintenance, item review, and, finally, an exam review. Thousands of CMQ/OE thought leaders have been involved with development since the exam's debut in 1995.

The way the CMQ/OE body of knowledge is developed helps ensure its relevance to current practices in quality management and organizational excellence. It is what organizations are looking for in a quality manager, director, or organizational excellence professional. The CMQ/OE body of knowledge changes as global economic conditions, societal concerns, and technology continue to change. This changing environment requires CMQ/OE professionals to recertify every three years in order to ensure their knowledge and skills remain relevant.

USE AND DEVELOPMENT OF THE FIFTH EDITION OF THIS HANDBOOK

This handbook was written to provide additional context to the CMQ/OE body of knowledge. It is an excellent reference for those preparing for the CMQ/OE exam. It can also be used by any professional wanting to understand the scope of quality management and organizational excellence practices. It is a practical guide for any professional to reference on a day-to-day basis when various quality management challenges occur.

While the most recent changes to the CMQ/OE body of knowledge are relatively minor, the fifth edition of this handbook has undergone some significant content changes in order to provide more clarity regarding the items in the body of knowledge. Examples have been updated to reflect more current perspectives, and of course, there is the addition of topics to the most recent body of knowledge.

Since the publication of the fourth edition of the CMQ/OE handbook, we have lost a great teacher and mentor. Russ Wescott has been the driving force behind this effort since the first edition was published in 1997. He touched many lives and is deeply missed. The editorial team of Dr. Sandra L. Furterer and Douglas Wood have taken the reigns, pulling this fifth edition together. Doug was a natural choice given his years of experience both developing and teaching the CMQ/OE prep course offered by ASQ's Learning Institute. Dr. Furterer has an extensive background in publications and editorial review as well as a great foundation in quality management principles. This editorial team recruited a team of recognized quality management thought leaders to contribute to this workbook. It was a true team effort.

Thanks to all of the team members who made the fifth edition of *The ASQ Certified Manager of Quality/Organizational Excellence Handbook* a reality.

—Jerry Rice, Chair, ASQ Quality Management Division

Acknowledgments

To our colleagues Bill Craddock, Denis Devos, Grace Duffy, Susan Gorveatte, Jeff Israel, Tim King, Jd Marhevko, Heather McCain, Eileen Serrano, and Joe Wojniak, who have contributed with us to this revised edition.

To the staff at Quality Press and the hardworking copy and production editors who have ably corrected grammatical errors and made valuable suggestions for improvement.

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

—Sandra L. Furterer and Douglas C. Wood
Editors, Fifth Edition

I would like to dedicate this handbook to my husband, Dan, and three amazing children, Kelly, Erik, and Zach, from whom I derive the meaning of life.

—Sandra L. Furterer

Introduction

EVOLUTION OF QUALITY

The principles and tools of modern-day quality have evolved over the last one hundred years or so. They were first used mostly independent from productivity and information technology (IT) practices. However, as the tools and concepts evolved, so did the integration between the separate bodies of knowledge. They are now very seamlessly integrated principles and tools that enhance quality, productivity, and automated and streamlined processes that create value for our customers. We will step through the evolution of the quality, productivity, and IT bodies of knowledge, principles, and tools using Figure I.1 as a guide. All three disciplines evolved first as separate practices but integrated together through the years, as practitioners and academics better understood and applied the concepts and tools first in manufacturing industries before branching out into service industries, including healthcare, financial services, retail, and education, to name a few.

We will describe this evolution first with the quality practices. The quality body of knowledge (BoK) started with statistical process control in the 1920s.[1] Walter A. Shewhart introduced statistical process control (SPC) based on applications at Western Electric and Bell Telephone Laboratories. Shewhart published *Economic Control of Quality of Manufactured Product* in 1931 and *Statistical Method from the Viewpoint of Quality Control* in 1939.[2] Dr. W. Edwards Deming installed SPC in Japanese manufacturing as he assisted Japan in their rebuilding efforts after World War II. Total quality management (TQM) was a natural outgrowth of SPC, adding a process improvement methodology. The statistical concepts, along with the principles of the quality gurus Dr. W. Edwards Deming, Joseph M. Juran, Philip B. Crosby, Armand V. Feigenbaum, and others, became the foundation for total quality management (TQM), which became popular in the 1980s. Also in the 1980s, business process reengineering (BPR) encouraged completely throwing out the old process and starting over many times within the context of implementing major information systems changes.[3] These methodologies evolved to Six Sigma. The underlying principles of TQM, BPR, and Six Sigma progressed to business process management (BPM). BPM encompasses documenting, understanding, managing, and controlling key processes in the business enterprise.

On the productivity side, the Ford Production System was used to assemble cars, which was the basis for the Toyota Production System (TPS).[4] Just-in-time (JIT) production philosophies joined with TPS, which evolved into lean.[5] More recently, lean and Six Sigma merged to capitalize on the best of both improvement philosophies and methodologies, combining to form Lean-Six Sigma.

We add the IT stream to show the evolution of business process management systems (BPMS) and business architecture. At the same time that lean and Six Sigma were evolving, IT was advancing from nonintegrated material requirements planning (MRP) and material resource planning (MRP) II applications focusing on managing the shop floor and purchasing processes to integrated enterprise resource planning (ERP) and customer relationship management (CRM) information systems that are evolving into managing the entire supply chain.[6]

The key concept of BPM is the convergence of technologies with process management theories. BPM enables the process enterprise. The process enterprise is organized around core business processes that go across departmental and divisional lines. Processes should be standardized, measurable, repeatable, and reusable. BPM and BPMS both support Six Sigma process improvement through documentation of processes and automated collection of process metrics. Another evolution of the underlying principles has started merging BPM into BPMS and is evolving into business architecture. The goal of BPM is to improve products and services through a structured approach to performance improvement that centers on systematic design and management of a company's business processes.[7] An enterprise can use business architecture principles and methods as the foundation for identifying the processes that need to be improved to enable the business strategies. It provides the

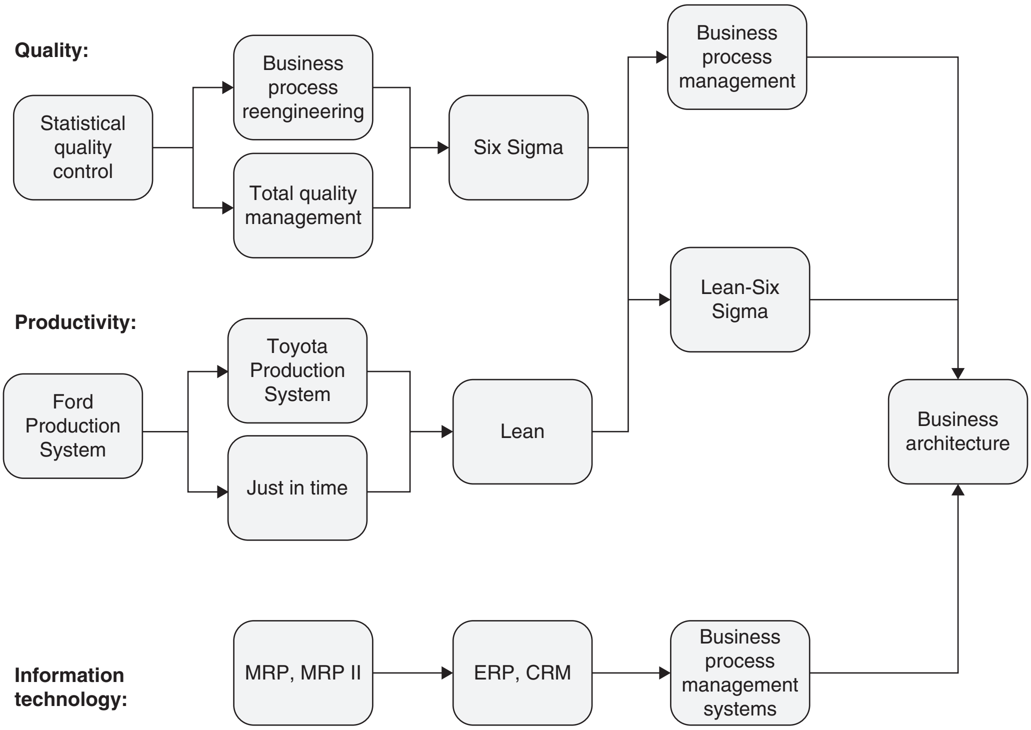
Quality:
Statistical quality control
Business process reengineering
Total quality management
Six Sigma
Business process management
Lean-Six Sigma
Productivity:
Ford Production System
Toyota Production System
Just in time
Lean
Business architecture
Information technology:
MRP, MRP II
ERP, CRM
Business process management systems

Figure I.1 Evolution of quality, productivity, and information technology to business process management and business architecture methodologies.

Source: Sandra L. Furterer.

documentation of the business processes and the identification of the optimized business processes and components that can be used across multiple business units, markets, and processes. It enables standardization of processes and alignment of process improvement initiatives with the key processes that enable the business's strategic plan. The business architecture BoK is a natural progression from BPM principles. Business architecture is helping to provide a context and prioritization of business strategies that can help to focus Six Sigma and quality improvement efforts.

Now that we have seen the evolution of quality and a possible direction of the quality evolution, from which the CQM/OE BoK may eventually evolve, let us discuss how quality and an enterprise view can help us to better understand, model, and practice within the quality discipline.

ENTERPRISE VIEW

A BoK from systems engineering in business architecture focuses on modeling the key concepts and elements of the enterprise by aligning the business strategies and enabling processes to optimize the key groups of activities that enable optimized IT and process improvement initiatives. Our CMQ/OE BoK includes systems thinking, process improvement, and automation and technology that support quality. I have created a model, the strategic business process architecture (SBPA), to create an enterprise view of an organization's processes, people, and technology that can enable operational excellence. A simplified view of the key elements of the SBPA is shown in Figure I.2.[8] The elements of the SBPA describe the business system enterprise. The SBPA includes understanding customers and their expectations. Another important element of the business architecture is documenting the business's strategies and goals. The goals should relate to the capabilities that the organization requires to meet its goals. The value chain comprises activities that provide value to your customer.[9] The value chains are decomposed into the business functions. Each value chain and the subsequent business functions will be used to further decompose to the processes and their activities. This ensures traceability to value chains that provide customer value. The business capabilities enable the business functions. The business processes and their activities describe the sequence of activities that enable the business to meet the customer's expectations and provide value through the value chains. The conceptual information uses and enables the processes, activities, and optimized components. The optimized components help to leverage key services that automate and support the processes. Applying SBPA enables performance improvement across the entire enterprise, focused on the strategic direction of the organization.

FUTURE OF QUALITY

I briefly discussed the evolution of quality, Figure I.1, and then the conceptual business architecture elements, Figure I.2, that can help to model the enterprise, enhancing both quality and operational excellence by developing a process architecture repository that can aid the organization in its quality journey. These same elements can help to document and build a quality management system, whether

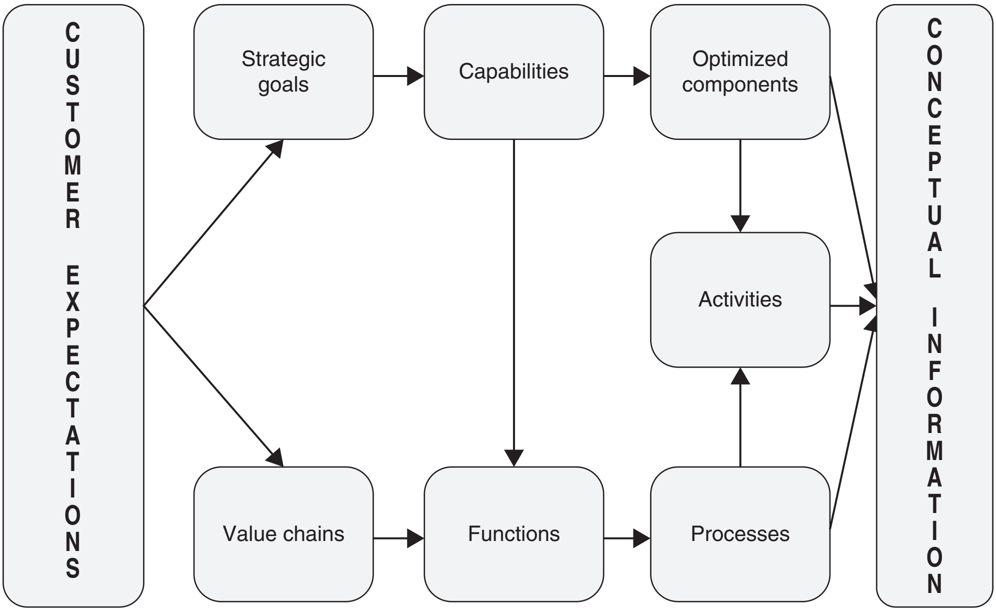

Figure I.2 Conceptual business architecture elements.
Source: Sandra L. Furterer.

using the Baldrige Criteria for Performance Excellence, the multitude of International Organization for Standardization (ISO) standards, or a homegrown system. So what does the future of quality hold? Change, most definitely. The world is becoming ever more complex; technology and product life cycles ever shorter. So how do we maintain and improve the quality of products, services, and the processes that develop and provide these products and services? It is by learning, applying, and evolving the quality management and operational excellence principles, tools, and methods that are so vital and so well presented in this handbook. We thank the wonderful contributors to this handbook who have helped you to continue evolving quality and operational excellence in your organizations.

STRUCTURE OF THIS HANDBOOK

The handbook follows the BoK scheme as set forth in Chapter 20. Throughout each section of this handbook, the categorical BoK requirements associated with good quality management practices for that section are shown in a box preceding the pertinent text. These BoK requirements represent the range of content and the cognitive level at which multiple-choice questions can be presented.[10]

There is some overlap of topics within the BoK. An attempt has been made to cover a given topic in depth in one section as it relates to that section of the BoK and cover it from a different perspective as it applies to a different section of the BoK. For example, failure mode and effects analysis (FMEA) is covered in Part II, "Strategic Plan Development and Deployment," as it would be used to augment the strategic planning process by identifying potential strategic risks to the organization and developing appropriate contingency plans to mitigate these risks. In Chapter 13, the FMEA is covered as a tool for risk management in processes and designs.

Additional references to material for each chapter are presented in Appendix A. 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. There is a wealth of information that can be found on the ASQ website and from the ASQ Knowledge Center, www.asq.org, to prepare for the certification exam, including excellent training workshops.[11]

In order to provide a broad perspective of quality management, this book has specifically been written to address:

- Historical perspectives relating to the evolution of particular aspects of quality management, including recognized experts and their contributions
- Key principles, concepts, and terminology relevant in providing quality leadership 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[12]

Not every quality manager will possess equal expertise in each BoK section and topic. The handbook's primary purpose is to help readers properly focus their study efforts in preparation for the examination. However, this handbook should prove useful as a reference guide back on the job.[13]

TERMINOLOGY

The ISO definition of *product* as "the result of a process" includes categories of hardware, software, services, and processed materials. The word *product* is 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 are used and to substitute terms that are more apropos for their own industry or experiences to help them clarify the material.[14] The principles, concepts, and tools discussed in this handbook apply to any and all industries, including manufacturing, service (healthcare, financial services), retail, and technology, to name just a few.

DISCLAIMER[15]

The BoK for the CMQ/OE 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. (No one ever said that making decisions as a manager/director is simple.)

Furthermore, you should know that ASQExcellence policy maintains a strict separation between the people who prepare the examination, those who score the completed examination papers, and those who present material (in whatever medium available) for people preparing to take the examination. 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 details about answer scoring cannot be answered by the editor of this handbook or by course instructors.

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

Sandra L. Furterer, Editor

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Part I

Leadership

Chapter 1 A. Organizational Structures
Contributor: Bill Craddock
Chapter 2 B. Leadership Challenges
Contributors: Bill Craddock and Sandra L. Furterer
Chapter 3 C. Teams and Team Processes
Contributor: Bill Craddock
Chapter 4 D. ASQ Code of Ethics

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

It is appropriate that a book on the management of quality begins with the subject of leadership. Perhaps no other factor has a greater 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.

Define and describe organizational designs (e.g., matrix, flat, and parallel) and the effect that a hierarchical management structure can have on an organization. (Apply)

Body of Knowledge I.A

ORGANIZATIONAL DESIGN

A major role 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 factors:

- *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 will the organization rely on standard guidelines and procedures to instruct and direct employee activities?
- *Centralization.* Whether decision-making authority is located primarily at upper management levels or is delegated to lower levels.[1]

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

- Divide the total work required into logical functional groupings (for example, departments and 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 between the levels by deciding who reports to whom and who has the authority to make what types of decisions. An appropriate organizational design will assist in aligning all of the employees, departments, and processes. Good work alignment is required to remove systemic conflict and achieve strategic goals.

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 level of authority and the amount of responsibility for the organizational members. Authority refers to the rights inherent in a managerial position to expect orders to be followed and is 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, staff functions are established, such as human resources, 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 and unrealistic view of sources of influence in organizations. Today, authority is recognized as only 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 diverse problems. Typically, top executives 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
- Manager's preferred style[5]
- Employee turnover
- Available resources
- Financial and competitive pressures
- Organizational beliefs and values

HORIZONTAL ORGANIZATIONAL 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 allocated?" 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 or group of steps. 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 giving employees a variety of activities to perform, allowing them to do a whole and complete piece of work, and putting them together into teams makes jobs 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 fourteen 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 with relatively centralized decision-making. As organizational environments have become more complex and dynamic, many organizations have begun 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 resolving issues such as distribution of authority, reporting relationships, span of control, and amount of 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 and 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 affected by larger factors, both internal and external.

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

- Work functions performed
- Product or service provided
- Customers served
- Geographic area or territory covered
- Product-customer process 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 common ways to group activities is by the function 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 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 particular categories of products, allowing greater expertise to be gained about 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 schools, high schools, 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

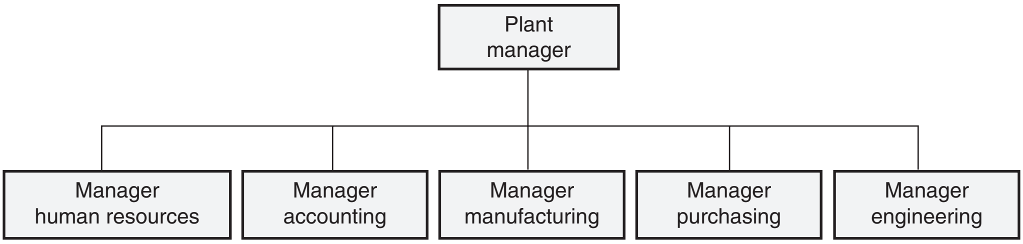
Plant manager
Manager human resources
Manager accounting
Manager manufacturing
Manager purchasing
Manager engineering

Figure 1.1 Functional departmentalization.

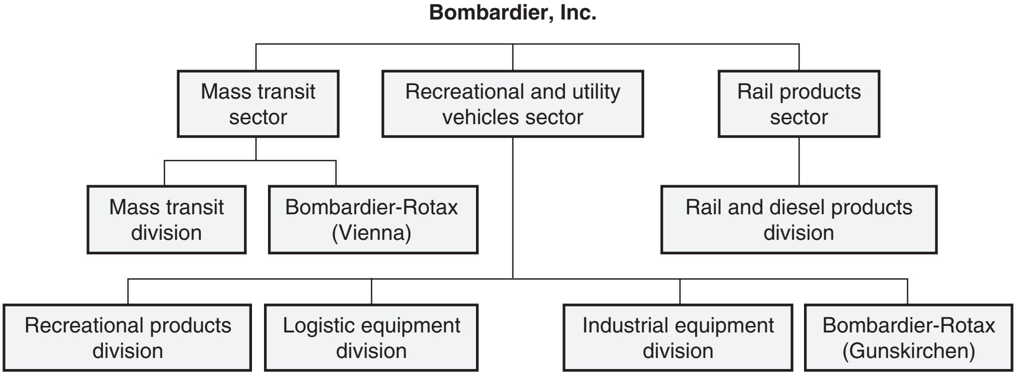
Bombardier, Inc.
Mass transit sector
Recreational and utility vehicles sector
Rail products sector
Mass transit division
Bombardier-Rotax (Vienna)
Rail and diesel products division
Recreational products division
Logistic equipment division
Industrial equipment division
Bombardier-Rotax (Gunskirchen)

Figure 1.2 Product departmentalization.

regions, as shown in Figure 1.4. A large school district might have six high schools to serve each of the geographic areas within its district. Geographic organization is valuable when an organization's customers are scattered over a large area, allowing the specific needs of the location 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 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.

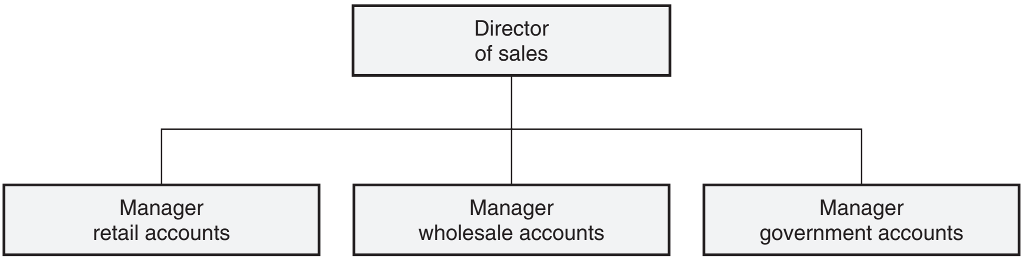
Director of sales
Manager retail accounts
Manager wholesale accounts
Manager government accounts

Figure 1.3 Customer departmentalization.

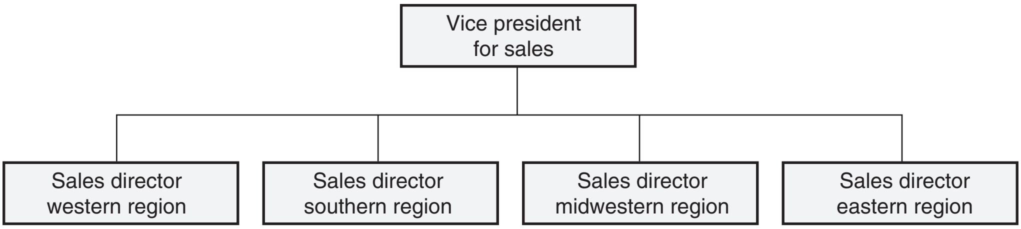
Vice president for sales
Sales director western region
Sales director southern region
Sales director midwestern region
Sales director eastern region

Figure 1.4 Geographic departmentalization.

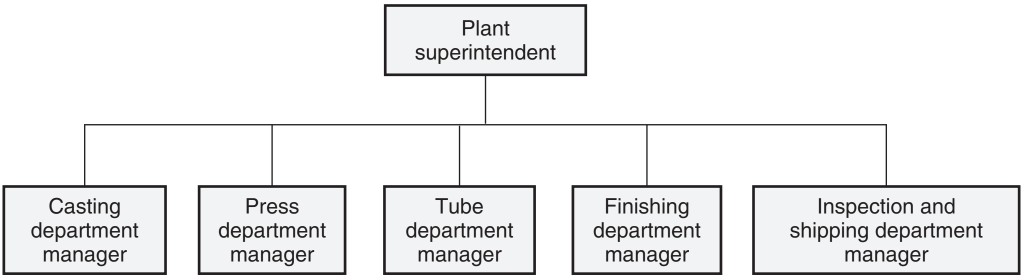
Plant superintendent
Casting department manager
Press department manager
Tube department manager
Finishing department manager
Inspection and shipping department manager

Figure 1.5 Process departmentalization.

- *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 competencies 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 processes 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. A manufacturing example would be a plant expansion requiring skills from facilities, procurement, human resources, and process engineering to plan and execute the addition successfully. The team members each contribute knowledge from their own areas of expertise, and team discussions result in rapid and optimal compromises for completing the expansion on time, on budget, and without excessive risk to the organization. Such a project handled sequentially by each department would not have allowed an ideal outcome.

- *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 enhancement, assignments to line or project units, and performance reviews.

- *Cells.* Parts of an organization may be structured in work cells. A *cell* is a self-contained unit dedicated to performing all the operations to complete a product or process or major portion of a product.

- *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 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.

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 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

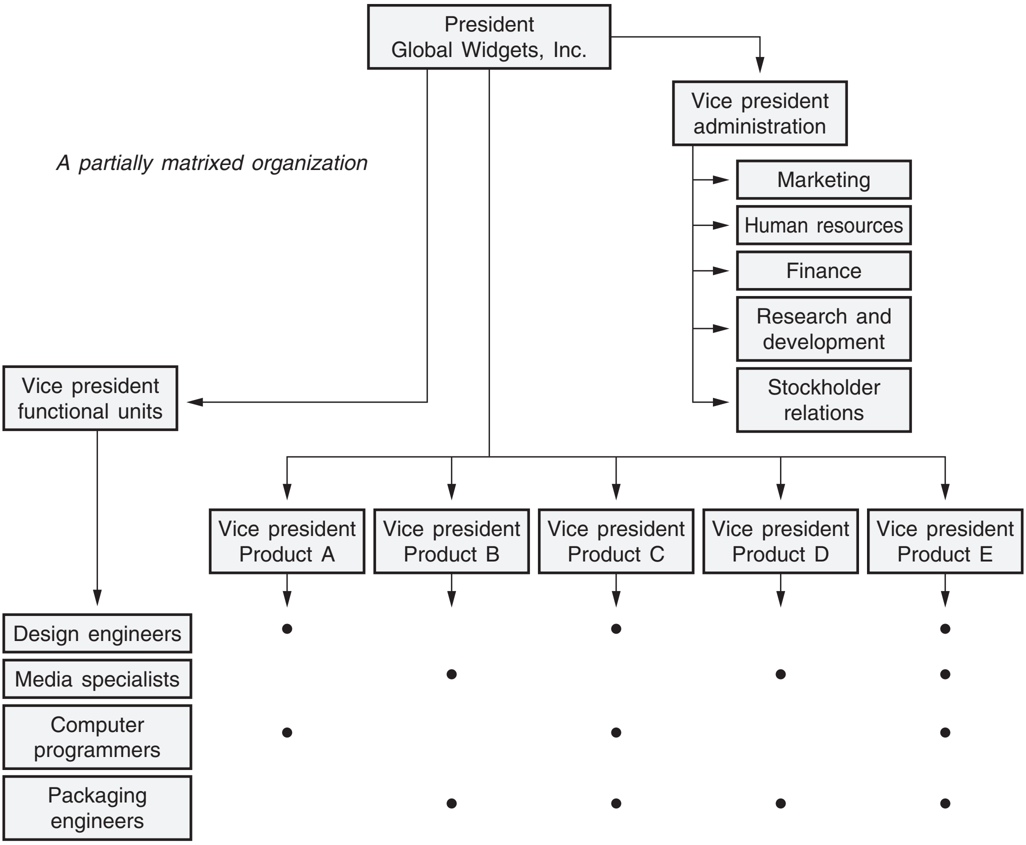
President
Global Widgets, Inc.
Vice president
administration
A partially matrixed organization
Marketing
Human resources
Finance
Research and
development
Stockholder
relations
Vice president
functional units
Vice president
Product A
Vice president
Product B
Vice president
Product C
Vice president
Product D
Vice president
Product E
Design engineers
Media specialists
Computer
programmers
Packaging
engineers

Figure 1.6 Matrix organization example.

attuned 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 a 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 affect the ability to achieve strategic objectives, structure should be based on the organization's strategy. 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 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 life cycle. 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 have an impact on 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 rein 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, specialized technologies, the knowledge and experience of its management, its 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 the 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 union leader participates with the 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 may 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, process improvement initiatives, and so on. Disagreement over the terms of the labor-management contract can result in a 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 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, an airport, and so on are important considerations. Some of these items may be termed infrastructure, but all are linked in a functional manner as facilities.

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

- *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, the United States, Europe, and 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 in 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, business partners, and the communities in which the organization is located.

Middle managers are responsible for carrying out the policies and procedures necessary for achieving the mission, goals, and strategic objectives. Their emphasis is more operationally than strategically oriented, playing a key role in day-to-day communications 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 (line management) is responsible for overseeing the workforce assigned to produce the products and/or services for which the organization is designed. Supervisors, while usually considered 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 of the workers. In this role, supervisors must communicate downward the vision, mission, principles, and 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.

Not an official member of management, the lead operator is often charged with the responsibility for some scheduling, instructing, and interwork 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.

Organization culture has an overarching influence on organization structure. Culture may be determined by leadership views, by past practice, or by prevailing attitudes in the surrounding society. If the leadership places a high value on following orders, a narrow span of control may result. If an organization has been successful allowing relative independence of different divisions, adding linkages to control this independence will be difficult to include, even if there is good economic reason to do so. A society that values following the direction of authority will find difficulty encouraging individuals to innovate against the possibly poor direction of leaders.

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See Appendix A for additional references for this chapter.

Chapter 2

B. Leadership Challenges

> *I believe leadership lies more in character than in technical competence, but these two are interwoven. As people grow in competence, they gain awareness of a new dimension of their character. Then, as they begin to develop that aspect of their character, they find that their competence also increases.*[1]
>
> —Stephen R. Covey

When is a manager not a leader? When is a leader not a manager? The answer to these questions begs for a precise definition of *leader* and *manager.* Yet, try as we often do to differentiate between the two roles, ambiguity creeps in to blur the line of demarcation. The fuzziness is exacerbated by common usage (or "misuse," depending on your point of view). One observation is that the title *leader* is rarely found on organizations' lists of position titles, although occasionally *team leader* may appear. Does this mean that a leader is some ethereal entity who does not truly exist in the real world? Not so.

A *leader* is an individual recognized by others as the person to lead an effort. One cannot be a leader without one or more followers. A leader might or might not hold an officially designated management position or officially have people reporting to him or her. A leader leads people. An organization can also be referred to as a leader, in the sense that it is on the leading edge (in technology, innovation, products, services, market share) compared with its contemporaries.

A *manager* is an individual who manages and is responsible for resources (people, material, money, time). This is a person officially designated with a management position title. A manager is granted authority from above, whereas a leader's role is earned by having followers. Managers manage organizations, processes, systems, projects, and themselves.

According to Deming, "The job of management is not supervision, but leadership."[2] The roles of leader and manager can be fulfilled by the same individual. It is really what the individual does, how the individual does it, and from where the individual derives the power to act that relate to which term is most applicable in a given situation.

> *Leadership focuses on doing the right things; management focuses on doing things right.*[3]
>
> —Stephen R. Covey

This chapter discusses techniques and tools available to leaders that include those used to overcome organizational roadblocks (change management). Also discussed are techniques and tools used in applying, evaluating, and creatively using interpersonal skills (motivating, influencing, negotiating, resolving conflict, and empowering). These are leadership challenges.

Strategic leadership involves creating both technical and social systems that are effectively integrated and address the needs of both customers and employees. Operational leadership requires ensuring that organizational processes are effectively carried out on a day-to-day basis, monitoring performance and addressing constraints. It involves ensuring that employees understand what is to be done and are provided with the appropriate authority, responsibility, requisite skills, tools, and work environment with which to do it.

The levels of employee motivation and empowerment and how conflict is resolved shape as well as serve to measure the organizational culture. Leadership must effectively attend to these softer issues that also affect organizational performance.

In a Gallup study conducted from 2005 to 2008, a question was asked to elicit the words that describe what the most positive leader in your life contributes to you. The four most commonly expressed words were *trust*, *compassion*, *stability*, and *hope*.[4]

1. ROLES AND RESPONSIBILITIES OF LEADERS

Describe typical roles, responsibilities, and competencies of people in leadership positions and how those attributes influence an organization's direction and purpose. (Analyze)

Body of Knowledge I.B.1

Much effort and countless pages of print have been expended in attempting to develop a universal profile for a leader. It appears to be an endless and (perhaps) pointless task, each effort adding but another viewpoint on what constitutes a leader. It has already been stated that the line between the roles of a leader and those of a manager tend to be blurry and often overlap. Let us explore some of the attributes that tend to identify an individual as a leader, under several different situations:

- *Organization leader.* Most often holding a position with managerial or supervisory responsibilities, this individual exhibits leadership qualities that enable the person to accomplish more than the position calls for. This individual may be perceived as a leader by his or her subordinates, peers, and bosses for exhibiting one or more of these attributes:

    — Knowledge

    — Skills

  - Experience
  - Charisma
  - Action
  - Convincing speech
  - Empathy
  - Ethics
  - Empowerment
  - Collaboration
  - Support
  - Trust
  - Multidimensional personality
- *Cause leader.* This individual may work either behind the scenes or be highly visible to followers. Through personal motivation and power of persuasion, this leader gathers followers to a common goal or cause, sometimes inciting the followers to take physical action against a targeted group. This type of leader has the ability to communicate in the language of the followers to stimulate their emotions, the stamina to build and sustain a high level of personal energy, and the ability to be seen as a fellow group member with issues the same as or similar to those of the group. This person is usually from the worker ranks of an organization or, sometimes, is a "hired gun" who looks and talks like the followers.
- *Transactional leadership.* A transactional style is one in which the manager views the relationship as one of getting the work done through a clear definition of tasks and responsibilities and providing whatever resources are needed. This view might be likened to a contractual relationship, with rewards (positive or negative) associated with achieving the desired goal.
- *Transformational leadership.* Transformational leadership is a style whereby a leader articulates the vision and values necessary for the organization to succeed. It is sometimes equated to charismatic leadership but is aimed more at elevating the goals of subordinates and enhancing their self-confidence to achieve those goals. Bob Galvin accomplished this transformational leadership at Motorola with the Six Sigma program, an approach that positioned Motorola to become a high-quality, reliable competitor in its market.
- *Other kinds of leaders.* Bass identifies several additional leadership types, namely:[5]
  - Educational leaders
  - Public leaders
  - Opinion leaders
  - Legislative leaders

To be a leader, one has to believe in oneself, but with reasonable doubt and humility. One has to have a zeal for the role and genuinely care for people (the latter does not apply to ruthless dictators who lead through fear). "Leaders of the future can no longer afford to maintain insularity. It is simply not an option in increasingly boundaryless organizations driven by customer power . . . now they must destroy those walls and replace them with bridges."[6] Key roles of a leader include being a:

- Facilitator
- Appraiser
- Forecaster
- Advisor[7]
- Enabler[8]
- Follower[9]

Requirements for good leadership are similar, regardless of the functional department a manager oversees. Some specific requirements for quality managers in leadership roles include the following:

- Personal commitment to process, product, and organizational quality
- Strong sense of value for others' work and leadership
- Skilled application of a broad base of knowledge of the quality field and an understanding of how to apply this knowledge in functional areas
- Wisdom about both people and things and an understanding of how to integrate them to get work accomplished
- Absence (or control) of temperamental or emotional characteristics that might interfere with the ability to work with others

Some critical personal attributes that leaders in the quality management area should exhibit include creativity, patience, flexibility, and self-discipline. Good listening skills, excellent coaching and training skills, sensitivity to customer and employee issues, and a personal commitment to excellence are all essential. Finally, a leader must be a mentor, capable of leading change and willing to empower followers.

In their book *The Leadership Challenge*,[10] Kouzes and Posner explain five practices that exemplary leaders use: (1) model the way, (2) inspire a shared vision, (3) challenge the process, (4) enable others to act, and (5) encourage the heart.

Just as organizational structures, processes, and priorities have changed in recent decades, so, too, have the defined roles and characteristics of an effective leader. Some writers have defined the difference between management and leadership as the amount of control exercised over people. Kouzes and Posner define leadership as a shared responsibility and state the difference as "Managers . . . get other people to do, but leaders get other people to want to do."[11] Warren Bennis defines the differences between the two as doing the right thing (leadership = effectiveness) versus doing things right (management = efficiency). Others have recognized that the type of leader needed often depends on the particular situation, such as the organization, its mission, its strategies, its competitive environment, and the makeup of the individuals being led.[12]

Some issues that make leadership difficult to define include:

- Leadership of an organization may be an appointed role (for example, president or department manager).
- Leadership may be taken on at various times by different people who are working together on a particular project. That is, the role of leadership is based on who has the competence necessary during a particular phase of a project.
- Increasingly, in a knowledge-based environment the person being led has more knowledge of the tasks to be accomplished than the individual who is regarded as the leader.
- The increase in virtual teams, in which a group of individuals is jointly responsible for a particular outcome but where team members do not have face-to-face contact (for example, where technologies are used to communicate).[13]
- Schein described paradoxes of leadership when stating that leaders of the future will be persons "who can lead and follow, be central and marginal, be hierarchically above and below, be individualistic and a team player, and, above all, be a perpetual learner."[14]
- Deming described the primary responsibility of leaders as "transformation of the organization."[15]
- Another leadership role is to ensure that the organization works effectively with respect to the interactions between individuals, groups, and business units both within and outside the organization and that behaviors meet accepted standards for business ethics.

The traits and actions of leaders will, or should, vary based on the contingencies they face. Hersey and Blanchard's situational leadership model focuses on three factors:[16]

1. Task behavior
    - The level of work-related detail and guidance a leader must provide to a performer
    - The extent to which direct action must be taken with the performer
2. Relationship behavior
    - The extent of the communication required with the performer
    - The amount of interpersonal support given a performer
3. Employee maturity or readiness
    - The ability of a performer to assume a task
    - The willingness of the performer to assume the task

Considering the maturity factor, the task and relationship behaviors comprise four situational leadership styles:

1. *High task, low relationship.* Specific instructions and close supervision of performance are indicated (a telling mode). For example, a new

or transferred employee is assigned a task for which he has no prior training and needs continual supervision until skill is developed.

2. *High task, high relationship.* Decisions are explained and there is opportunity to clarify and ask questions (a selling mode). For example, a newly trained operator is trying to apply the training to the task at hand but does not understand the need to follow the prescribed sequence of steps and requires supervisory support.
3. *High relationship, low task.* Ideas are shared, encouragement is provided, and the leader acts as a coach (a participating mode). For example, a trained operator is hesitant to assume full responsibility for the entire task assigned and needs help to build confidence.
4. *Low relationship, low task.* Responsibility for decisions and implementation are turned over to the employee (a delegating mode). For example, an experienced operator knows what to do and how to do it, as well as how to troubleshoot a problem should one occur, and assumes full responsibility for the task assigned without requiring direct supervision.

The keys to effective situational leadership are:

- Being able to determine, situation to situation, the leadership style most appropriate to apply in working with performers
- Realizing that one style does not fit all situations
- Realizing that the style used last with a performer may not be the best next time
- Realizing that other factors can influence performance, such as:
  - —The performer's physical and/or mental health
  - —Events in the performer's personal life
  - —The influence of coworkers
  - —Lack of material, tools, equipment, and so on
  - —Inadequate working conditions

Another aspect to leadership is the emotional competence of the incumbent leader. Daniel Goleman identifies five dimensions, three personal and two social, and related competencies.[17]

The personal dimensions and related competencies are:

1. Self-awareness
   - Emotional awareness
   - Accurate self-assessment
   - Self-confidence
2. Self-regulation
   - Self-control

  - Trustworthiness
  - Conscientiousness
  - Adaptability
  - Innovation
3. Motivation
   - Achievement drive
   - Commitment
   - Initiative
   - Optimism

The social dimensions and related competencies are:

4. Empathy
   - Understanding others
   - Developing others
   - Service orientation
   - Leveraging diversity
   - Political awareness
5. Social skills
   - Influence
   - Communication
   - Conflict management
   - Leadership
   - Change catalyst
   - Building bonds
   - Collaboration and cooperation
   - Team capabilities

Good leaders challenge the status quo. They inspire and enlist others. They encourage collaboration and enable others to take action. Effective leaders share their power and information to strengthen others. They look for and recognize people who are doing things right. Respected leaders set an example, recognize others' contributions, and celebrate successes. Exemplary leaders continually strive to improve both their intellectual intelligence (cognitive capacity) and their emotional intelligence. Leadership is a daily balancing act of juggling responsibilities and withstanding pressures.

2. ROLES AND RESPONSIBILITIES OF MANAGERS

> *The inherent preferences of organizations are clarity, certainty, and perfection. The inherent nature of human relationships involves ambiguity, uncertainty, and imperfection. How one honors, balances, and integrates the need of both is the real trick of management.*[18]
>
> —Richard Pascale and Anthony Athos

Describe typical roles, responsibilities, and competencies of people in management positions and how those attributes contribute to an organization's success. (Analyze)

Body of Knowledge I.B.2

What Managers Do

Managers attend to the work and resources of the organization—a stewardship role. This may include obtaining, allocating, distributing, using, disposing, and accounting for the resources that fall within the purview of the position to which they are assigned. Primary categories of resources include:

- Money
- Time
- People
- Material
- Physical assets: equipment, facilities, land, and water
- Information
- Intellectual property

Managers may be assigned a variety of different position titles, some of which are:

- Chief executive officer, chief operating officer, chief finance officer, chief information officer
- Vice president of ____________________
- Director of ____________________
- General manager of ____________________
- Manager of ____________________
- Superintendent of ____________________
- Supervisor of ____________________
- Staff supervisor of ____________________

- Designer of ____________________
- ____________________ engineer
- Purchasing agent/buyer for ____________________

Labor laws differentiate between exempt employees (employees free from certain laws pertaining to hours and compensation) and nonexempt (employees covered by laws relating to hours worked and compensation). Generally, management employees are exempt (however, the nature of one's work and compensation received are key determinants of exempt versus nonexempt status; for example, some management employees receive overtime pay as nonexempt employees do).

As stated earlier, there is often overlap between the roles and responsibilities of a leader and a manager. A significant difference is that the manager's role is mandated by some higher authority and is in effect as long as the higher authority so states. The role of leader is less permanent and, in fact, may either be shared through rotation or acquired through acceptance by followers. Being recognized as a leader often has no relationship to an organizational position title. Thus, a manager may or may not be recognized as a leader. A worker may be recognized as a leader without having any managerial-type title or responsibility. Organizations often interchange the two terms—for example, by calling someone a project leader when the intention is really project manager. A chairperson may be a leader and/or a manager, depending much on the influence he or she may have on an organization and the decision authority granted.

Managers' roles may include:

- *Strategist.* Establishes direction for the enterprise through strategic planning and deployment of the plan's goals and objectives
- *Architect.* Builds an enterprise structure that supports the strategic goals and objectives
- *Organizer.* Organizes people, ideas, and things to achieve the enterprise's objectives
- *Business generator.* Grows and sustains a viable business by creating and retaining satisfied customers
- *Value creator.* Adds value to the enterprise's processes, products, and services
- *Innovator.* Continually seeks ways to introduce, improve, or replace processes, products, and services to further the strategic goals of the enterprise
- *Administrator.* Optimizes the use of results obtained from the resources available
- *Entrepreneur.* Redeploys resources from activities producing poor results to activities where improved results may be obtained
- *Supporter.* Provides visible support, personal involvement, and reinforcement in furthering the efforts of the workers in fulfilling the enterprise's objectives

- *Ethicist*. Embraces the principles, standards, morals, and norms of the society in which the enterprise operates
- *Environmentalist.* Operates the business with high regard for sustaining and improving the physical environment in which the enterprise exists, with responsible use of land, air, and water and safeguarding of wildlife
- *Mentor.* Provides a personal role model and guidance for the development of future managers
- *Motivator.* Creates and sustains a work environment that stimulates motivation in others
- *Coach*. Sets an example and guides others in achieving excellence
- *Trainer.* Imparts knowledge and teaches skills to others
- *Communicator.* Keeps others informed
- *Integrator.* Brings previously disassociated people and processes together
- *Harmonizer.* Balances and harmonizes major functions of the enterprise
- *Controller.* Oversees the financial affairs of an enterprise
- *Evaluator.* Tracks, measures, analyzes, and evaluates the performance, outputs, and outcomes produced by the enterprise and the contribution toward achieving the strategic goals of the enterprise and addressing the needs of society

Sometimes a person may be titled a manager even though she or he is an individual contributor (makes a personal professional contribution to benefit the enterprise) and is not responsible for managing people.

Management functions may be grouped as follows:

- *Planning*
    - —Mapping the work unit's processes and interfaces with other work unit's processes
    - —Defining the work unit's performance objectives and linkage with the organization's mission, strategic goals, and objectives
    - —Identifying the actions and activities needed to achieve the unit's objectives
- *Organizing*
    - —Acquiring or assembling the resources needed to meet the unit's objectives
    - —Establishing the structural framework (systems and procedures) for managing the unit's processes and resources
- *Staffing*
    - —Selecting, hiring, assimilating, and training personnel needed to achieve the unit's objectives

  - Developing the unit's individual and collective competence level to meet or exceed the planned objectives
  - Retaining the unit's competent personnel by creating a motivational environment
- *Directing*
  - Directing the actions and activities of the unit's personnel in achieving the planned objectives
  - Providing the support needed by the unit's performers in realizing the product or service produced by the unit
- *Controlling*
  - Monitoring unit performance and comparing actual results to plans
  - Taking appropriate corrective actions as needed
  - Identifying areas for continual improvement

Competencies needed by managers cover a wide range.[19] Typical managerial competencies may include:

- *Technical competence*, for example:
  - Value streams
  - Techniques and tools
  - Enterprise resource planning
  - Process and quality auditing
  - Process benchmarking
  - Information technology
  - Knowledge management
- *Business competence*, for example:
  - Strategic planning
  - Customer relationship management
  - Finance
  - Metrics
  - Risk analysis and management
  - Project management
  - Performance management
  - Organization structures
  - Marketing
  - Processes

  - —Legal requirements
  - —Ethics issues
  - —Stockholders/ownership issues
  - —Supply chain management
- *People competence*, for example:
  - —Personality types
  - —Managing styles
  - —Diversity issues
  - —Behavior management
  - —Interacting
  - —Communicating
- *Human resource competence*, for example:
  - —Hiring
  - —Training
  - —Affirmative action
  - —Benefits
  - —Recognition and rewards
  - —Compensation
  - —Safety and well-being
  - —Professional development
- *Environmental competence*, for example:
  - —Factors affecting the world
  - —Politics and power issues
  - —Earth sciences
  - —Competition

Drucker identifies four tasks of management:[20]

- *The task of economic performance.* Business enterprises exist for the purpose of economic performance—profitability. Other societal needs cannot be fulfilled without a surplus of economic resources.
- *The task to make work productive and the worker achieving.* Performance is accomplished through work. Achieving implies consideration of the human resource as human beings and not as things.
- *The task of managing the social impacts and the social responsibilities of the enterprise.* No institution can exist outside of community and society.

- *The task of managing within the dimension of time.* Management always has to consider both the present and the future, both the short run and the long run.

Persons holding management positions lower in the organizational structure are usually responsible for designated short-term outputs—for example, parts produced, engines serviced, reports generated, and so on. Managerial personnel at the high end of the organizational hierarchy are more likely to be responsible for longer-term strategic outcomes affecting the profitability, growth, and overall success of the enterprise.

3. CHANGE MANAGEMENT

> Use various change management strategies to overcome organizational roadblocks, assess impacts of global changes, achieve desired change levels, and review outcomes for effectiveness. Define and describe factors that contribute to an organization's culture. (Evaluate)
>
> **Body of Knowledge I.B.3**

3.1 Organizational Perspective of Change Management

Techniques for Facilitating or Managing Organizational Change

External change is inevitable; internal change is probable. Change can occur as a result of outside forces or inside forces. Organizations that continually improve their processes will have a greater probability of success than those who only react to problems. As an organization evolves, there are not only incremental changes but also increasingly major shifts in strategy, technology, and work organization.

Fear of change is also a real and valid concern. People are afraid of change because of its potential impact on them. Corporate downsizing and outsourcing cause major disruptions of people's work and personal lives, and continual improvement efforts are sometimes blamed for job losses.

Change management is a process for ensuring that the people affected by change understand the nature of the change and the reasons for it, with the expectation that the new methods of operating will be internalized without creating undue resistance, conflict, and fear. To reduce fear, it is important that the vision of the future be well communicated and that jobs be protected when feasible. Ongoing and open communication during any change process is paramount. Although these precautions will not totally remove fear, they can remove some of the uncertainty of not knowing the direction in which the organization is headed.

Change Agents

Change agents are individuals who play a specific role in the planning and implementation of the change management process.[21] They may be members of the organization or may be outsiders. Collaboration of an internal change agent with an external change agent who has extensive experience in the type of change to be implemented can be a useful strategy.

An internal change agent is a person within the organization designated, usually by management, to facilitate a particular change effort. Internal change agents possess an understanding of the organization's culture, infrastructure, and business and also have a vested interest in seeing change efforts succeed. However, they can be hindered by political pressures that can influence objective feedback when problems arise. They might also lack perspective of the big picture or have a vested interest in preserving certain traditions that keep them from seeing specific opportunities for improvement. The role of the internal change agent may be filled by a staff or line person, depending on the type and magnitude of the change being implemented.

An external change agent is a person from outside the organization who has been retained to advise and help facilitate the change process. An external change agent often has a greater degree of freedom and should be better able to objectively assess activities and provide honest feedback to senior management without fear of repercussion. Also, organizational members are less likely to have previous experiences with the change agent that might have an impact on effectiveness, and the agent does not have a vested interest in preserving long-held organizational traditions. The danger, of course, is that organizations can become so dependent on an external change agent that the change process is adversely affected when the agent leaves. Another disadvantage of external change agents can be their lack of familiarity with the specific corporate culture.

External change agents must work diligently to build a relationship with the client organization. This includes becoming familiar with company norms, shared beliefs, and behaviors, as well as understanding both formal and informal leadership structures. In most organizations, the change agent needs to become acquainted with persons who serve as informal leaders and to whom others turn for new ideas. Building a relationship between informal leaders can be beneficial because other members of the organization will check with them for affirmation that it is beneficial or safe to support the change process.

Deming emphasized the role of change agents in his view of organizational transformation by stating, "A system cannot understand itself. The transformation requires a view from outside."[22]

Guidelines for Implementing Change

The following steps are key to implementing change:[23]

1. Create an awareness of the need for change.
2. Organize a project with sufficient authority to guide the process.
3. Define the vision and strategies for achieving it.
4. Communicate the vision and demonstrate personal commitment to it.

5. Remove obstacles that prevent others from acting on the vision.
6. Go for early and visible successes.
7. Build on success by rewarding supporters and involving more people.
8. Institutionalize the new methods by aligning other systems with them.

The following are common errors made in managing change:[24]

- Not sufficiently emphasizing urgency and allowing people to be complacent
- Allowing personnel who do not have sufficient power to guide the process
- Lacking a clear and compelling vision or not communicating it strongly and/or frequently enough
- Failing to manage the forces that resist change
- Not ensuring some early successes that encourage others
- Celebrating victory prematurely
- Not changing the other organizational systems and cultural elements that are required for long-term continuation of the change

In Peter Senge's *The Fifth Discipline*, he refers to the parable of the boiling frog to emphasize how threats to corporate and personal survival are perceived when transformational change is taking place: A frog suddenly placed in boiling water—the turbulence of organizational change—will scramble out. Placing a frog in water that is room temperature will not upset the frog. In fact, the frog might even be calmed. Now the water can be gradually heated until it is boiling. As the heat increases, the frog will become groggier until it can no longer climb out. When the water is boiling, the transformation is complete. The frog's internal apparatus senses the change as a threat to survival and instinctively seeks to avoid the situation.[25] For effective organizational change, use a slow and gradual process change while paying attention to the subtle reactions from employees.

At the same time, a significant lesson that psychologists will emphasize is that the change process, from an individual perspective, is a progressive one that usually occurs over a considerable length of time. For major changes in culture, this is also true at the organizational level. Trying to shortcut the process may create an illusion of speed but will not produce the desired results.

Techniques and Roles of Change Agents

Change agents may assume several roles and use a variety of techniques, such as:

- Coaching top management to:
    - Create an environment in which change can take place with minimum resistance.
    - Develop and support an improvement plan.
    - Provide the resources to implement the plan.

- Supporting and advising management colleagues on how to:
    - Deal with technical issues.
    - Cope with intellectual and emotional resistance.
    - Measure, monitor, and report progress.
    - Handle behavioral issues.
    - Provide performance feedback, including reinforcement of top management for the decision it made and reinforcing the work of those implementing the change.
    - Use the change agent as a facilitator when needed.
- Managing a specific project or segment of a large project to:
    - Fill in where no other suitable resource person is available.
    - Serve as a role model for other project management efforts.
- Guiding the development of a network to:
    - Support the implementation of the change.
    - Deploy the principles and practices for managing change throughout the organization.
- Guiding the assessment of the results and closure of the change, including:
    - Reviewing lessons learned
    - Evaluating the economic case for the change
    - Documenting the change

Organizational Roadblocks

Organizational change is difficult, partially due to the inherent nature of how organizations are designed and operated. That is, by constructing an organization in one way (for example, defining the specific roles and processes to be used), other options are excluded by default. Although the boundaries of organizational structure, policies and procedures, and norms are actually quite permeable, the fact that they are defined, documented, and reinforced makes them appear permanent in the minds of many employees. This may be especially true in an organization with a history of success, where that success is linked mentally to the way things have been done in the past.

The division of labor in an organization, both horizontally and vertically, creates several roadblocks. Following are some examples, along with methods for reducing the effect on the organization's ability to change:

- *Lack of cross-functional collaboration.* Functional or other forms of work units are created in order to help clarify the mission and focus of each particular group in the organization. An organization, however, is a system with interdependencies in many different directions. When the interdependencies (for example, internal customer-supplier relationships) are not clearly defined and fostered, each work unit may view a request for change only as it relates to their own processes, rather than the entire organization.

A possible solution is to ensure that improvement initiatives, performance measures, and rewards are designed such that collaboration (teamwork across boundaries) will be necessary in order to achieve objectives. Develop internal customer-supplier agreements and performance measures, along with ongoing joint reviews of progress.

- *Lack of authority.* The reason for dividing up work processes and tasks is because time and/or skills constraints prevent any one person from carrying out all the necessary activities. This means that responsibility and authority are divided among many. When a change in work activity is required, however, new roles, responsibilities, and processes may not fit into the predefined boundaries.

A possible solution is to ensure that someone (for example, a champion/sponsor) is identified who has authority over the entire area to be affected by the change and that they have a direct link to higher levels of the organization in the event they need additional support outside their area of authority.

- *Inward focus.* Similar to the lack of cross-functional collaboration is the problem of the boundaries between the organization and its environment. By definition, each organization consists of only certain processes and people, and outside these boundaries are suppliers, customers, regulators, and other stakeholders. The day-to-day attention of many members of the organization, however, is on internal processes, resources, and knowledge. Being willing to look externally for ideas, support, and feedback may not come naturally.

A possible solution is to have employees go outside of the organizational walls—for example, by visiting customer sites, locations where the final product/service is in the hands of the final user, or where other sources of information on new ideas might exist (such as trade shows, conferences, workshops).

- *Internal competition for resources or rewards.* All organizations have limited resources and opportunities and must allocate them so as to best accomplish the mission with high efficiency. Limited funds, people, or promotions can cause employees to compete against each other—not wanting to suboptimize their area—instead of seeing their efforts as needing to be focused on maximization of the enterprise.

A possible solution is to ensure that strategic and operational plans clearly indicate the priorities and strategies of the organization and where and how resources are to be allocated. Involve employees in creating these plans through a catchball-type process.

- *Lack of understanding.* In a typical organization, there are so many different strategies, initiatives, projects, and day-to-day activities always going on that it is often difficult to keep everyone fully informed. People therefore put their focus where it seems best placed, but this may not agree with what is actually expected or desired.

A possible solution is to communicate, communicate, and communicate. The biggest problem noted in many employee surveys is lack of adequate communication. When people have gaps in their understanding, they often fill them in as best they can, even though what they hear or think may be incorrect. Management must ensure that information relative to organizational direction (for example, vision, mission, values, strategy, objectives, projects, and performance) is continuously communicated, with the amount and type of communication being adapted to the message and audience.

- *Slow decision-making.* Although an organization may have clearly communicated plans and good cross-functional relationships, levels of the hierarchy slow down and frustrate some people who are actively working on improvement initiatives. Vertical communication is meant to ensure ongoing alignment of goals and activities but is often slower than optimal due to the number of channels through which it may travel and differing time perspectives at each level.

A possible solution is to ensure that authority levels are clearly defined for typical situations and use an exception basis where a few key people have the authority to act if the decision involves crossing a particularly difficult organizational boundary. Specify decision-making channels that do not require everyone in the hierarchy to be involved in all decisions, especially those related to improvement opportunities.

Those who study human development discover a tension within many individuals who, on the one hand, want to improve their lives but, on the other, want a life that is stable and without chaos. Similar paradoxical issues have an impact on an organization's ability to change. Following are some examples:

- *Lack of willingness to invest for the long term.* Managers are often measured according to the end-of-quarter financial results. Yet a significant commitment of funds and other resources is usually required in the early part of organizational transformation, with the more strategic payoffs occurring perhaps three or more years later.
- *Wanting results fast.* Many of the cause-and-effect relationships dealt with on a day-to-day basis in organizations are quickly resolved. This gets translated into people's expectations for many other issues, although there is often a significant time lag between cause and effect. People become impatient and want to stop taking action if they are not seeing results.
- *Be selective in what to work on first.* Take the classic low-hanging-fruit approach. Make sure that initial efforts are focused on areas where success and payoff are highly probable.
- *Poor history of change.* Some organizations have a long record of unsuccessful change efforts, which causes people to become cynical and to want to avoid future attempts.
- *Learn from errors.* Study and admit past mistakes and ensure that future efforts do not repeat them.
- *Fear of the unknown.* By definition, change means that things will be different than in the past. People are often uncertain of what their new roles will be and whether they will be able to adapt to the changes, or want to.
- *Provide support for change.* Allow employees to talk with others who have been through similar changes. Provide reassurance that necessary support will be available throughout the change.

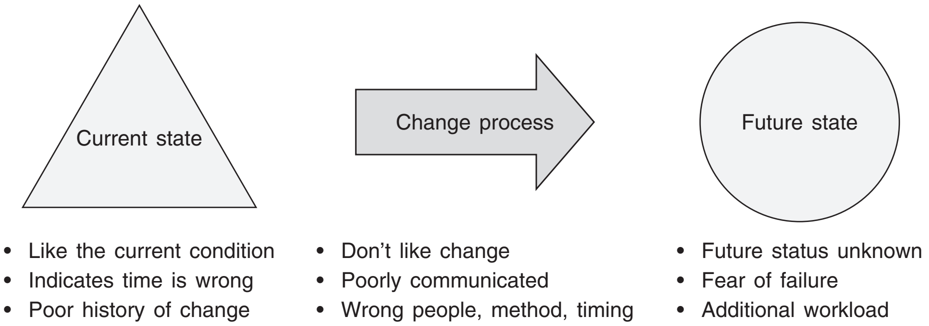

Current state
Change process
Future state
• Like the current condition
• Indicates time is wrong
• Poor history of change
• Don't like change
• Poorly communicated
• Wrong people, method, timing
• Future status unknown
• Fear of failure
• Additional workload

Figure 2.1 Causes for resistance to change.
Source: Reprinted with permission of APLOMET.

- Ensure that there is a common vision of change; communicate the purpose and importance. Figure 2.1 depicts the change process and causes for resistance to change. In the current state, people are comfortable with and like the current condition. There may be a prior history of poor attempts at change. The time may never have been considered right for change. When the change process is begun, people may not like the change. The required change may be poorly communicated. The organization may have the wrong people, method, and timing to make effective change occur. The future state and status may be unknown. People may have a fear of failure in the future state and fear additional workload.
- Understand the emotional impact of change.
- Understand the systems view—that is, be aware of how changing one process or part of the organization will affect other processes or parts.
- Communicate what will and what will not change.
- Model the behaviors that are desired.
- Provide effective feedback, rewards, and consequences.
- Be consistent in responding to resistance.
- Be flexible, patient, and supportive.[26]

Constraint Management

Managing change is particularly complex due to the fact that much of what must be changed often consists of intangibles such as beliefs, behaviors, and policies. These types of constraints are more difficult to identify and manage than issues such as the capacity limitation of a piece of equipment. Conceptual models or diagrams are useful for representing situations. It is important to provide models that are visual and aid in the understanding of intangible constraints that may need to be addressed. Following are some examples of how these diagrams can be used:

Identifying Constraints with an Interrelationship Diagraph. Creating the interrelationship diagraph is a method for representing several elements involved in a process and their cause-and-effect relationship. The diagraph involves first developing an affinity diagram, then analyzing and organizing the components into their respective relationships.

Figure 2.2 is an example of an interrelationship diagraph developed by an organization that was considering developing a suggestion system. Some people had reservations about whether it would be worthwhile, so the management team developed the diagram to represent its thinking about the issues involved. Team members included whether the relationships between components were positive or negative (for example, would or would not be beneficial), as some members of management had reservations about the costs, both resource and financial, of administering the program. They subsequently discovered that they could design the system to fit their particular needs rather than basing it solely on the systems they had seen and read about. The diagram helped them understand the true cause-and-effect relationships involved and that the design they selected would be the major driver for both costs and resources. An organization unhappy with an existing suggestion system might also learn from a similar analysis.

This type of analysis allows a group to develop a common view of how something is working or should work. The model can also be used as a diagnostic tool to guide collection of data to determine which components of the system are not working as desired. Managing constraints requires understanding the issues involved in the situation, how they are interrelated, which have the most leverage, and which will or may block the desired outcome.

Identifying Constraints Using a Tree Diagram. Another approach to finding constraints is to break the situation down into component parts using a logic tree diagram.

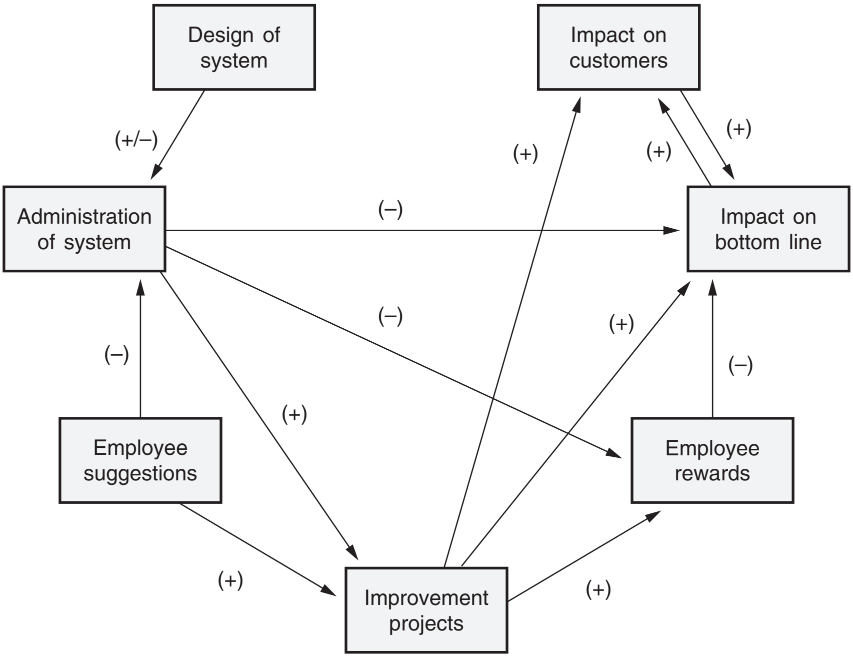


Figure 2.2 Analysis of an employee suggestion system.

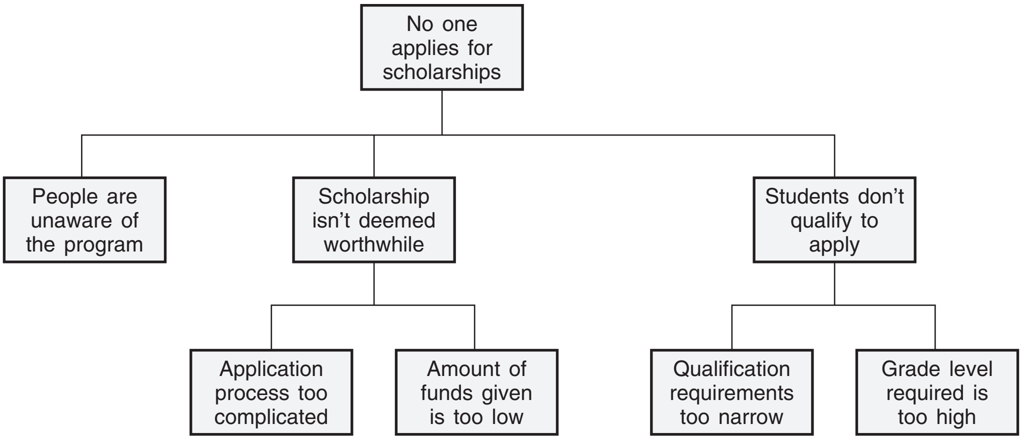

No one applies for scholarships
People are unaware of the program
Scholarship isn't deemed worthwhile
Students don't qualify to apply
Application process too complicated
Amount of funds given is too low
Qualification requirements too narrow
Grade level required is too high

Figure 2.3 Logic tree analysis.

Figure 2.3 demonstrates the use of the process by an organization that offered a scholarship program for three years but had no applicants. The organization had widely publicized the program so elected not to look at that branch of the tree. By breaking down the other two branches, however, it found some likely sources of the problem. It may again ignore some of the branches (for example, keeping the required grade level at what is deemed necessary for true scholarship purposes) and either investigate or alter other aspects of the program in order to affect the next application period.

The logic tree diagram uses a top-down approach to analyzing the situation. As with many improvement tools, the process can also be enhanced by involving key stakeholders in developing the model and in gathering information to identify the constraint(s) for which action will be taken.

3.2 Factors That Contribute to an Organization's Culture

Schein defined culture as:

> The culture of a group can now be defined as a pattern of shared basic assumptions learned by a group as it solved its problems of external adaptation and internal integration, which has worked well enough to be considered valid and therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems.[27]

Culture includes the underlying assumptions and value that drive experiences in the organization. Culture is longer-term and typically enduring in an organization.[28]

Schein identified events and forces that help to understand culture: (1) group norms, or how people typically behave in groups; (2) espoused values; (3) formal philosophy; (4) rules of the game; (5) organizational climate, the meaning that organizational members attach to experiences within the organization; (6) habits of thinking, mental models, and/or linguistic paradigms; (7) shared meanings; (8) root metaphors or integration symbols; and (9) formal rituals and celebrations.[29]

Schein also analyzed culture at three levels: artifacts, espoused beliefs and values, and basic underlying assumptions. Artifacts include visible and feelable structures and processes and observed behavior. Espoused beliefs and values include: (1) ideals, goals, values, and aspirations; (2) ideologies; and (3) rationalizations. Basic underlying assumptions include unconscious, taken-for-granted beliefs and values.[30]

One must first understand the existing organizational culture before an attempt can be made to change it. Johnson suggested asking questions that can help to understand the culture aligned to several identifying artifacts:[31]

- Symbols, such as organizational logos, office layouts, and parking spaces
- Power structures, such as managerial groupings and the most powerful functional areas
- Organizational structures, such as organizational hierarchy (chart) and informal structures
- Control systems, such as performance measurement and reward systems
- Rituals and routines, such as the annual Christmas party and meetings around the water cooler
- Stories and myths, such as stories about mavericks and myths about promotion opportunities
- The paradigm, such as client satisfaction at all costs

Different areas of the globe apply different change management tools, including:[32]

North America (in priority order):

1) Strategic planning
2) Mission and value statements
3) Benchmarking
4) Customer satisfaction surveys
5) Growth strategies

Europe:

1) Benchmarking
2) Mission and vision statements
3) Strategic planning
4) Customer satisfaction measurement
5) Outsourcing

South America:

1) Strategic planning
2) Customer satisfaction measurement

3) Pay-for-performance
4) Mission and vision statements and total quality management

Country cultures can also impact organizational culture, which may require different change management strategies and tools, depending upon both the organization and the organization's country location where the change projects occur.

4. LEADERSHIP TECHNIQUES

> Develop and implement techniques that motivate employees and sustain their enthusiasm. Use negotiation techniques to enable parties with different or opposing outlooks to recognize common goals and work together to achieve them. Determine when and how to use influence, critical thinking skills, or Socratic questioning to resolve a problem or move a project forward. (Create)
>
> **Body of Knowledge I.B.4**

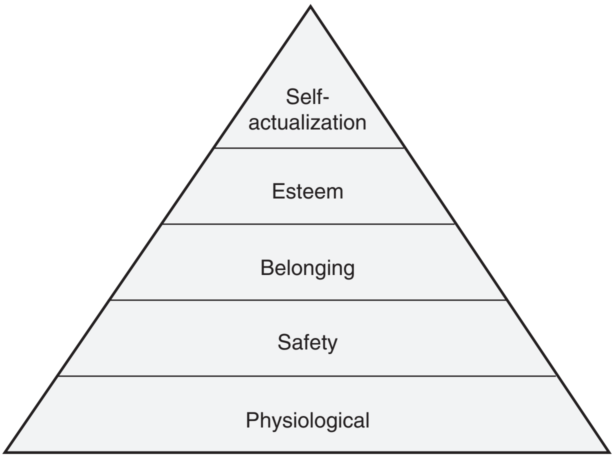
It is impossible for one person to motivate another person. Motivation is derived from within a person—a person needs to feel motivated. Therefore, motivating a person can only be done by creating an environment in which the person feels motivated. When one person (for example, a supervisor) says she is going to motivate a subordinate, she means (or should mean) she is going to do something that will cause the subordinate to become motivated. The idea that a "kick in the butt" will motivate a subordinate is incorrect; it may just move the subordinate and usually will make the subordinate angry and/or afraid. That kind of movement is erroneously perceived as motivation.

Theories of Motivation and Influence

Two types of motivation have been identified:[33]

- *Extrinsic motivation:* The satisfaction of either material or psychological needs that is applied by others or the organization through preaction incentive or postaction reward.
- *Intrinsic motivation:* The qualities of work itself or of relationships, events, or situations that satisfy basic psychological needs (such as achievement, power, affiliation, autonomy, responsibility, creativity, and self-actualization) in a self-rewarding process.

Abraham Maslow developed a model demonstrating a *hierarchy of needs* through which he believed people progressed.[34] Maslow's pyramid (see Figure 2.4) assumes that once humans satisfy the basic, physiologically driven needs, they will then



Stage	Process	Needs
1st	Physiological	To eat, sleep, have shelter
2nd	Safety	To have economic and physical security
3rd	Belonging	To be accepted by family and friends
4th	Esteem	To be held in high regard; status
5th	Self-actualization	To achieve one's best

Figure 2.4 Maslow's hierarchy of needs.

be motivated by higher-level needs, and this process will continue until achieving self-actualization. The workplace is obviously a key aspect in allowing an individual to satisfy physiological and safety needs, but someone who has satisfied these levels and is working to satisfy higher levels can quickly return to the bottom of the hierarchy in the event of a job loss. The workplace can also allow an individual to reach higher levels, assuming there are job opportunities that enable the person's personal desire for recognition and achievement to be satisfied. It is important to note that since Maslow's theory is based very much on values, it would not necessarily apply to people from all cultures or socioeconomic strata.

Frederick Herzberg identified two categories into which work motivation factors could be classified—*satisfiers* and *dissatisfiers*.[35] Dissatisfiers included factors such as work conditions, salary, company policies, and relationship with one's supervisor. He also called them *hygiene factors* since, although they create dissatisfaction if not adequately addressed, correcting the deficiencies would not create satisfaction. Satisfiers included items such as responsibility, achievement, advancement, and recognition.

There are also three motivational theories specifically related to recognition and rewards:

- *Equity theory.* Job motivation depends on how equitable the person believes the rewards (or punishment) to be.[36]
- *Expectancy theory.* What people do is based on what they expect to gain from the activity (Victor Vroom).[37]

- *Reinforcement theory.* What people do depends on what triggers a behavior initially (the antecedent) and the consequences that have in the past resulted from such behavior or the consequences the performer believes will happen as a result of a behavior (B. F. Skinner).[38]

What motivates one person may not motivate another. McClelland and others have posited that:[39]

- An individual who enjoys working closely with other people is motivated by affiliation.
- Someone who works in order to accomplish personal goals is motivated by achievement.
- A person who works in order to contribute to the well-being of others is motivated by altruism.
- Someone who wants to have control over her or his work is motivated by power.

These motivations are not mutually exclusive nor is any one person driven only by a single factor. In fact, in order to satisfy their many different needs, people are often involved in several different activities at work, in their local community, and in other organizations.

A paradoxical view of motivation is the division between intrinsic motivation and extrinsic motivation. Some people are driven more by their own internal needs or desires, while others are motivated primarily by external factors. This is partially a function of whether the person has an internal or external locus of control—whether you believe your future is influenced more by your own actions or by the actions/decisions of others.

Caution is advised in assuming that what stimulates motivation for an individual in one situation or time frame will continue to motivate the next time. Also, what provides motivation for one person may not do so for another. Consider this example: Work is backing up, and the manager tells her work unit personnel that the unit will have to work overtime each day for the next ten days. Rose, a young woman who is saving money to buy a dirt bike, is delighted about the prospect of extra compensation. Ray, a single father whose baby is cared for during the day by a babysitter, is distraught because he has to be home by 6:00 p.m. to relieve the babysitter and realizes that any other option will cost more than he will earn on overtime. Rose is motivated; Ray is not. Six months later, the same need for overtime occurs. Rose resents the mandate (she has purchased her dirt bike and wants to ride it in the early evenings before the sun sets). Ray's aunt has moved in with him and now cares for the baby. Ray needs the additional compensation to help with his expanded family. Ray is motivated; Rose is not.

Negotiation

In order for multiple parties, whether individuals or groups, to work together to achieve common goals, there must be agreement on the goals, the methods for achieving them, and what will occur when difficulties arise. Each party will typically have different values and priorities that need to be addressed, and that calls for negotiations resulting in an agreement acceptable to all parties. Management-union negotiations are perhaps the most widely discussed example, but negotiation also occurs as part of many other normal business processes, such as:

- Establishing specifications for purchased components for a new product
- Setting performance measures for a process or department
- Defining the desired outcomes for an improvement project
- Identifying personal development goals

Parties involved in such negotiations might include customers and suppliers, senior management and middle management, sponsor and team leader, or manager and employee.

A difficulty in the negotiation process is that the two parties often approach the task as though there were only two sides to the situation, when, in fact, multiple views could be taken. This is exacerbated when a win-lose attitude is taken, as the process will become divisive and usually result in outcomes that are not seen as beneficial by either party. There are four orientations to negotiation: win-win, win-lose, lose-win, and lose-lose. When both parties approach negotiation with an anticipation of achieving mutual benefit, both parties tend to win. The other three orientations leave the parties striving not to lose at any cost.

Principled negotiation based on a win-win orientation includes:

- Separating the people from the problem
- Focusing on interests, not position
- Understanding what both sides want to achieve
- Inventing options for mutual gain
- Insisting on objective criteria

Timing also affects negotiations, both long-term and short-term. For negotiations that recur on a long-term periodic basis (such as labor agreements), the years between sessions allow the parties to store up their frustrations and release them just as they come together to forge a new contract. At the same time, allowing a break between negotiation sessions allows the parties to back off from what may be an emotional discussion and reflect on their primary purposes.

Negotiations should take place in an environment that is conducive to open discussion and allows all involved to see each other face-to-face. Rather than making presentations to each other, both parties should focus on a conversation with each other, which means that listening in order to understand the other person's viewpoint is a key requirement. A set of ground rules or a third-party mediator may be useful if the negotiations involve a highly controversial or emotional subject.

Some techniques that have been found to improve the negotiation process include:

- Focusing on common objectives before discussing areas of difference
- Avoiding power strategies such as lying about one's priorities in order to get the other party to submit to lowered expectations
- Doing something for the other party, even if symbolic, to create positive energy

- Separating out discussion issues that are not interconnected so they can be discussed based on their own merit
- Bringing in other parties that may have additional or different information about the situation[40]

Additional techniques include:

- Identifying, up front, a range of acceptable outcomes—and why you want what you want
- Determining the real intentions of the other party: the goals, objectives, and priorities
- Being prepared with supporting information
- Not rushing the process
- Keeping the most difficult to resolve issues for last
- Being sensitive to face-saving needs of the other party
- Being firm, fair, and factual
- Always controlling your emotions
- Evaluating each move against your objectives and assessing how it relates to all other moves
- Being adept at formulating a win-win compromise
- Being aware of the effect of the outcomes of the present negotiation on future negotiations
- Actively listening and seeking clarity of expectations
- Being flexible with your position and being able to step back and look critically at your position—there may be multiple ways the same overall objective can be achieved. This view involves going up the vertical hierarchy of one's cognitive view of the situation, rather than only going horizontally across perceived options.[41]

Figure 2.5 is a portion of a decision option hierarchy for reducing deficit spending by a city government. Negotiations between city officials and the school board often focus only on option C, while negotiations with the citizenry focus only on options A and B. By limiting the focus to the *hows*, the larger picture of the higher *why* is often ignored, which means that option D is often not even understood as a possibility.

Negotiating is a skill very much needed in the project management arena. Often, the project manager/leader has less authority than ongoing operations managers, and that necessitates negotiating for needed resources. This is especially problematic when the project team is not dedicated solely to the project. Then, one of the largest problems is ensuring that the project team members get the time needed to work on the project.

Change management usually involves negotiation in eliminating organizational roadblocks and managing constraints. (Change management will also involve conflict resolution.)

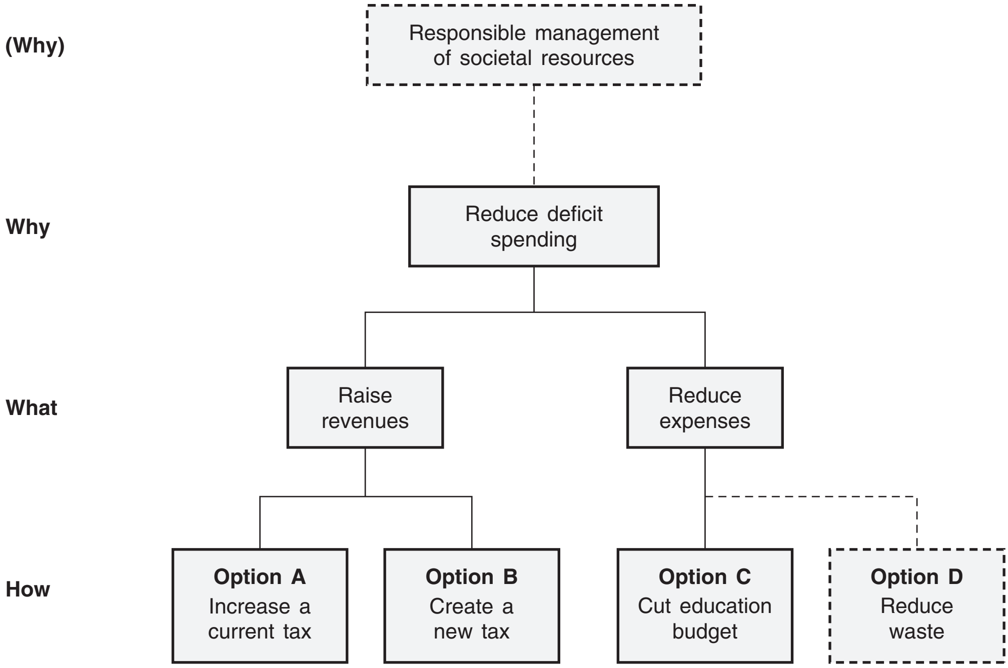

(Why)
Responsible management of societal resources
Why
Reduce deficit spending
What
Raise revenues
Reduce expenses
How
Option A
Increase a current tax
Option B
Create a new tax
Option C
Cut education budget
Option D
Reduce waste

Figure 2.5 A decision option hierarchy.

Some common uses for negotiation are:

- Customer-supplier purchasing contracts
- Negotiation of compensation terms between a potential new hire and the organization
- Labor-management contracts
- Facilities/equipment rental contracts
- Negotiating for approval of the annual budget for a work unit

Having effectively completed negotiations usually means that the relationship between the parties will continue and that the agreement should be documented. The agreement should include the standards against which the compliance of each party will be compared, a frequency or process for reviewing performance, and what is to take place if a violation should occur.

Conflict

Sources and Views of Conflict. Because organizations consist of individuals and groups with different backgrounds and responsibilities, some conflict is inevitable. A conflict might occur between two individuals (for example, between a manager and an employee, or between peers), between groups (for example, departments or teams), or between organizations (for example, customer and supplier). Although conflict will often be created by disagreements over goals or resource allocation, beneath the surface are differences in values, priorities, roles, and personal styles that cause the conflict to become emotional and/or personal.

Conflict occurs when two or more options appear to be mutually exclusive, and a viable alternative is felt to be absent. Conflict cannot be resolved when the parties involved firmly believe that what each wants is incompatible with what the other wants.

Conflict may be due to personal issues or may be caused by underlying organizational issues (for example, incongruent policies or unclear boundaries). The effect is that energy that should be focused on the organization's mission instead gets transferred to activities that are unproductive. Regardless of whether the activities are unseen or visible, it is in the best interests of the organization to identify and address the conflict. Quality managers, because of their expanded role in facilitating cross-functional cooperation for strategic alignment and continual improvement, should be aware of and develop their conflict management abilities.

On the plus side, conflict can also be viewed as an energizing force. Management and resolution of differences between individuals and groups can unlock creativity. "Contrary to conventional wisdom, the most important single thing about conflict is that it is good for you. While this is not a scientific statement of fact, it reflects a basic and unprecedented shift in emphasis—a move away from the old human relations point of view where all conflict was basically seen as bad. In brief, in our new frontier environment, conflict is the order of the day."[42]

One model for understanding conflict resolution is based on the dimensions of assertiveness (extent to which a party attempts to satisfy his/her own concerns) versus cooperativeness (extent to which the party attempts to satisfy the other's concerns).[43] The resulting matrix (see Figure 2.6) has been incorporated in an assessment instrument that can be used to evaluate conflict-handling style. Interpretation of the instrument emphasizes that each conflict mode might be appropriate for a particular situation. The following list further expands on these options:[44]

- Approach it as a problem to be solved. Utilize facts and information that can be useful for looking at and evaluating different options.
- Smooth over the conflict by emphasizing the positives and trying to avoid the negatives. This is obviously only a temporary solution if the conflict is substantial.
- Transfer the problem to a higher level of authority.
- Resolve any scarcity of resources that is creating the conflict.
- Avoid the conflict if it is not in the organization's best interests to continue to pursue it.
- See if compromise will resolve it to the satisfaction of both parties.
- Change the minds of the people involved.

Since the latter option involves trying to change a person's mind, it is not a very viable one. Research indicates that people's basic personalities do not change substantially over their lifetimes, so changing a mind is obviously difficult. Additionally, organizations do not have the right to change a person's thought processes per se. The option is viable if interpreted differently—people may be transferred or otherwise removed from the conflict situation as a final option. In a quality organization, however, it is more likely that additional methods for resolving the situation would be attempted.

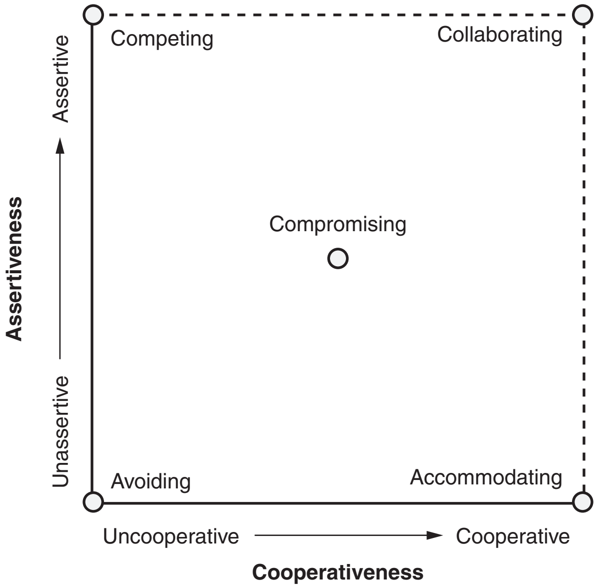


Figure 2.6 Conflict-handling modes.

Techniques for Conflict Resolution. The best method for resolving a particular conflict depends on the situation. If there is clearly a solution that simply needs to be identified and agreed to, and the parties involved are not adamantly opposed to each other, then simple discussions utilizing brainstorming, multivoting, and consensus may be sufficient. The brainstorming process can be used to identify several possible solutions, followed by a multivoting process that narrows the list to a smaller, more viable list. Looking at the positive and negative attributes of each option may then result in agreement of all parties on what action(s) will be taken. This discussion can be aided by looking at each activity required by each party in the conflict, the effort it would require, and the impact it would have both on resolving the issues and on the relationship between the parties.

A more difficult situation arises when, although there may be several viable solutions, the involved parties do not appear to be prepared to work cooperatively in order to reach a joint decision. A process such as *interest-based bargaining* (also called *principled negotiation*) might then be used to attempt to satisfy as many interests as possible using the following steps:

1. Define the problem in a way that distinguishes it from the people involved.
2. Clarify the interests of the parties (as opposed to their positions on the issue).
3. Identify new and creative options beneficial to all parties.
4. Determine objective criteria to be used to evaluate fairness of the outcomes for all parties.

Conflict resolution may also involve intervention by a third party. For example, a person trained in human process interventions might help parties involved in a conflict by engaging them in dialogue. Strategies that might be used include:[45]

- Helping the parties avoid the factors that trigger conflict
- Setting guidelines for interaction of the parties
- Helping the parties find ways to cope with the conflict
- Identifying and eliminating the underlying issues

Real dialogue involves not only listening to what the other party says but also taking care to truly comprehend his or her perspective and why it is important to him or her. It also requires that one understand the values and assumptions underlying one's own position and be willing to share them.

Core Issues in Conflict Management. Conflict management is difficult when people take a "What's in it for me?" viewpoint. A win-win approach provides the following benefits:

- A unified direction—a platform for achieving the organization's goals and objectives
- Higher employee satisfaction, especially when active listening is used, and the search for alternatives is expanded
- Improved health and safety of employees due to encountering less stress in their lives

Following are components of an approach to resolving conflict to the mutual benefit of all involved parties:

- Define the conflict as a mutual problem.
- Identify goals common to all parties.
- Find creative alternatives that satisfy all parties.
- Ensure that all parties understand their own needs and communicate them clearly.
- Emphasize mutual interdependence (as opposed to independence or dependence).
- Be certain that contacts are made on a basis of equal power.
- Communicate needs, goals, positions, and proposals openly, honestly, and accurately.
- State needs, goals, and positions in the opening offer.
- Empathize with and understand others' positions, feelings, and frames of reference.
- Reduce defensiveness by avoiding threats, harassment, or inconveniences to other parties.

A conflict is not likely to be resolved successfully when either party does the following:

- Defines the conflict as a win-lose strategy
- Pursues his or her own goals or hidden agenda
- Forces the other party into submission

- Increases power by emphasizing independence from the other party and the other party's dependence on them
- Tries to arrange contacts based on power relationships
- Uses inaccurate or misleading communications
- Overemphasizes needs, goals, and position in the opening offer
- Avoids empathy and understanding of others' positions, feelings, and frames of reference
- Would rather both parties lose (lose-lose) than have the other party get his or her way

Critical Thinking and the Socratic Method

Critical thinking is defined by Davis-Seaver[46] as "purposeful thinking that uses the skills of problem solving, decision making, evaluation, and metacognition to resolve conflicts, arrive at solutions and understand depth. It is that part of the creative thinking process that analyzes and evaluates the appropriateness and logicalness of the creative process or outcome." The constructivism perspective of critical thinking aligns best with the quality management aspects of critical thinking. This perspective incorporates critical thinking from an experiential one that requires curiosity and reflection.[47] There are many quality management and improvement tools that can enhance the ability to think critically. Taiwo used the term *critical systems thinking* to include the elements of total quality management incorporating customer focus, process improvement, and employee involvement.[48] From that perspective, systems thinking and the many quality principles can potentially unlock critical thinking and new solutions to enhance quality and improve efficiency. The Six Sigma and lean perspectives bring myriad tools into our tool kit that engage the tenants of critical thinking. Performing root cause analysis and applying such tools as cause-and-effect diagrams, why-why diagrams, and failure mode and effects analysis can help us to think critically and ensure that we identify and eliminate the root causes of quality and process problems. Seeing our processes as systems that create products and services while applying process mapping and value stream mapping tools ensures we consider the entire system and not just subsets or parts of the processes.

Socrates approached critical thinking by asking questions, called the *Socratic method*. These questions can help the thinker to examine assumptions and find evidence for facts. According to Merrill, there are four steps in critical thinking: (1) gather information, (2) test assumptions, (3) restructure thoughts, and (4) reach conclusions. Merrill also supports the need for systems thinking to enhance problem-solving and critical thinking.[49] The TRIZ methodology, or the theory of inventive problem-solving, developed by Genrich Altshuller, is focused on helping product designers design innovative products by thinking differently. "In the TRIZ methodology, the fundamental idea in the conceptual framework is the extraction of the essential conflicts from the problems and the eventual resolution of the conflicts. Altshuller asserted that an invention frequently appears when a contradiction between the engineering parameters is resolved. The contradictions can either be technical contradictions in the form of two mutually conflicting parameters within a system, or physical contradictions that are the direct opposite of two values for a parameter formulated by the same system."[50] TRIZ originated from Altshuller analyzing thousands of patents and identifying only forty fundamental inventive principles and was initially applied to product innovation and invention. It can be applied in service process design to incorporate critical-thinking approaches.

5. EMPOWERMENT

Apply various techniques to empower individuals and teams. Identify typical obstacles to empowerment and appropriate strategies for overcoming them. Describe and distinguish between job enrichment and job enlargement, job design and job tasks. (Apply)

Body of Knowledge I.B.5

One of the core components of quality leadership is having everyone in the organization involved in managing and improving quality of the processes for which they are responsible. This might be done as part of day-to-day operations as a member of a natural work team or a self-directed team, or in becoming part of a group that is going to take on a special process design or improvement project. Regardless of the way it occurs, it involves giving employees greater responsibility and authority and is commonly labeled *empowerment.*

Empowerment is based on the belief that employees have the ability to take on more responsibility and authority than have traditionally been given them and that heightened productivity and a better quality of work life will result. Different words and phrases are used to define empowerment, but most are variations on a theme: to provide employees with the means for making influential decisions. Juran defined empowerment as "conferring the right to make decisions and take action."[51]

Empowerment means different things in different organizations, depending on culture and work design; however, empowerment is based on the concepts of job enlargement and job enrichment. *Job enlargement* means changing the scope of the job to include a greater portion of the horizontal process. An example would be a bank teller who not only handles deposits and disbursements but now distributes traveler's checks and sells certificates of deposit. *Job enrichment* means increasing the depth of the job to include responsibilities that have traditionally been carried out at higher levels of the organization. An example would be if a bank teller also had the authority to help a client fill out a loan application and complete initial screening to determine whether or not to refer the customer to a loan officer.

As these examples show, empowerment of employees will require:

- A work environment and managing style that supports empowerment
- Training in the skills necessary to carry out the additional responsibilities
- Access to information on which decisions can be made
- Willingness and confidence on the part of the employee to take on greater responsibility

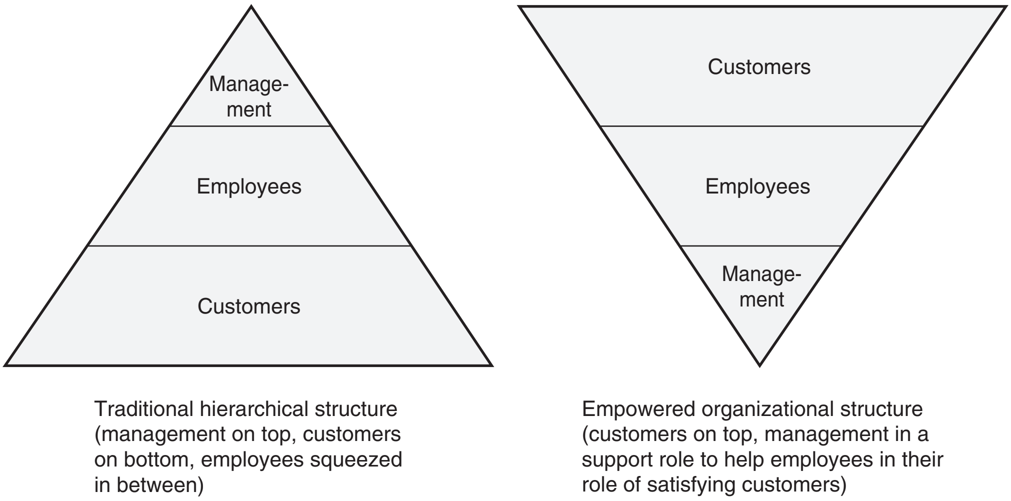
Empowerment also means management giving up some of the power traditionally held by it, which means management must take on new roles and responsibilities and gain new knowledge. It does not mean that management relinquishes all authority, totally delegates decision-making, and allows operating without accountability. It requires a significant investment of time and effort to develop mutual trust, assess, and add to individuals' competencies, as well as develop clear agreements about roles, responsibilities, risk-taking, and boundaries.

Empowerment is difficult to implement because it is often a major culture change from past ways of working. It involves behavioral changes in all members of the organization: management, operations personnel, and support staff. Therefore, it is critical that the organization lay the appropriate groundwork. To start, an organization should develop an operational definition of empowerment and communicate a strong commitment to it, starting with top management. It should develop a time-phased implementation plan and build or modify the necessary organizational systems to support empowerment.

Empowerment requires the transfer of authority with a clear agreement about expectations, responsibilities, and boundaries. This process takes place over a period of time as both managers and workers become comfortable with the concepts and implications of empowerment. Four principles that foster this transition are:

1. Give people important work to do on critical issues.
2. Give people discretion and autonomy over their tasks and resources.
3. Give visibility to others and provide recognition for their efforts.
4. Build relationships by finding them sponsors and mentors.[52]

Empowerment often also calls for restructuring the organization to reduce levels of hierarchy or to provide a more customer- and process-focused organization. Empowerment is often viewed as an inverted triangle of organizational power. In the traditional view, management is at the top while customers are on the bottom, whereas in an empowered environment, customers are at the top while management is in a support role at the bottom (see Figure 2.7).



Traditional hierarchical structure (management on top, customers on bottom, employees squeezed in between)

Empowered organizational structure (customers on top, management in a support role to help employees in their role of satisfying customers)

Figure 2.7 Traditional versus empowered organization.

For empowerment to be successfully implemented, the leader's role must shift from that of a traditional manager to that of an enabler. Leaders must balance their need for personal control with the ability to provide freedom for others to act on their own authority. This is a mindset as well as a negotiated agreement between leaders and their subordinates. Leaders who empower others create an environment in which this balance can take place. They involve their subordinates in planning, delegating responsibility, clarifying the scope of authority, delineating boundaries, encouraging, providing a motivational environment, and rewarding accomplishments.

The process also needs to occur from top to bottom. Frontline managers need to understand how to implement the process and how to transition from a traditional role to that of an empowering leader. Middle management needs to work to remove barriers to empowerment and to help coach frontline managers in their new roles. Changes in performance review and compensation systems are usually required to align these systems with the new responsibilities.

People who are well matched with the jobs they hold do not require force, coercion, bribery, or trickery to work hard and produce quality work. They are internally motivated. An example of a mismatch is assigning a usually gregarious extrovert to spray-painting parts in an isolated room while wearing a protective mask all day. This would certainly be totally dissatisfying and lead to poor work for this individual. Another example would be reassigning an operator who formerly worked at a help desk solving customers' problems to a role as a telemarketer where he or she has to cold call prospective customers. Initiating customer contact may be a totally distasteful job for the individual. Type of personality, personal beliefs and interests, fear of danger, and so on are all factors to consider when matching people to jobs—assuming a motivated workforce is desired.

For a person to be internally motivated from the job itself, the person must:

- Receive sufficient skills training and knowledge to succeed in the job assigned
- Know what level of performance and results are expected
- Be provided with appropriate tools, equipment, and a workplace conducive to producing a quality product or service within a safe, secure, and healthful (physical and mental) environment
- Experience responsibility for the results of the work
- Experience a challenge but not be overwhelmed
- Have the authority to make decisions commensurate with the job responsibilities and personal competence and within preestablished boundaries
- Experience the work as contributing value
- Know how the results from personal work contribute to the organization
- Know how work is measured and evaluated
- Have the opportunity to improve the processes used in the work
- Know that management is aware of, supports, and appreciates the work

Table 2.1 Relationship changes in an empowered organization.

Issue for comparison	Traditional organization	Empowered organization
Employees' primary focus is on:	Management	Customers
Management's role is:	Monitoring and controlling	Facilitating and coaching
Management–employee relationship is:	Boss-to-subordinate	Peer-to-peer

Although work design is the most visible change in empowerment, the relationships of managers and employees is perhaps the most significant and difficult aspect of that change. Table 2.1 summarizes these changes, emphasizing the inherent difficulty in trying to change from a traditional to an empowered organization.

Common mistakes and barriers to empowerment include:

- A lack of a clear commitment. To succeed, top management must clearly communicate its support. Without this commitment, empowerment will be impossible to implement.
- Failure to define empowerment. Failing to develop an operational definition of empowerment results in confusion and inconsistent implementation. Many managers do not understand the term and can unwittingly block its effective implementation by sending conflicting messages.
- Failure to establish the boundaries within which employees can be empowered.
- Failure to provide appropriate training to management and the performers.
- Failure to implement appropriate incentives. People who have been rewarded for behavior that serves a traditional hierarchical system will resist transitioning to a new role unless incentives to encourage change are in place.
- Lack of an implementation plan. Empowerment consumes time, resources, and up-front costs for training and organizational support systems. An implementation plan is essential to prepare this groundwork. An organization that does not think through all of the implications sets up serious barriers to success.
- Inability to modify organizational culture. Many traditional organizations will hinder empowerment by virtue of their hierarchical structures, reward processes, and cultural values. Unless appropriate changes are made, empowerment will fail.
- Some people will resent a shift to empowerment. They often do not want to assume the responsibility involved. Others may feel management is trying to pass down their responsibility in order to save money or whatever.

- Not everyone will buy in at first. Some will wait and see if this is just another "here today, gone tomorrow" scheme of management. Some are terrified at the new freedom, fearful they might make a dreadful mistake and be punished for it.
- Middle and first-level management resent giving up their authority (and perhaps the curtain they have been hiding behind). Learning and practicing new behavior is tough on those who grew up in the traditional ways.
- If top management is not visibly and continually seen using empowerment techniques, the effort will likely not succeed.
- Changing the culture from a traditional hierarchical mode to one where empowerment is practiced takes a long time and costs money. A high level of sustained commitment is needed for years.
- The organization structure and reporting relationships will need to be changed.
- Major systems and processes will require modification or replacement—for example, the strategic planning process, compensation system, employee recognition and reward process, customer service processes, expense reimbursement procedure, and so on.

Benefits from Empowerment

Aubrey and Felkins reported a survey administered in several companies to evaluate the perceived benefits of employee involvement. It indicated significant improvements in attitudes and behavior. For example, results showed an increase in individual self-respect, increased respect for employees by supervisors, increased employee understanding of management, reduced conflict, and increased employees' awareness of why many problems are not solved quickly. A similar survey administered to management indicated that employee involvement seemed to increase productivity.[53]

Customer satisfaction also typically improves when personnel are given the authority to make decisions directly related to customer problems or needs. For example, a major credit card service organization reported that through its employee empowerment program, customer delight helped to propel the organization to the number two spot in the bank credit card industry and helped it win the Baldrige Award. Other Baldrige Award winners report similar results.

The very highest leader is barely known by men.
Then comes the leader they know and love.
Then the leader they fear.
Then the leader they despise.
The leader who does not trust enough will not be trusted.
When actions are performed without unnecessary speech
The people say, "We did it ourselves."

—Lao-tzu

This chapter has discussed a number of leadership challenges and issues. While the expression "_________________ is a born leader" may be true in some cases, for the rest of us being a good, effective leader is a learned skill. In transforming ourselves to become a good leader, we may have to change our behavior—sometimes drastically. We may have to disregard traditional teachings and practices from our early years. We are in a rapidly evolving world that calls for innovative, adaptive, and ethical leaders. Relationships with people are critical, especially as technology tends to lead us toward dehumanizing internal and external organizational interactions.

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See Appendix A for additional references for this chapter.

Chapter 3

C. Teams and Team Processes

A team is a group of people who perform interdependent tasks to work toward a common mission. Some teams have a limited life—for example, a design team developing a new product or a process improvement team organized to solve a particular problem. Other teams are ongoing—for example, a departmental team that meets regularly to review goals, objectives, activities, and performance. Understanding the many interrelationships that exist between organizational units and processes, and the impact of these relationships on quality, productivity, and cost, makes the value of teams apparent.

Many of today's team concepts were initiated in the United States during the 1970s through the use of quality circles or employee involvement initiatives. The initiatives were often seen as separate from normal work activities rather than integrated with other organizational systems and processes. Team designs have since evolved into a broader concept that includes many types of teams formed for different purposes.

Difficulty with teams in the United States is often blamed on a cultural emphasis on individual accomplishments versus shared responsibility and success. The problems are also due to inadequate organizational support structures. For example, since reward systems often reinforce individual performance, it is logical that people would be less interested in sharing responsibilities. Formal gainsharing programs that reward individuals financially based on performance of the company, division, facility, product line, and/or project of which they are part are more likely to reinforce the need for working together toward common goals.

Just as individuals develop over their life span, groups tend to change over time. Being aware of this normal progression and ways to overcome difficulties that arise can help the team process be a very positive experience. As Senge pointed out in *The Fifth Discipline*, if a team really jells, the resulting experience can be a highlight of one's career.[1]

The team process also helps an organization change and begin working in different ways. If decisions are made in a multidisciplinary way, the team will consider a broader perspective and will be likely to better address problems. Other members of the organization will often more readily accept the decisions. Some work design changes mean that people from formerly separate functional areas now work together in a newly designed process. These types of changes require more significant attention to organizational change issues to help the group focus on its new mission.

Team processes offer the following benefits to the organization:

- Synergistic process design or problem-solving
- Objective analysis of problems or opportunities
- Promotion of cross-functional understanding
- Improved quality and productivity
- Greater innovation
- Reduced operating costs
- Increased commitment to organizational mission
- More flexible response to change
- Increased ownership and stewardship
- Reduced turnover and absenteeism

Individuals can gain the following benefits from teams:

- Enhanced problem-solving skills
- Increased knowledge of interpersonal dynamics
- Broader knowledge of business processes
- New skills for future leadership roles
- Increased quality of work life
- Feelings of satisfaction and commitment
- Sense of being part of something greater than one could accomplish alone

Numerous reasons have been noted for why teams often fail to reach their full potential. Common reasons are:

- Failing to integrate cooperative work methods into the organizational culture
- Lack of organizational systems necessary to support the team process
- Minimal up-front planning of how the organization plans to utilize teams
- Failure to prepare managers for their changing roles
- Failure to prepare team members for their new roles
- Inappropriate recognition and compensation systems
- Inadequate training
- Impatience of top management with the time needed for maturation
- Incomplete understanding of group dynamics

1. TYPES OF TEAMS

Identify and describe different types of teams and their purpose, including process improvement, self-managed, temporary or ad hoc (special project), virtual, and work groups. (Understand)

Body of Knowledge I.C.1

Team Configurations

Consider the differences between a baseball team, a jazz quartet, and a bomb squad. They differ according to the number of members, the range and complexity of skills required, the forms of leadership used, the frequency of working together, and the total time spent working together. As Louis Sullivan, a mentor of Frank Lloyd Wright, stated, "Form follows function," and this also applies to teams. Although they may take different names in different industries or organizations, this section presents eight types of teams:

- Process improvement teams
- Self-managed teams
- Temporary/ad hoc teams
- Work groups
- Cellular teams
- Special project teams
- Virtual teams
- Combinations of two or more of the above types

Process Improvement Teams. A process improvement team is a project team that focuses on improving or developing a specific business process and is more likely to be trying to accomplish breakthrough-level improvement. The team comes together to achieve a specific goal, is guided by a well-defined project plan, and has a negotiated beginning and end. Such teams are typically cross-disciplinary, bringing together people from different functions and with different skills related to the process to be improved. The team may have a management sponsor who charters the team and ensures that the team has the appropriate resources and organizational support.

The leader of a process improvement team is usually selected by the project sponsor, and the team meets on a regular basis (for example, weekly) to plan activities that will be carried out outside the meeting, review information gathered since the previous meeting, and make decisions regarding implementation of process changes. An independent facilitator who has no involvement in the process to be improved may also work with the team if team members do not have sufficient skills or experience with team facilitation.

In today's fast-paced environment, many organizations also perform process improvement through an accelerated team process sometimes called a *kaizen event* or *kaizen blitz.* These teams spend three to five consecutive full days focusing on a very narrow project scope and implement many of their recommended changes during that period. Gains on the order of 70% (for example, increase in productivity or reduction in changeover time) are not uncommon. In order to accelerate the pace of progress, the facilitator typically has more authority than with most teams.

Self-Managed Teams. Self-managed teams are groups of employees involved in directly managing the day-to-day operation of their particular process or department. They are authorized to make decisions on a wide range of issues (for example, safety, quality, maintenance, scheduling, and some personnel decisions). Their responsibilities also include processes traditionally performed by managers, such as setting objectives, allocation of assignments, and conflict resolution. These teams are also called *self-directed teams* or *high-performance work teams*. They give employees much broader responsibility and ownership of a work process.

The leader of a self-managed team is usually selected by the team members, and in many cases the role is rotated among the members over time. Also often rotated is the responsibility for providing within-team coordination of particular technical aspects of the team's processes, such as safety or scheduling.

All of the elements that apply to work groups also apply to self-managed teams. Self-managed work teams, however, require more up-front planning, support structures, and nurturing. The transition will usually take a significant time period and needs consistent support from management.

The following key lessons related to self-managed teams were identified during a study of a financial organization:[2]

- Implement a well-thought-out structure to design and guide the implementation process, such as a steering committee, a design team, and a pilot effort.
- Provide special training to managers and supervisors to help them make the transition from their current role to the new support role.
- Develop a careful plan to manage people throughout the transition. The new team structure will cause changes that will appear threatening to many involved, as they interpret the changes as a loss.
- Set realistic expectations that consider the long and energy-consuming time required for the process to become integrated into the business.

Comprehensive training is also critical in order to move from a traditional to a self-managed work environment. For example, one Fortune 500 company provides training in the following subjects:[3]

- Maintaining a focus on the customer
- Developing a vision and mission that are integrated with the larger organization's mission
- Understanding roles and operating guidelines
- Working together to make decisions, plan work, resolve differences, and conduct meetings

- Implementing concepts and strategy for empowerment
- Setting goals (objectives) and solving problems for continuous improvement

Self-managed teams are more likely to be successful when they are created as part of starting up a new facility (a greenfield site) since the cultural change required if an existing facility (a brownfield site) attempts to transition from a traditional work design is so dramatic. In order to smooth the transition to self-managed teams, an existing organization may begin by first implementing cross-functional process improvement teams and/or work teams as a means for learning.

Temporary/Ad Hoc Teams. In a flexible organization, a need for a temporary team may be identified due to a specific problem or situation. Although such ad hoc teams may not use the same formal structures (for example, agenda and regular meeting frequency), the same general principles and processes are still necessary. An empowered organization often sanctions the use of such teams when deemed useful to carry out a short-term mission. For example, many organizations regularly use temporary teams to conduct internal audits of compliance of their quality management system with the ISO 9001 standard.

A problem or situation may arise that requires immediate and dedicated attention. For example:

- A flood or fire has occurred, and decisions have to be made regarding temporary relocation of the process. What emergency plans need upgrading to deal with a similar future emergency?
- A major customer is sending in an auditing team to assess the adequacy of your quality management system. What needs to be done to prepare for the audit?
- Your information management computer system has been compromised by an outside virus. What processes have been affected, and what emergency steps must be taken to recover from the infected data and programs? What safeguards need upgrading or replacement to prevent a similar future disaster?

Usually, management designates the person to form the team to address the situation. Typically, and depending on the nature of the situation, the team will be small and cross-functional and will call on other technical expertise as needed.

Situations less critical than those listed may also be addressed by a temporary team—for example, the disposition of an unusually large return or recall of unacceptable product.

Work Groups. Work groups, sometimes called *natural teams*, are teams of employees who have responsibility for a particular process (for example, a department, a product line, or a stage of a business process) and who work together in a participative environment. The degree of authority and autonomy of the team can range from relatively limited to full self-management depending on the organizational culture. The participative approach is based on the belief that employees will be more productive if they have a higher level of responsibility for their work and are empowered. Since the team understands the work processes, the members should monitor and improve the processes on an ongoing basis. The team leader is usually the individual responsible for the work area, such as a department supervisor.

Work groups function similarly to quality circles, in which department personnel meet weekly or monthly to review performance of their process. They monitor feedback from their customers and track internal performance measures of processes and suppliers. These teams focus on continual, incremental improvements in their work processes. They are similar to process improvement teams, with the key differences being that they are neither cross-functional nor temporary. Again, a facilitator is usually available for teams if needed. Other outside personnel may be brought in as resources on a temporary basis.

More effective use of the work group team design involves applying it at all levels of an organization, with each level linked to the one above and below it (see Figure 3.1). The top management team monitors performance of processes for which it is responsible (for example, overall business performance), teams at the next level monitor and improve their processes (for example, logistics and delivery performance), and teams at the next level track and improve their performance. Since performance of a work area can be affected by issues outside the team's control, one work group might request that another (for example, the supplier work group) improve a particular process. Alternatively, a process improvement team may be organized that involves both departments working together.

Since work groups are an ongoing organizational structure, it is critical that the organizational systems and values support the effort. Certain basic elements should be considered when an organization is attempting to initiate work groups:

- Top management support
- Clear communication
- Improvement objectives and expectations
- Team training
- Appropriate competencies
- Supportive compensation and performance appraisal systems

Other issues to consider include:

- Team's scope of responsibility and authority
- Degree of autonomy
- Information needed by team and where obtained
- Decision-making process
- Performance measures and success factors
- Recognition and rewards for performance
- Competencies that must be developed
- Selection process for leaders and facilitators
- Risk management process

An implementation plan including the necessary support systems should be defined before initiating such groups. If work groups are being introduced into an existing

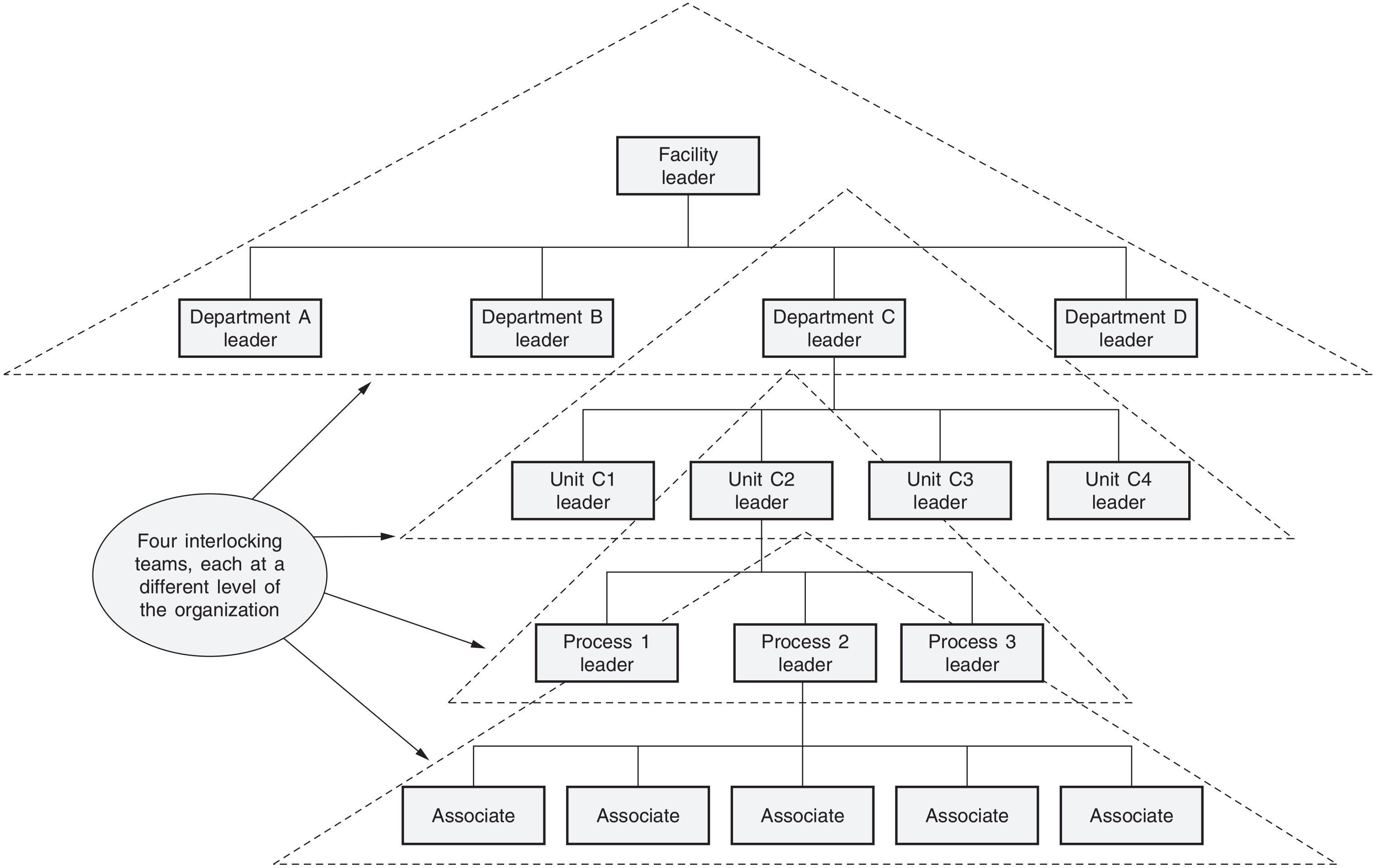

Facility leader
Department A leader
Department B leader
Department C leader
Department D leader
Unit C1 leader
Unit C2 leader
Unit C3 leader
Unit C4 leader
Process 1 leader
Process 2 leader
Process 3 leader
Associate
Associate
Associate
Associate
Associate
Four interlocking teams, each at a different level of the organization

Figure 3.1 Linking team structure.

organization where a participative management style has not been used before, a pilot program in a department where it is likely to succeed is highly recommended.

Cellular Teams. When processes are organized into cells, the layout of workstations and/or machines used in a given part of the process typically is arranged in a U-shape configuration. This allows operators to proceed with a part from machine to machine, performing a series of sequential steps to produce a whole product or a major subassembly.

The team that operates the cell is usually totally cross-trained in every step in the series. Team effectiveness depends on coordination, timing, and cooperation. Team members' competencies must be as closely matched as possible to maintain a reasonable and consistent work pace and quality.

Cell team members usually assume ownership and responsibility for establishing and improving the work processes. Leadership of the cell team may be by a person designated as lead operator, or a similar title. In some cases the role of lead operator may be rotated among the members. The lead operator is usually responsible for training new team members, reporting team output, and balancing the flow of work through the process. A cellular team is a specialized form of a self-directed work group.

Special Project Teams. Often, a need develops to form a long-duration, totally dedicated project team to implement a major new product, system, or process. Some examples are:

- Reengineering an entire process
- Relocating a major segment of the operation
- Mergers, acquisitions, or divestitures
- Replacing a major information system
- Entering a new market with a new product
- Preparing to apply for the Baldrige Award

Such special project teams may operate as a parallel organization during their existence. They may be located away from the main organization and even be exempt from some of its policy and work-rules constraints. The core team members are usually drafted for the duration of the project. Persons with additional expertise may be called into the team on a temporary, as-needed basis. Usually, the project is headed by an experienced project manager. Depending on the nature of the team's objectives, external specialists or consultants may be retained to augment the core competencies of the team members.

Virtual Teams. In today's global and electronic business environment, it may be expedient to have team members who do not work in the same geographic location. These virtual teams also require many of the same roles and processes, but the substitution of electronic communications (for example, e-mail and videoconferencing) for face-to-face meetings provides an additional challenge to team leadership. A key competency of team members is the ability and motivation to self-manage their time and priorities.

Virtual teams have special needs, some of which are:

- Telephones, local area networks, satellites, videoconferencing
- Computers, high-speed and wireless connections, internet technology, e-mail, web-based chat rooms/forums, and so on
- Software for communications, meeting facilitation, time management, project management, groupware, accessing online databases
- Combinations of the above may facilitate communication and performance

The benefits of virtual teams are:

- Team members may work from any location and at any time of day.
- Team members are selected for their competence, not for their geographic location.
- Expenses may be reduced or eliminated, such as travel, lodging, parking, and renting/leasing or owning a building, office equipment, and furniture.

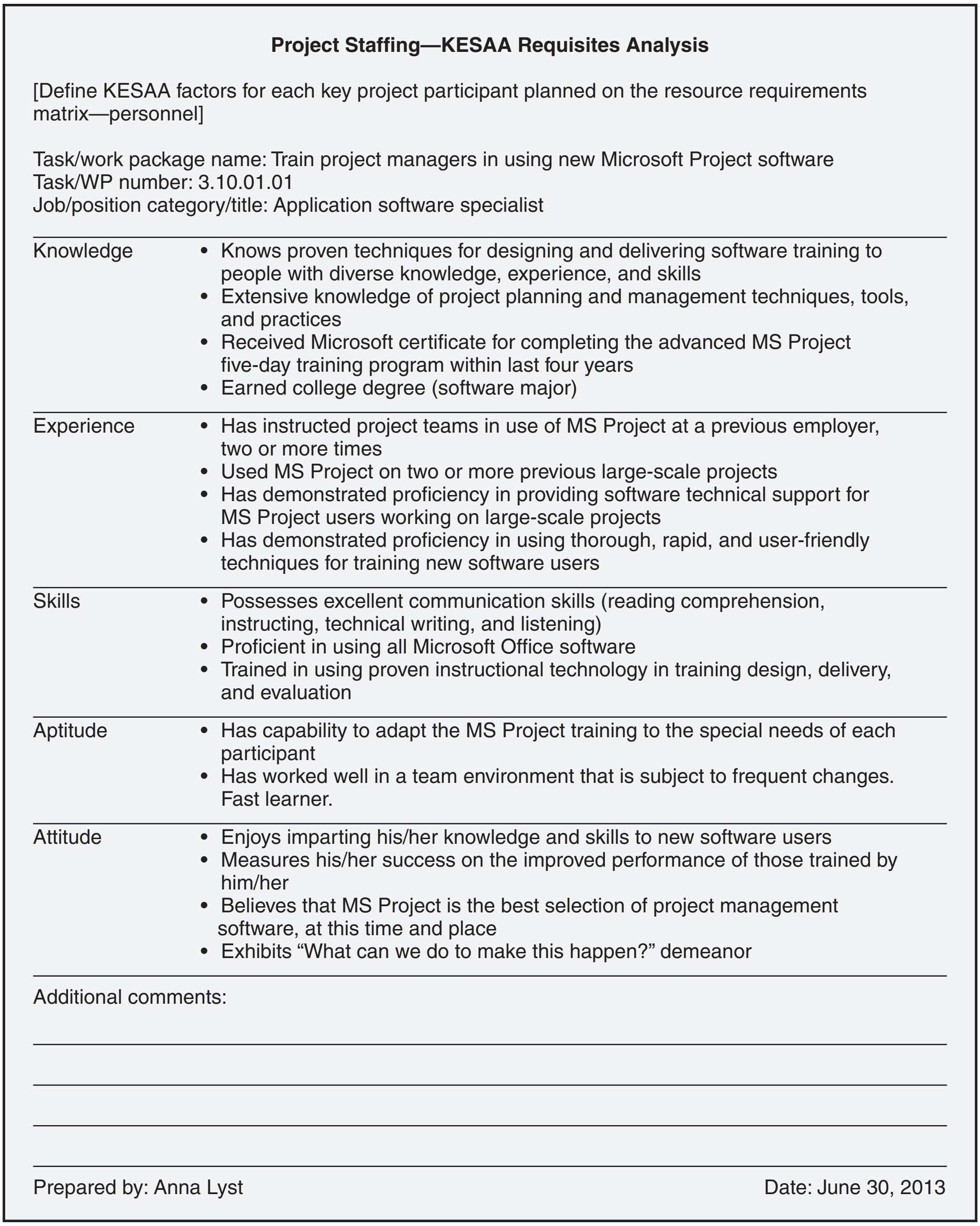
Team Selection

Management selects the team leader. Team members may be selected by either management or the team leader. When the choice of the team members is left to the team leader, however, some methods and tools may be used. To begin, the team leader should identify the competence needed. Competence comprises five factors (KESAA):

- *Knowledge.* Formal education, degrees, educational certifications, professional certifications, and self-study achievements
- *Experience.* Years spent applying knowledge and skills in pertinent types of organizations and industries and in jobs/positions held
- *Skills.* Skill certifications, training received, and demonstrated proficiency in the use of pertinent tools and equipment
- *Aptitude.* Natural talent, capability, capacity, innate qualities, deftness, knack, adaptability to change, natural ability to do things requiring hand-eye coordination, and fine motor skills
- *Attitude.* Manner of showing one's feelings or thoughts; one's disposition, opinion, mood, ideas, beliefs, demeanor, state of feeling, reaction, bias, inclination, emotion, temperament, mental state, frame of mind, and ease in accepting and adopting new or changed plans and practices

By analyzing the tasks facing the team, the team leader can complete a *KESAA requisites analysis* for each individual role, major task, or task cluster.[4] A sample from staffing a project team is shown in Figure 3.2.

In addition, the *Myers-Briggs Type Indicator* may be used to determine how each potential team member is best suited to the team tasks and team dynamics anticipated. Team leaders should also consider any problems obtaining cooperation from a selected person's boss relative to time constraints and conflicts, prior



Project Staffing—KESAA Requisites Analysis

[Define KESAA factors for each key project participant planned on the resource requirements matrix—personnel]

Task/work package name: Train project managers in using new Microsoft Project software
Task/WP number: 3.10.01.01
Job/position category/title: Application software specialist

Knowledge	• Knows proven techniques for designing and delivering software training to people with diverse knowledge, experience, and skills • Extensive knowledge of project planning and management techniques, tools, and practices • Received Microsoft certificate for completing the advanced MS Project five-day training program within last four years • Earned college degree (software major)
Experience	• Has instructed project teams in use of MS Project at a previous employer, two or more times • Used MS Project on two or more previous large-scale projects • Has demonstrated proficiency in providing software technical support for MS Project users working on large-scale projects • Has demonstrated proficiency in using thorough, rapid, and user-friendly techniques for training new software users
Skills	• Possesses excellent communication skills (reading comprehension, instructing, technical writing, and listening) • Proficient in using all Microsoft Office software • Trained in using proven instructional technology in training design, delivery, and evaluation
Aptitude	• Has capability to adapt the MS Project training to the special needs of each participant • Has worked well in a team environment that is subject to frequent changes. Fast learner.
Attitude	• Enjoys imparting his/her knowledge and skills to new software users • Measures his/her success on the improved performance of those trained by him/her • Believes that MS Project is the best selection of project management software, at this time and place • Exhibits "What can we do to make this happen?" demeanor

Additional comments:

Prepared by: Anna Lyst
Date: June 30, 2013

Figure 3.2 Project staffing—KESAA requisites analysis.

Source: Reprinted with permission of R. T. Westcott & Associates.

commitments (unfinished work on regular assignment), priorities (which work is most important?), and reporting relationships (to whom does the selected person report?).

A selected individual's reluctance to join a team may be because of the potential for losing interaction with colleagues from the same discipline and the potential for losing an opportunity for further education and training in the individual's chosen field, as well as potential impact on pay raises and promotion.

2. STAGES OF TEAM DEVELOPMENT

Describe how the stages of team development (forming, storming, norming, performing) affect leadership style. (Apply)

Body of Knowledge I.C.2

Teams will progress through stages of growth and maturity as the members work together over time. Understanding these development stages is valuable for the effective management of the team process. The stages can vary in intensity and duration depending on the type of team, the environment in which it works, and the individuals who constitute it. Since trust is essential for high-performance teams, successfully completing these stages is necessary for reaching a consistent high-performance level. A generic model for the phases of team development, described by Tuckman,[5] is shown in Figure 3.3:

- *Stage 1: Forming.* When team members first come together, they bring with them individual identities and the values and the priorities of their

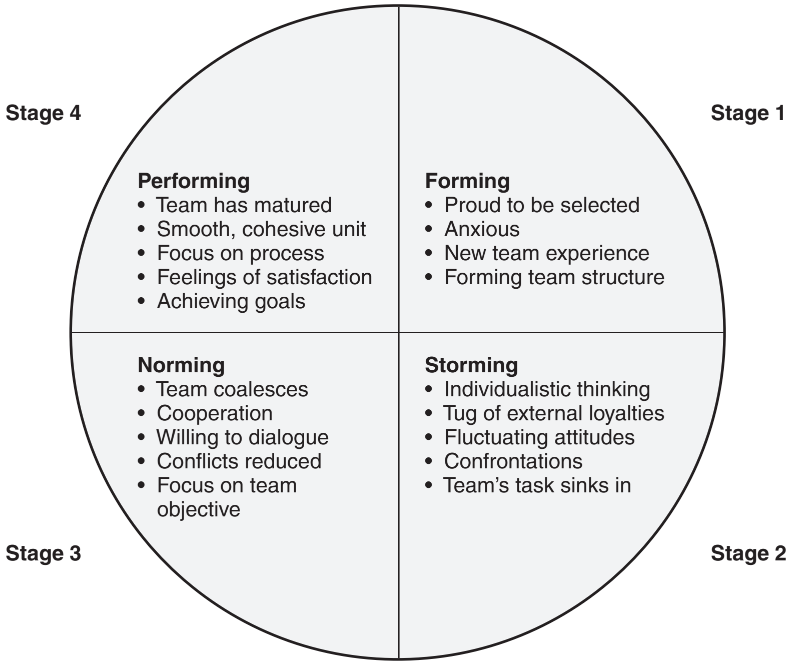

Stage 4
Stage 1
Performing
• Team has matured
• Smooth, cohesive unit
• Focus on process
• Feelings of satisfaction
• Achieving goals
Forming
• Proud to be selected
• Anxious
• New team experience
• Forming team structure
Norming
• Team coalesces
• Cooperation
• Willing to dialogue
• Conflicts reduced
• Focus on team objective
Storming
• Individualistic thinking
• Tug of external loyalties
• Fluctuating attitudes
• Confrontations
• Team's task sinks in
Stage 3
Stage 2

Figure 3.3 Team development phases.

usual environment. Each team is a new experience, even for those who have previously been members of teams. Individuals enter this situation cautiously, feeling uncertain of what their roles and performance will be in this new environment. During the forming stage, the team usually clarifies its purpose, identifies roles for each member, and defines rules of acceptable behavior (often called *norms*).

- *Stage 2: Storming.* During this phase the reality of the team's task sinks in. Team members still think primarily as individuals and might attempt to form decisions on the basis of their individual experiences rather than pooling information with other members. Collaboration has not yet become the norm as team members fluctuate in their attitude about the team's chances for success. The behaviors exhibited during this time may involve argument, testing the leader's authority, attempts to redefine goals, and competitive or defensive acts.
- *Stage 3: Norming.* In this phase the individuals coalesce into a team by shifting their focus from personal concerns to that of meeting the team-related challenges. Interpersonal conflicts and the tug of external loyalties are reduced. Team members are willing to discuss differences for the sake of the team, resulting in more cooperation and dialogue.
- *Stage 4: Performing.* At this stage, the team has matured to the point where it is working as a smooth, cohesive unit. Team members have a good understanding of each other's strengths and weaknesses and how they support the mission and are now able to work through group problems. There is a better appreciation of the team's processes and a general satisfaction with team membership. During this phase, the team is making significant progress toward achieving its goals.

Although the four stages of development indicate a logical sequence that occurs over time, the actual progress made by each team will vary. For example, a team that has progressed to stage 3 or 4 may fall back to stage 1 or 2. This may occur if team members learn that previous assumptions about one another are not true, information they have been using for decision-making is found to be inaccurate, or team membership changes. Some teams might never progress beyond an earlier stage because of limited project duration or poor resolution of group dynamics issues.

Some authors have added a stage to Tuckman's original model: *adjourning*. It is the process of closure that occurs when the team has accomplished its mission. The team should take time to review the lessons learned and what was accomplished, complete documentation, celebrate, and formally disband. Frequently, this stage is either skipped over or incompletely performed, or in some cases, project teams just continue to meet without "closing" the project and without a continuing business purpose.

Team development can be enhanced by making sure that team members have a basic understanding of how to (1) interact in positive ways, (2) deal with difficult people or situations, (3) contribute to accomplishing the team's goals, and (4) give or receive constructive feedback.

3. TEAM-BUILDING TECHNIQUES

Apply basic team-building steps such as using ice-breaker activities to enhance team introductions and membership, developing a common vision and agreement on team objectives and identifying and assigning specific roles on the team. (Apply)

Body of Knowledge I.C.3

Team Processes

There are two major groups of components in team processes—task type and maintenance type. Task-type processes keep a team focused and moving toward its goal, while maintenance processes help build and preserve the effectiveness of relationships between team members. Key task components include:

- Reviewing and documenting the team's objective(s).
- Preparing an agenda for every team meeting and staying focused on the agenda. If other issues come up that need to be addressed, the agenda can either be intentionally modified or new issues can be placed on a list for the next meeting agenda.
- Defining or selecting and following a technical process that fits the particular project mission (for example, a seven-step problem-solving model if the team is trying to solve a problem).
- Using decision-making techniques (for example, consensus, consultative) appropriate to the situation.
- Defining action items, responsibilities, and timing and holding team members accountable.

Maintenance tasks are somewhat less easily defined but can also dramatically affect team performance. An outsider might see only the tasks involved with meeting objectives as important, but for team members, the dynamics of interactions between team members can be just as critical. Theories and practices of team dynamics have come from fields as diverse as sociology, psychology, anthropology, organizational development, and political science, where group behavior has been studied in working, living, academic, and therapeutic environments.

Team maintenance tasks are meant to help alleviate the problems created by the fact that each individual on the team has her or his own perspectives and priorities. These are shaped by individual personality, current issues in the person's personal life, and the attitudes of both the formal and informal groups within the organization to which the individual belongs. This means that although the team may have a specific objective and agenda, each individual perceives things differently.

Preventing Problems with Team Process. Two common ways of preventing team dynamics problems are to use *norms* and *roles*. A list of behavioral expectations (norms) is defined by the team during the first meeting, or a predetermined set of norms used by all teams within the organization might be adopted. Following are a few examples of norms and the purpose of each:

- "Be on time for meetings." Emphasizes that meeting time needs to be used effectively and to wait for someone to arrive is a waste of others' time.
- "At least four (of five) team members must be able to attend." Recognizes that vacation, business travel, and other events may prevent some team members from attending a particular meeting while ensuring that meetings are not held and decisions made by only a small proportion of the members.
- "No side conversations." Ensures that members are fully present and listening to what is being said, making sure that each person's ideas are heard and considered.
- "Staying on the agenda." Although somewhat task oriented, this emphasizes that team meetings are not the place for personal gripes and that the team has an important mission.
- "Participation by everyone." Clarifies that all are expected to play an active role, even though the particular skills and activities may differ.
- "Use the *parking lot.*" For issues not on the agenda that are set aside to be dealt with at a later time.
- "No phones or other electronic devices" are to be used in a team meeting unless specifically required to accomplish the task at hand.
- "The management of team members must be apprised that the need for absolute dedication to the team objectives by team members is not to be interrupted, except for extreme personal or business emergencies."

Having team members take on particular roles helps get them involved and reduces the likelihood of their feeling that their time is being wasted. Two common roles often rotated among team members are scribe and timekeeper. A *scribe* is responsible for capturing information from the team meeting in a record of meeting minutes and distributing them appropriately following the meeting. A *timekeeper* monitors how well the team is progressing against the time line spelled out in the agenda and will notify the team if it is straying off the scheduled times.

Another method for getting team members more involved and working together is to have them work in even smaller groups on narrow activities. For example, if the team needs to acquire some data that are readily available, having two team members work together to get and present the data will provide an opportunity for them to develop a closer working relationship that can carry over into the overall team process.

The first team meeting can set the tone for the entire team effort, and it is therefore important that it be well planned. Following are some actions that can enhance the first meeting:

- Have the sponsor or other stakeholders attend the meeting to emphasize the importance of the project and the support that will be provided
- Ensure that all team members have a full understanding of the team's mission and scope
- Allow team members to get acquainted

- Clarify team members' roles
- Work out decision-making issues
- Establish meeting ground rules (norms)
- Define or select the technical process improvement methodology/model to be used
- Define/review the project plan and schedule
- Draft the team's objectives (may be modified in second meeting)
- Define the structure for future meetings

Special exercises (often called *icebreakers*) can also be conducted during the first meeting to help team members feel more comfortable in the new environment. (Training material providers offer a plethora of such exercises.) Aside from structured exercises, team members can be asked to state what they hope to personally gain from the project experience. The team can come up with a name for the group. Team members can discuss previous experiences with working in teams and what they learned from them. Activities such as these allow the personalities and values of individual team members to become more visible and bring team members closer together.

Setting the Team's Objectives. Setting objectives not only gives the team some work to do but begins the team's development and helps to clarify the task ahead. It is likely that the first draft will require modification at a subsequent meeting. As a template, consider the *S.M.A.R.T. W.A.Y.* (Table 5.1).

Decision-Making Method. Consensus decision-making is the process recommended for major project issues. The approach is more time-consuming and demanding but provides the most thorough and cohesive results. It allows the team to work out different points of view on an issue and come to a conclusion that is acceptable. Consensus means that the decision is acceptable enough that all team members will support it. To achieve consensus, all team members must be allowed to express their views and must also objectively listen to the views of others. The decision and alternatives should be discussed until consensus is reached.

4. TEAM ROLES AND RESPONSIBILITIES

Define and describe typical roles related to team support and effectiveness such as facilitator, leader, process owner, champion, project manager, and contributor. Describe member and leader responsibilities with regard to group dynamics, including keeping the team on task, recognizing hidden agendas, handling disruptive behavior, and resolving conflict. (Analyze)

Body of Knowledge I.C.4

Of the seven roles described in Table 3.1, the roles of timekeeper and scribe are the only ones that are optional depending on the ability of a team member to effectively fulfill a dual role of participating member and either scribe or timekeeper. While the remaining five roles are essential, they may be combined in a variety of ways. Crucial roles for the success of the team, once it is formed, are the team leader and facilitator roles. The *team leader* is responsible for the content—the work done by the team. The *facilitator* is responsible for ensuring that the process used by the team and the team dynamics are the best for the stage and situation the team is in.[6]

There is a need for a trained facilitator when:

- No team member is trained for, capable of, or willing to assume this role in addition to functioning as a participating member.
- The team has been meeting for some time and is incapable of resolving conflicting issues.
- A new member has been added, thus upsetting established relationships.
- A key contributor has left the team.
- There are other factors, such as running short on resources, project cancellation, or major change in requirements that may disturb the smooth functioning of the team.

Supplementing the team with on-call experts can often compensate for a shortfall in either the number of members or members' competencies. Such temporary members must willingly share their expertise, listen attentively, abide by team norms, and support team decisions.

The selection of a team member to serve as a timekeeper may be helpful, at least until the team has become more adept at self-monitoring time usage. When a timekeeper is needed, the role is often rotated, giving consideration to whether the selected member has a vital role to play in the deliberations at a particular meeting.

For some team missions where very formal documentation is required, a scribe or notetaker may be needed. This role can be distracting for a member whose full attention may be needed on the topics under discussion. For this reason, an assistant, not a regular member of the team, is sometimes assigned to take the minutes and publish them. Care should be taken not to select a member to serve as a scribe solely based on the person's gender or position in the organization.

All team members must adhere to expected standards of quality, fiduciary responsibility, ethics, and confidentiality. It is imperative that the most competent individuals available are selected for each role. See Table 3.1 for attributes of good role performance.

Frequently, a team must function in parallel with day-to-day assigned work and with the members not being relieved of responsibility for their regularly assigned work. This, of course, places a burden and stress on the team members. The day-to-day work and the work of the team must both be conducted effectively. Being unable to be in two places at one time calls for innovative time management, conflict resolution, and negotiation skills.

Table 3.1 Roles, responsibilities, and performance attributes.

Role name	Responsibility	Definition	Attributes of good role performance
Sponsor	Backer, risk-taker	The person who supports a team's plans, activities, and outcomes	• Believes in the concept/idea • Has sound business acumen • Is willing to take risk and responsibility for outcomes • Has authority to approve needed resources • Will be listened to by upper management
Champion	Advocate	The person promoting the concept or idea for change/improvement	• Is dedicated to seeing it implemented • Holds absolute belief it is the right thing to do • Has perseverance and stamina
Facilitator	Helper, trainer, advisor, coach	A person who: • Observes the team's processes and team members' interactions and suggests process changes to facilitate positive movement toward the team's goals and objectives • Intervenes if discussion develops into multiple conversations • Intervenes to skillfully prevent an individual from dominating the discussion or to engage an overlooked individual in the discussion • Assists the team leader in bringing discussions to a close • May provide training in team building, conflict management, and so forth	• Is trained in facilitating skills • Is respected by team members • Is tactful • Knows when to and when not to intervene • Deals with the team's process, not content • Respects the team leader and does not override his or her responsibility • Respects confidential information shared by individuals or the team as a whole • Will not accept facilitator role if expected to report to management any information that is proprietary to the team • Will abide by the organization's Code of Ethics and principles

Table 3.1 Roles, responsibilities, and performance attributes. *(continued)*

Role name	Responsibility	Definition	Attributes of good role performance
Team leader	Change agent, chair, head	A person who: • Staffs the team or provides input for staffing requirements • Strives to bring about change/improvement through the team's outcomes • Is entrusted by followers to lead them • Has the authority for and directs the efforts of the team • Participates as a team member • Coaches team members in developing or enhancing necessary competencies • Communicates with management about the team's progress and needs • Handles the logistics of team meetings • Takes responsibility for team records	• Is committed to the team's mission and objectives • Has experience in planning, organizing, staffing, controlling, and directing teams • Is capable of creating and maintaining communication channels that enable members to do their work • Is capable of gaining the respect of team members; serves as a role model • Is firm, fair, and factual in dealing with a team of diverse individuals • Facilitates discussion without dominating • Actively listens • Empowers team members to the extent possible within the organization's culture • Supports all team members equally • Respects each team member 's individuality
Timekeeper	Gatekeeper, monitor	A person designated by the team to watch the use of allocated time and remind the team members when their time objective may be in jeopardy	• Is capable of assisting the team leader in keeping the team meeting within the predetermined time limitations • Is sufficiently assertive to intervene in discussions when the time allocation is in jeopardy • Is capable of participating as a member while still serving as a timekeeper

(continued)

Table 3.1 Roles, responsibilities, and performance attributes. *(continued)*

Role Name	Responsibility	Definition	Attributes of good role performance
Scribe	Recorder, notetaker	A person designated by the team to record critical data from team meetings. Formal “minutes” of the meetings may be published and distributed to interested parties.	• Is capable of capturing on paper, or electronically, the main points and decisions made in a team meeting and providing a complete, accurate, and legible document (or formal minutes) for the team’s records • Is sufficiently assertive to intervene in discussions to clarify a point or decision in order to record it accurately • Is capable of participating as a member while still serving as a scribe
Team members	Participants, subject matter experts	The persons selected to work together to bring about a change/improvement, achieving this in a created environment of mutual respect, sharing of expertise, cooperation, and support	• Are willing to commit to the purpose of the team • Are able to express ideas, opinions, and suggestions in a nonthreatening manner • Are capable of listening attentively to other team members • Are receptive to new ideas and suggestions • Are even-tempered and able to handle stress and cope with problems openly • Are competent in one or more fields of expertise needed by the team • Have favorable performance records • Are willing to function as team members and forfeit “star” status

Source: R. T. Westcott and G. L. Duffy, eds., *The Certified Quality Improvement Associate Handbook*, 3rd ed. (Milwaukee: ASQ Quality Press, 2015).

Steering Committee

Top management is ultimately responsible for organizational performance improvement. One of top management's key roles, then, is to identify and prioritize opportunities and initiate teams to address those of greatest value to the organization. Projects might be selected on the basis of new strategic initiatives (for example, developing a new service for a new market niche), customer satisfaction data, cost-of-quality reports, or other strategic or operational performance measures or initiatives (for example, capacity, throughput, and lean projects such as waste reduction).

In order to carry out this process and to simultaneously provide opportunities for learning, a special group called the *steering committee* is often set up for guiding and tracking team efforts. The group usually includes key leaders in the organization (for example, president, operations manager, quality manager), as well as others who represent particular interests. In an organization working under a union contract, the union representative is also likely to be a member of the steering committee. The steering committee is often a diagonal slice representing all levels of the organization.

One role of the steering committee is to initiate desired organizational improvement efforts. It is vital that each team have a clear understanding of its purpose and how that purpose is linked to and supports the organization's strategic plans. This is done through a written charter that defines the mission and objectives of each project, as well as key personnel (for example, team leader, members, and facilitator) and project timing. The charter is a formal document agreed to by both the team and by management. It legitimizes the team's effort and documents a tacit agreement from management to provide whatever support is necessary to sustain the team. The charter should also include boundaries of authority and responsibility and related limitations, relationship of the team to other teams or projects, the scope of work, the team's reporting relationships within the organization, and the expected deliverables.

If a process improvement team is chartered without a clear mission or objective, the team will either do nothing or will go in the direction it believes best. One way to test understanding is to ask, "What will you measure to determine whether the objective has been accomplished?"

The steering committee may also have the responsibility for approving the team's recommendations and certainly has the authority to enable implementation. This helps ensure that teams' recommendations are acted on. Inaction will result in the belief of team members that management is not serious about the process, and employees will be reluctant to get involved in future efforts.

Another role of the steering committee is to ensure that managers and team members are trained in all aspects of the team concept. This should include team dynamics, project management, process design and improvement methodologies, empowerment, managing organizational change, attributes of leadership and the transformation process, and how to motivate and reward efforts.

Team Structure

How a team is structured will depend on the scope of the process on which it will work. A cross-functional team is most widely used for process improvement, as it may be necessary to cover the full range of job functions that the process involves.

The dynamics of individual personalities will affect the team's development and performance and should be taken into account when selecting team members. Every team needs a leader, appropriate team members, and, in some cases, a facilitator.

Team Leader. The team leader is responsible for coordinating meetings, which includes scheduling meeting rooms, creating agendas, guiding the team through the agenda (including reviews of homework assignments), and reporting progress to the steering committee. The team leader may also coordinate implementation of the team's approved recommendations. The team leader should have a vested interest in the process and may be a process owner responsible for the results of the process. The team leader must have strong organizational and interpersonal skills and should be sensitive when dealing with diverse opinions.

Team Members. Other team members are those involved with the process to be improved and may also include internal or external customers and suppliers. Technical experts and outsiders with no vested interest in the process are sometimes added to help provide additional knowledge, objectivity, or creativity. The team members will generally have action items to accomplish outside the team meetings and will often take on special roles during a meeting (such as scribe or timekeeper).

Team Facilitator. The team facilitator has the responsibility of helping the team to work effectively. The facilitator can play a critical role by asking questions, thereby encouraging the group members to look at the technical process on which they are working from different points of view. It is important that the team facilitator understand quality management theory. In particular, he or she should recognize the impact of individual and social psychology in groups. The facilitator may also provide or arrange for training to assist the team with the technical tools of improvement, such as process mapping, selecting data collection strategies, using relevant analysis tools, and ultimately guiding the development of a project plan to carry out improvement recommendations.

Dealing with Team Process Problems

Team members are most productive in an environment in which others are responsive and friendly, encourage contributions, and promote a sense of worth. Peter Scholtes spelled out ten problems that frequently occur within teams and are typical of the types of situations for which team leaders and facilitators must be prepared. Following is the list along with recommended actions:[7]

Problem 1. Floundering or difficulty in starting or ending an activity. *Solution:* Redirect team to the project plan and written objectives.

Problem 2. Team members attempt to influence the team process based on their position of authority in the organization. *Solution:* Talk to the members off-line; clarify the impact of their organizational role and the need for consensus and ask for cooperation and patience.

Problem 3. Participants who talk too much. *Solution:* Structure meeting so that everyone is encouraged to participate (for example, have members write down their opinions, then discuss them in the meeting one person at a time).

Problem 4. Participants who rarely speak. *Solution:* Practice gatekeeping by using phrases such as, "John, what's your view on this?" or divide tasks into individual assignments and have all members report.

Problem 5. Unquestioned acceptance of opinions as facts or participants making opinions sound like facts. *Solution:* Do not be afraid to ask whether something is an opinion or a fact. Ask for supporting data.

Problem 6. Rushing to get to a solution before the problem-solving process is worked through. *Solution:* Remind the group of the cost of jumping to conclusions.

Problem 7. Attempting to explain other members' motives. *Solution:* Ask the other person to clarify.

Problem 8. Ignoring or ridiculing another's values or statements made. *Solution:* Emphasize the need for listening and understanding. Support the discounted person.

Problem 9. Digression/tangents creating unfocused conversations. *Solution:* Remind members of the written agenda and time estimates. Continually direct the conversation back on track. Remind team of its mission, objectives, and the norms established.

Problem 10. Conflict involving personal matters. *Solution:* Request that these types of conflict be taken off-line. Reinforce ground rules.

Solutions to conflicts should be in the best interest of the team. Team members should be nonjudgmental, listening to team discussions and new ideas. Group feelings should be verbalized by periodically surfacing any undercurrents or by giving feedback.

One important skill needed in working with teams is the ability to provide constructive feedback during and/or at the end of a meeting. Feedback is an important vehicle to help the team mature. This feedback can be provided by the facilitator or by team members.

There are two types of appropriate feedback: motivational and coaching. *Motivational feedback* must be constructive—that is, specific, sincere, clear, timely, and descriptive of what actually occurred in the meeting. *Coaching*, or *corrective feedback*, specifically states the improvements that need to be made. Scholtes provides the following guidelines for providing constructive feedback (obviously, destructive or degrading feedback is not acceptable behavior):[8]

- Be specific
- Make observations, not conclusions
- Share ideas or information, not advice
- Speak for yourself
- Restrict feedback to known things
- Avoid using labels
- Do not exaggerate
- Phrase the issue as a statement, not a question

Having a team do a self-evaluation at the end of each meeting can be useful in helping the team to further develop team skills and to take more responsibility for team progress. Team members can be asked to write down how well the team is doing on each of the norms (for example, on a scale of 1–5) and to list any additional norms they believe need to be added. A group discussion of the information can then result in revised norms and specific actions the team will take to improve in the future.

Team Facilitation Techniques

A *facilitator* is a person who helps a team manage the team dynamics and relationship processes. A facilitator does not normally get involved in the content—the technical aspects of what the team is working on. The role of the facilitator is instead to act as:

- A guide to circumvent the pitfalls of a stoppage or detour in difficult situations
- A catalyst to assist in developing a plan that provides follow-up to all management levels, thus maintaining continuity of support
- An objective evaluator and auditor of team progress, identifying any roadblocks to success and opportunities to improve performance[9]

Some specific responsibilities of the facilitator include:

- Cultivating an unbiased and impartial environment
- Ensuring that a full examination and discussion of issues take place
- Providing an objective framework
- Reinforcing focus on mission and objectives
- Helping organize multiple and diverse viewpoints
- Regulating interruptions
- Ensuring that everyone on the team has the opportunity to participate in discussions and decision-making
- Defusing destructive behaviors
- Encouraging visual or verbal tracking of ideas

In order to carry out these responsibilities, the facilitator typically does the following:

- Encourages reluctant participants to speak
- Helps to resolve conflict between team members
- Provides feedback to the leader and/or team
- Ensures that ground rules (agreed-to group norms) are followed
- Ensures that members are listening to and understanding others

- Legitimizes everyone's perceptions and feelings
- Verbalizes what is going on
- Checks for agreement
- Maintains or regains focus on the meeting agenda or topic of discussion
- Provides ideas on approaches for gathering or analyzing data
- Ensures consensus
- Periodically summarizes results

A well-trained facilitator is a valuable asset in any team situation. A combination of formal training and considerable experience will produce the best results. Facilitators should be trained in meeting process facilitation, conflict resolution, training and coaching skills, interpersonal skills in a group environment, basic behavior management skills, quality management principles and practices, and appropriate use of quality tools.

Facilitators are less necessary as the team becomes more experienced and capable. Initially, the facilitator is more of a coach and referee in the team process and therefore requires good communications skills as well as some technical knowledge of the subject, meeting facilitation skills, and the ability to resolve conflict when it occurs. If performance of the team remains dependent on the facilitator, however, then the facilitator has not done an effective job of helping the team to develop. A highly developed team should have the knowledge and ability to deal with problems that might arise, such as a deviation from the agenda, interpersonal conflict, or ineffective decision-making—in effect, it should become self-facilitating.

Sponsor. Each team usually has a sponsor responsible for ensuring success. The *sponsor* is an individual who has a significant stake in the outcome of a particular team project. She or he is often the process owner. Such a person must be at a level high enough in the organization to be able to address any difficulties encountered by the team. In the early part of a continuous improvement effort, the sponsor may also be a member of the steering committee. A sponsor's responsibilities include the following:

- Helping to initiate the team effort by authorizing the activity
- Defining the purpose and scope of the team
- Coordinating the front-end planning
- Helping to select the team leader, facilitator, and members
- Negotiating additional resources needed

During the team effort, the sponsor maintains an awareness of team progress, monitors team performance problems, acts as a liaison to the steering committee, top management, or other departments or teams, helps obtain any additional information and resources that are outside the team's authority boundaries, and acts as a coach to the team leader.

Team Leader. The *team leader* is responsible for the team's ongoing success. Responsibilities include:

- Organizing and managing team meetings
- Working with the sponsor to develop and monitor the project plan
- Keeping the team effort on track
- Providing status updates to the sponsor and steering committee
- Addressing group dynamics issues
- Serving as a liaison between the team and other parts of the organization
- Helping to resolve problems
- Handling administrative duties and keeping team records

A team leader is also responsible for contributing to the team's content, although he or she must be careful that those contributions do not receive greater status than those of other team members. When a facilitator is not involved, the leader also has the same responsibilities as a facilitator relative to team dynamics and relationships.

A team's growth is the responsibility both of individual team members and of the organization. As shown in Figure 3.4, both must create the cultural synergy that makes teams productive.

A new type of organizational leadership is necessary to provide teams with the authority they need to be successful. This requires a transformation from the old type of autocratic leadership to the new facilitating, coaching, and participative approach.

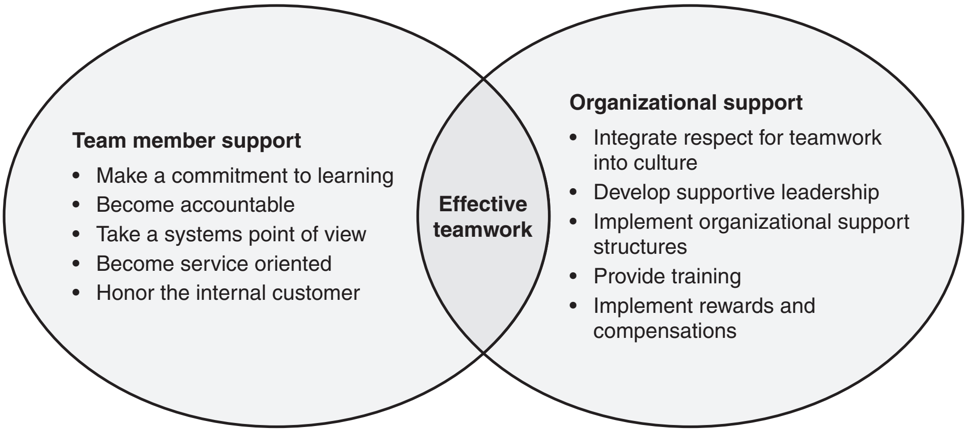

Team member support
• Make a commitment to learning
• Become accountable
• Take a systems point of view
• Become service oriented
• Honor the internal customer
Effective teamwork
Organizational support
• Integrate respect for teamwork into culture
• Develop supportive leadership
• Implement organizational support structures
• Provide training
• Implement rewards and compensations

Figure 3.4 Supporting factors for effective teamwork.

5. TEAM PERFORMANCE AND EVALUATION

> Evaluate team performance in relation to established metrics to meet goals and objectives. Determine when and how to reward teams and celebrate their success. (Evaluate)
>
> **Body of Knowledge I.C.5**

Team members and top management will quickly become frustrated if teams are not making progress. The organization should be tracking progress to identify problems, such as poor meeting attendance, failure of other departments to provide the necessary support, or lack of specialized technical knowledge. Long-term projects also require more complex project management skills and processes. Measuring and communicating the effectiveness of a team can help promote necessary changes and stimulate improvement. The feedback is important to management to indicate the degree to which a team is meeting its objectives.

Objective measures directed toward the project goal could include data such as changes in process performance (for example, increase in first-time yield, reduction of customer waiting time), resource utilization (for example, number of person-hours invested in the project, funds spent), and timing against the project plan. The team may also use internally oriented measures such as overall percentage of team member attendance at meetings and the team's evaluation of meeting effectiveness. A team should take responsibility for self-evaluation, with appropriate measures reported to the sponsor and steering committee.

One way a team can evaluate itself is to select criteria based on team effectiveness guidelines included in team training materials or based on the team's list of behavioral norms. A list of questions and a rating scale can then be used at the end of each meeting to monitor how well the team performed. The evaluation criteria can also evolve over time as the team develops. Standard instruments available from providers of training and organization development materials can also be used.

Questionnaires or interviews can be administered to outside-the-team personnel—such as internal and external customers, other teams, or management—and used to capture metrics related to perceived progress on attributes such as relationship building, effectiveness of the team's progress, and efficiency of the team's process. Maintaining a list of lessons learned can also help the team to see what additional benefits are being gained, and these lists can be shared with others to accelerate organization-wide learning.

Teams, like individuals, deserve recognition for their efforts. This recognition can also provide encouragement for future progress and success. In an organization that is just beginning to use the team process, this might be the single most important factor for sustaining momentum. The following suggestions for recognition and rewards are described by Aubrey and Felkins:[10]

- Supportive comments and helpful suggestions provided by management during team presentations
- Public recognition through professional societies or through publication of results in such journals as *Quality Progress* or industry publications, as well as company newsletters and bulletins
- Performance appraisals that reflect employees' personal growth and contribution as team members
- Material rewards such as certificates, pins, coffee mugs, and lunches
- Gainsharing, or distributing some of the cost savings or revenue enhancements to team members
- Bonuses or other monetary rewards

What is measured (and recognized/rewarded) and how it is measured and administered requires careful thought and team members' input. Applying recognition and rewards fairly implies the creation of standard performance definitions and values. Ignoring some achievements, recognizing or rewarding under-standard achievements, and giving the wrong weighting to an achievement are reasons why care and good judgment are critical, and each are causes of disappointment, disillusionment, and discontent among team members.

Nonmonetary forms of recognition are used to acknowledge a team's efforts in a majority of cases. Examples are public recognition in articles published in the organization's newsletter and/or community newspapers, verbal mention at group meetings, plaques and certificates, T-shirts, pins, and other visible but low-cost items. Recognizing an entire team with one standard reward can be less effective than when team members choose their own rewards within a value range. Catalog programs have evolved to service this approach. Sustained performance excellence may be rewarded by promotions and preferred assignments for team members.

Rather than focusing on rewarding performance, some organizations create a pay-for-skills plan. As employees progress through a ladder-style development program, their pay is increased at predefined increments. This is especially relevant in a self-directed team environment.

In addition to external recognition, it is important that team members and leaders provide internal recognition for team progress when important milestones have been accomplished. Recognition might also be given to individuals whose contributions are exceptional or above expectations or to people outside the team who have provided valuable support.

The team goal must be focused on team success, and teams need to behave as if they are owners. This begins when the teams are given responsibility, encouragement, and knowledge. The focus must also be directed to external customers. This focus depends on limited organization layers, a general focus on business and customers, logical boundaries for the team, strong networks, and open communications. The focus also relies on helping teams know who the critical customers are, what their needs are, and how the business may meet those needs.[11]

Groupthink

In the team selection process, as well as when the team is functioning day to day, care must be taken to avoid groupthink.[12] *Groupthink* occurs when most or all of the team members coalesce in supporting an idea or a decision that has not been fully explored or when some members may secretly disagree. The members are more concerned with maintaining friendly relations and avoiding conflict than in becoming engrossed in a controversial discussion. Actions to forestall groupthink may include:

- Brainstorming alternatives before selecting an approach
- Encouraging members to express their concerns
- Ensuring that ample time is given to surface, examine, and comprehend all ideas and suggestions
- Developing rules for examining each alternative
- Appointing an "objector" to challenge proposed actions

Final Thought

An effective team leader can provide an environment in which team members feel motivated. This can be achieved by applying the *six Rs*:

1. *Reinforce.* Identify and positively reinforce work done well.
2. *Request information.* Discuss team members' views. Is anything preventing expected performance?
3. *Resources.* Identify needed resources, the lack of which could impede quality performance.
4. *Responsibility.* Customers make paydays possible; all employees have a responsibility to the customers, internal and external.
5. *Role.* Be a role model. Do not just tell; demonstrate how to do it. Observe learners' performance. Together, critique the approach and work out an improved method.
6. *Repeat.* Apply the above principles regularly and repetitively.[13]

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13. Ibid.

See Appendix A for additional references for this chapter.

Chapter 4

D. ASQ Code of Ethics

Identify and apply behaviors and actions that comply with this code. (Apply)

Body of Knowledge I.D

It is important that people in an organization know and understand the behaviors that are considered acceptable. Therefore, another critical role of leadership is to ensure that the organization has defined those behaviors and the principles behind them as clearly as possible. Documenting and communicating the values and principles that should be used as a guide for day-to-day decision-making is one way employees learn what is acceptable. Another way is through observation of the actions of persons in leadership roles and others in influential or powerful positions. Therefore, it is important that a leader's actions be congruent with the stated principles and values.

For some fields of professional practice, codes of conduct are defined by professional organizations. Following is the code of ethics for quality professionals established by the American Society for Quality (ASQ). It provides both general principles and specific actions designed to ensure that ASQ members demonstrate ethical behaviors in their relationships with the public, employers, customers and clients, and peers. The code is critical to quality decisions and behavior and valuable when designing systems as well as in day-to-day communications.

It is important for leaders in organizations to take action on the basis of how well employees meet ethical guidelines. Employees who demonstrate ethical practices, especially during difficult situations, must be commended for their actions, whereas those who do not must be dealt with appropriately.

Use the ASQ Code of Ethics as a model to assist your organization in developing its own code as well as using it to develop your personal code of ethics. Refer often to your organization's code and your own code. Ensure that you are behaving at or above the ethical level embodied in the code.

One thing to consider, though, is that unethical behavior in one country may be an acceptable behavior in another locale.

Although the term *supplier* is not specifically mentioned, the intent of an ethical relationship between a customer and a supplier may be implied from the intent

ASQ CODE OF ETHICS

Introduction

The purpose of the American Society for Quality (ASQ) Code of Ethics is to establish global standards of conduct and behavior for its members, certification holders, and anyone else who may represent or be perceived to represent ASQ. In addition to the code, all applicable ASQ policies and procedures should be followed. Violations to the Code of Ethics should be reported. Differences in work style or personalities should be first addressed directly with others before escalating to an ethics issue.

The ASQ Professional Ethics and Qualifications Committee, appointed annually by the ASQ Board of Directors, is responsible for interpreting this code and applying it to specific situations, which may or may not be specifically called out in the text. Disciplinary actions will be commensurate with the seriousness of the offense and may include permanent revocation of certifications and/or expulsion from the society.

Fundamental Principles

ASQ requires its representatives to be honest and transparent. Avoid conflicts of interest and plagiarism. Do not harm others. Treat them with respect, dignity, and fairness. Be professional and socially responsible. Advance the role and perception of the Quality professional.

Expectations of a Quality Professional

A. Act with Integrity and Honesty

1. Strive to uphold and advance the integrity, honor, and dignity of the Quality profession.
2. Be truthful and transparent in all professional interactions and activities.
3. Execute professional responsibilities and make decisions in an objective, factual, and fully informed manner.
4. Accurately represent and do not mislead others regarding professional qualifications, including education, titles, affiliations, and certifications.
5. Offer services, provide advice, and undertake assignments only in your areas of competence, expertise, and training.

B. Demonstrate Responsibility, Respect, and Fairness

1. Hold paramount the safety, health, and welfare of individuals, the public, and the environment.
2. Avoid conduct that unjustly harms or threatens the reputation of the Society, its members, or the Quality profession.
3. Do not intentionally cause harm to others through words or deeds. Treat others fairly, courteously, with dignity, and without prejudice or discrimination.
4. Act and conduct business in a professional and socially responsible manner.
5. Allow diversity in the opinions and personal lives of others.

C. Safeguard Proprietary Information and Avoid Conflicts of Interest

1. Ensure the protection and integrity of confidential information.
2. Do not use confidential information for personal gain.
3. Fully disclose and avoid any real or perceived conflicts of interest that could reasonably impair objectivity or independence in the service of clients, customers, employers, or the Society.
4. Give credit where it is due.
5. Do not plagiarize. Do not use the intellectual property of others without permission. Document the permission as it is obtained.

of the ASQ code. A code developed for use by a different type of organization would, no doubt, include specific principles applying to supplier ethics.

There is an increasing concern that the *social responsibilities* of an organization, its management, its employees, and its subcontractors be addressed in any code of ethics. Although this concern is not specifically mentioned in the ASQ Code of Ethics, it can be assumed the intent exists. The International Organization for Standardization (ISO) 26000 standard provides guidance.[1]

This is a short chapter, but the importance of embracing and sustaining ethical behavior permeates every aspect of organizations' operations. Laws and regulations have been enacted to control certain industries and types of organizations and punish wrongdoers. Behaving ethically, however, has to derive from personal values and integrity. Controls are useful reminders, but individuals must believe in and feel the need to conduct themselves ethically.

REFERENCE

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See Appendix A for additional references for this chapter.

Chapter 20

The Certified Manager of Quality/Organizational Excellence Body of Knowledge

> *Total quality management addresses the quality of management as well as the management of quality.*
>
> —V. Daniel Hunt

CERTIFIED MANAGER OF QUALITY/ORGANIZATIONAL EXCELLENCE (CMQ/OE) BODY OF KNOWLEDGE (BOK)—2019

The topics in this new BoK include descriptive details (subtext) that are used by the Exam Development Committee as guidelines for writing test questions. This subtext is also designed to help candidates prepare for the exam by identifying specific content within each topic that may be tested. The subtext is not intended to limit the subject matter or be all-inclusive of what might be covered in an exam but is intended to clarify how the topics relate to a manager's role. The descriptor in parentheses at the end of each entry refers to the maximum cognitive level at which the topic will be tested. A complete description of cognitive levels is provided at the end of this document.

I. **Leadership (28 Questions)**

A. **Organizational Structures**

Define and describe organizational designs (e.g., matrix, flat, and parallel) and the effect that a hierarchical management structure can have on an organization. (Apply)

B. **Leadership Challenges**

1. **Roles and responsibilities of leaders**

Describe typical roles, responsibilities, and competencies of people in leadership positions and how those attributes influence an organization's direction and purpose. (Analyze)

2. **Roles and responsibilities of managers**

Describe typical roles, responsibilities, and competencies of people in management positions and how those attributes contribute to an organization's success. (Analyze)

3. Change management

Use various change management strategies to overcome organizational roadblocks, assess impacts of global changes, achieve desired change levels, and review outcomes for effectiveness. Define and describe factors that contribute to an organization's culture. (Evaluate)

4. Leadership techniques

Develop and implement techniques that motivate employees and sustain their enthusiasm. Use negotiation techniques to enable parties with different or opposing outlooks to recognize common goals and work together to achieve them. Determine when and how to use influence, critical thinking skills or Socratic questioning to resolve a problem or move a project forward. (Create)

5. Empowerment

Apply various techniques to empower individuals and teams. Identify typical obstacles to empowerment and appropriate strategies for overcoming them. Describe and distinguish between job enrichment and job enlargement, job design and job tasks. (Analyze)

C. Teams and Team Processes

1. Types of teams

Identify and describe different types of teams and their purpose, including process improvement, self-managed, temporary or ad hoc (special project), virtual, and work groups. (Understand)

2. Stages of team development

Describe how the stages of team development (forming, storming, norming, performing) affect leadership style. (Apply)

3. Team-building techniques

Apply basic team-building steps, such as using ice-breaker activities to enhance team introductions and membership, developing a common vision and agreement on team objectives, and identifying and assigning specific roles on the team. (Apply)

4. Team roles and responsibilities

Define and describe typical roles related to team support and effectiveness, such as facilitator, leader, process owner, champion, project manager, and contributor. Describe member and leader responsibilities with regard to group dynamics, including keeping the team on task, recognizing hidden agendas, handling disruptive behavior, and resolving conflict. (Analyze)

5. Team performance and evaluation

Evaluate team performance in relation to established metrics to meet goals and objectives. Determine when and how to reward teams and celebrate their success. (Evaluate)

D. ASQ Code of Ethics

Identify and apply behaviors and actions that comply with this code. (Apply)

II. Strategic Plan Development and Deployment (22 Questions)

A. Strategic Planning Models

Define, describe, and use basic elements of strategic planning models, including how the guiding principles of mission, vision, and values relate to the plan. (Apply)

B. Business Environment Analysis

1. Risk analysis

Analyze an organization's strengths, weaknesses, opportunities, threats, and risks using tools such as SWOT. Identify and analyze risk factors that can influence strategic plans. (Analyze)

2. Market forces

Define and describe various forces that drive strategic plans, including existing competition, the entry of new competitors, rivalry among competitors, the threat of substitutes, bargaining power of buyers and suppliers, current economic conditions, global market changes, and how well the organization is positioned for growth and changing customer expectations. (Apply)

3. Stakeholder analysis

Identify and differentiate the perspectives, needs, and objectives of various internal and external stakeholders. Ensure that the organization's strategic objectives are aligned with those of the stakeholders. (Analyze)

4. Technology

Describe how changes in technology can have long-term and short-term influences on strategic planning. Identify new and upcoming technologies that may have an impact on business strategy and quality, such as automation, autonomation, Quality 4.0, cloud computing, or machine learning. (Understand)

5. Internal capability analysis

Identify and describe the effects that influence an organization's internal capabilities: human resources, facilities capacity, and operational capabilities. Analyze these factors in relation to strategy formation. (Analyze)

6. Legal and regulatory factors

Define and describe how legal and regulatory factors can influence strategic plans. (Understand)

C. Strategic Plan Deployment

1. Tactical plans

Identify basic characteristics of tactics: specific, measurable, attainable, relevant, and time specific and how these are linked to strategic objectives. Evaluate proposed plans to determine whether they meet these criteria. (Evaluate)

2. Resource allocation and deployment

Evaluate current resources to ensure they are available and deployed in support of strategic initiatives. Identify and eliminate administrative barriers to new initiatives. Ensure that all internal stakeholders understand the strategic plan and have the competencies and resources to carry out their responsibilities. (Evaluate)

3. Organizational performance measurement

Develop measurements and ensure that they are aligned with strategic goals and use the measures to evaluate the organization against the strategic plan. (Evaluate)

4. Quality in strategic deployment

Support strategic plan deployment by applying continuous improvement and other quality initiatives to drive performance outcomes throughout the organization. (Create)

III. Management Elements and Methods (31 Questions)

A. Management Skills and Abilities

1. Principles of management

Evaluate and use basic management principles such as planning, leading, delegating, controlling, organizing, and allocating resources. (Evaluate)

2. Management theories and styles

Define and describe management theories such as scientific, organizational, behavioral, learning, systems thinking, and situational complexity. Define and describe management styles such as autocratic, participative, transactional, transformational, management by fact, coaching, and contingency approach. Describe how management styles are influenced by an organization's size, industry sector, culture, and competitors. (Apply)

3. Interdependence of functional areas

Describe the interdependence of an organization's areas (human resources, engineering, sales, marketing, finance, research and development, purchasing, information technology, logistics, production, and service) and how those dependencies and relationships influence processes and outputs. (Understand)

4. Human resources (HR) management

Apply HR elements in support of ongoing professional development and role in quality system: setting goals and objectives, conducting performance evaluations, developing recognition programs, and ensuring that succession plans are in place where appropriate. (Apply)

5. **Financial management**

Read, interpret, and use various financial tools, including income statements, balance sheets, and product/service cost structures. Manage budgets and use the language of cost and profitability to communicate with senior management. Use potential return on investment (ROI), estimated return on assets (ROA), net present value (NPV), internal rate of return (IRR), and portfolio analysis to analyze project risk, feasibility, and priority. (Analyze)

6. **Risk management**

Identify the kinds of risk that can occur throughout the organization, from such diverse processes as scheduling, shipping/receiving, financials, production and operations, employee and user safety, regulatory compliance, and changes. (Apply)

7. **Knowledge management (KM)**

Use KM techniques in identifying core competencies that create a culture and system for collecting and sharing implicit and explicit knowledge among workers, stakeholders, competitors, and suppliers. Capture lessons learned and apply them across the organization to promote best practices. Identify typical knowledge-sharing barriers and how to overcome them. (Apply)

B. **Communication Skills and Abilities**

1. **Communication techniques**

Define and apply various modes of communication used within organizations, such as, verbal, nonverbal, written, and visual. Identify factors that can inhibit clear communication and describe ways of overcoming them. (Apply)

2. **Interpersonal skills**

Use skills in empathy, tact, friendliness, and objectivity. Use open-minded and nonjudgmental communication methods. Develop and use a clear writing style, active listening, and questioning and dialogue techniques that support effective communication. (Apply)

3. **Communications in a global economy**

Identify key challenges of communicating across different time zones, cultures, languages, terminology, and business practices and present ways of overcoming them. (Apply)

4. **Communications and technology**

Identify how technology affects communications, including improved information availability, its influence on interpersonal communications, and etiquette for e-communications. Deploy appropriate communication methods within virtual teams. (Apply)

C. **Project Management**

1. **Project management basics**

Use project management methodology and ensure that each project is aligned with strategic objectives. Plan the different phases of a project: initiation, planning, execution, monitoring and controlling, and closure. Ensure the project is on time and within budget. Consider alternate project management methodologies (linear, evolutionary, or iterative) as they apply to the project. (Evaluate)

2. **Project planning and estimation tools**

Use tools such as risk assessment matrix, benefit-cost analysis, critical path method (CPM), Gantt chart, PERT, and work breakdown structure (WBS) to plan projects and estimate related costs. (Apply)

3. **Measure and monitor project activity**

Use tools such as cost variance analysis, milestones, and actual versus planned budgets to monitor project activity against project plan. (Evaluate)

4. **Project documentation**

Use written procedures and project summaries to document projects. (Apply)

D. **Quality System**

1. **Quality mission and policy**

Develop and monitor the quality mission and policy and ensure that it is aligned with the organization's broader mission. (Create)

2. **Quality planning, deployment, and documentation**

Develop and deploy the quality plan and ensure that it is documented and accessible throughout the organization. (Create)

3. **Quality system effectiveness**

Evaluate the effectiveness of the quality system using various tools: balanced scorecard, internal audits, feedback from internal and external stakeholders (including stakeholder complaints), warranty/return data analytics, product traceability and recall reports, and management reviews. (Evaluate)

E. **Quality Models and Theories**

1. **Quality management standards**

Describe and apply the requirements and basic principles of the ISO 9000–based standards used to support quality management systems. (Apply)

2. **Performance excellence models**

Define and describe common elements and criteria of performance excellence models such as the European Excellence

Award (EFQM), Excellence Canada, ASQ International Team Excellence Award (ITEA), or Malcolm Baldrige National Quality Award (MBNQA). Describe how their criteria are used as management models to improve processes at an organization level. (Understand)

3. Other quality methodologies

Describe and differentiate methods such as total quality management (TQM), continuous improvement, and benchmarking. (Apply)

4. Quality philosophies

Describe and apply basic methodologies and theories proposed by quality leaders such as Shewhart, Deming, Juran, Crosby, Feigenbaum, and Ishikawa. (Apply)

IV. Quality Management Tools (30 Questions)

A. Problem-Solving Tools

1. The seven classic quality tools

Select, interpret, and evaluate output from these tools: Pareto charts, cause-and-effect diagrams, flowcharts, control charts, check sheets, scatter diagrams, and histograms. (Evaluate)

2. Basic management and planning tools

Select, interpret, and evaluate output from these tools: affinity diagrams, tree diagrams, process decision program charts (PDPCs), matrix diagrams, prioritization matrices, interrelationship digraphs, and activity network diagrams. (Evaluate)

3. Process improvement tools

Select, interpret, and evaluate tools such as root cause analysis, Kepner-Tregoe, PDCA, Six Sigma DMAIC (define, measure, analyze, improve, control), and failure mode and effects analysis (FMEA). (Evaluate)

4. Innovation and creativity tools

Use various techniques and exercises for creative decision-making and problem-solving, including brainstorming, mind mapping, lateral thinking, critical thinking, the five whys, and Design for Six Sigma (DFSS). (Apply)

5. Cost of quality (COQ)

Define and distinguish between prevention, appraisal, internal, and external failure cost categories and evaluate the impact that changes in one category will have on the others. (Evaluate)

B. Process Management

1. Process goals

Describe how process goals are established, monitored, and measured and evaluate their impact on product or service quality. (Evaluate)

2. **Process analysis**

Use various tools to analyze a process and evaluate its effectiveness on the basis of procedures, work instructions, and other documents. Evaluate the process to identify and relieve bottlenecks, increase capacity, improve throughput, reduce cycle time, and eliminate waste. (Evaluate)

3. **Lean tools**

Identify and use lean tools such as 5S, just-in-time (JIT), kanban, value stream mapping (VSM), quick changeover (single-minute exchange of die), poka-yoke, kaizen, standard work (training within industry), and productivity (OEE). (Apply)

4. **Theory of constraints (TOC)**

Define key concepts of the TOC: systems as chains, local versus system optimization, physical versus policy constraints, undesirable effects versus core problems, and solution deterioration. Classify constraints in terms of resources and expectations as defined by measures of inventory and operating expense. (Understand)

C. **Measurement: Assessment and Metrics**

1. **Basic statistical use**

Use statistical techniques to identify when, what, and how to measure projects and processes. Describe how metrics and data-gathering methods affect resources and vice versa. (Apply)

2. **Sampling**

Define and describe basic sampling techniques such as random and stratified. Identify when and why sampling is an appropriate technique to use. (Understand)

3. **Statistical analysis**

Calculate basic statistics: measures of central tendency (mean, median, mode) and measures of dispersion (range, standard deviation, and variance). Identify basic distribution types (normal, bimodal, skewed) and evaluate run charts, statistical process control (SPC) reports, and other control charts to make data-based decisions. (Evaluate)

4. **Measurement systems analysis**

Understand basic measurement terms such as accuracy, precision, bias, and linearity. Understand the difference between repeatability and reproducibility in gage R&R studies. (Understand)

5. **Trend and pattern analysis**

Interpret graphs and charts to identify cyclical, seasonal, and environmental data trends. Evaluate control chart patterns to determine shifts and other trend indicators in a process. (Evaluate)

6. Process variation

Analyze data to distinguish between common and special cause variation. (Analyze)

7. Process capability

Recognize process capability (C_p and C_{pk}) and performance indices (P_p and P_{pk}). (Understand)

8. Reliability terminology

Define and describe basic reliability measures such as infant mortality, end of life (e.g., bathtub curve), mean time between failures (MTBF), and mean time to repair (MTTR). Understand the value of estimating reliability to meet requirements or specifications. NOTE: Reliability calculations will not be tested. (Understand)

V. Customer-Focused Organizations (21 Questions)

A. Customer Identification and Segmentation

1. Internal customers

Define internal customers and describe the impact an organization's treatment of internal customers will have on external customers. Evaluate methods for influencing internal customers to improve products, processes, and services and evaluate the results. (Evaluate)

2. External customers

Define external customers and describe their impact on products and services. Evaluate strategies for working with them and integrating their requirements and needs to improve products, services, and processes. (Evaluate)

3. Customer segmentation

Describe and assess the process of customer segmentation and its impact on aligning service and delivery to meet customer needs. (Evaluate)

4. Qualitative assessment

Identify subjective information such as verbatim comments from customers, observation records, and focus group output. Describe how the subjective information differs from objective measures and determine when data should be captured in categories rather than numeric value. (Analyze)

B. Customer Relationship Management

1. Customer needs

Use quality function deployment (QFD) to capture the voice of the customer (VOC) and examine customer needs in relation to products and services offered. Analyze the results to prioritize future development in anticipation of changing customer needs. (Analyze)

2. Customer satisfaction and loyalty

Develop systems to capture positive and negative customer feedback and experiences, using tools such as listening posts, focus groups, complaints and warranty data, surveys, and interviews. Use customer value analysis to calculate the financial impact of existing customers and the potential results of losing those customers. Develop corrective actions and proactive methods to improve customer satisfaction, loyalty, and retention levels. (Create)

3. Customer service principles

Demonstrate strategies that support customer service principles: courtesy, politeness, smiles, cheerfulness, attention to detail, active listening, empathy, rapid response, and easy access for information and service. (Apply)

4. Multiple and diverse customer management

Establish and monitor priorities to avoid or resolve conflicting customer requirements and demands. Develop methods and systems for managing capacity and resources to meet the needs of multiple customers. Describe the impact that diverse customer groups can have on all aspects of product and service development and delivery. (Evaluate)

VI. Supply Chain Management (17 Questions)

A. Supplier Selection and Approval

Define and outline criteria for selecting, approving, and classifying suppliers, including internal rating programs and external certification standards. (Analyze)

B. Supplier Risk Management

Assess and manage supplier risk and the impact it may have on various internal processes of the organization. (Evaluate)

C. Supplier Communications

Prepare and implement specific communication methods with suppliers, including regularly scheduled meetings and routine and emergency reporting procedures. Direct, communicate, and confirm explicit expectations so that the supplier is aware of critical product and delivery requirements. (Apply)

D. Supplier Performance

Define, assess, and monitor supplier performance in terms of quality, cost, delivery, and service levels and establish associated metrics for defect rates, product reliability, functional performance, timeliness, responsiveness, and availability of technical support. (Evaluate)

E. **Supplier Improvement**

Define and conduct supplier audits, evaluate corrective and preventive action plans, provide feedback, and monitor process improvements. (Evaluate)

F. **Supplier Certification, Partnerships, and Alliances**

Define, appraise, and implement supplier certification programs that include process reviews and performance evaluations. Outline strategies for developing customer-supplier partnerships and alliances. (Evaluate)

G. **Supplier Logistics and Material Acceptance**

Describe the impact purchased products and services can have on final product assembly or total service package, including ship-to-stock and just-in-time (JIT). Describe the incoming material inspections process. (Understand)

VII. **Training and Development (16 Questions)**

A. **Training Plans**

Develop and implement training plans that are aligned with the organization's strategic plan and general business needs, including leadership training and alignment of personal development plans. (Create)

B. **Training Needs Analysis**

Use various tools and techniques such as surveys, performance reviews, regulatory guidances, and gap analyses to identify and assess training needs. (Evaluate)

C. **Training Materials, Development, and Delivery**

Use various tools, resources, and methodologies to develop training materials and curriculum that address adult learning principles and the learning needs of an increasingly diverse workforce. Describe various methods of training delivery: classroom, workbooks, simulations, computer delivered, on the job, and self-directed. Use mentoring and coaching to support training outcomes. (Apply)

D. **Training Effectiveness and Evaluation**

Assess training effectiveness and make improvements based on feedback from training sessions, end-of-course test results, on-the-job behavior or performance changes, and departmental or area performance improvements. (Evaluate)

LEVELS OF COGNITION

BASED ON BLOOM'S TAXONOMY—REVISED (2001)

In addition to **content** specifics, the subtext for each topic in this BOK also indicates the intended **complexity level** of the test questions for that topic. These levels are based on "Levels of Cognition" (from Bloom's Taxonomy—Revised, 2001) and are presented below in rank order, from least complex to most complex.

Remember: Recall or recognize terms, definitions, facts, ideas, materials, patterns, sequences, methods, principles, et cetera.

Understand: Read and understand descriptions, communications, reports, tables, diagrams, directions, regulations, et cetera.

Apply: Know when and how to use ideas, procedures, methods, formulas, principles, theories, et cetera.

Analyze: Break down information into its constituent parts and recognize their relationship to one another and how they are organized; identify sublevel factors or salient data from a complex scenario.

Evaluate: Make judgments about the value of proposed ideas, solutions, et cetera, by comparing the proposal to specific criteria or standards.

Create: Put parts or elements together in such a way as to reveal a pattern or structure not clearly there before; identify which data or information from a complex set is appropriate to examine further or from which supported conclusions can be drawn.

Appendix A

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A list that the preparers of the CMQ/OE examination may use to create questions is available for download from http://prdweb.asq.org/certification/control/manager-of-quality/references).

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Appendix B

Glossary and Acronyms

A

A-B-C analysis—A systematic collection and analysis of the behavior observed of an individual or a work group for the purpose of determining the cause of specific behaviors.

acceptable quality limit (AQL)—The quality level that is the worst tolerable process average when a continuing series of lots is submitted for acceptance sampling.

acceptance sampling—Inspection of a sample from a lot to decide whether to accept or not accept that lot. There are two types: attributes sampling and variables sampling. In *attributes* sampling, the presence or absence of a characteristic is noted in each of the units inspected. In *variables* sampling, the numerical magnitude of a characteristic is measured and recorded for each inspected unit; this involves reference to a continuous scale of some kind.

acceptance sampling plan—Specific plan that indicates the sampling sizes and the associated acceptance or nonacceptance criteria to be used. In attributes sampling, for example, there are single, double, multiple, sequential, chain, and skip-lot sampling plans. In variables sampling, there are single, double, and sequential sampling plans. For detailed descriptions of these plans, see ANSI/ISO/ASQ A35342.

accreditation—Certification, by a duly recognized body, of the facilities, capability, objectivity, competence, and integrity of an agency, service, or operational group or individual to provide the specific service or operation needed. For example, the Registrar Accreditation Board (United States) accredits those organizations that register companies to the ISO 9000 series standards.

accuracy—A characteristic of measurement that addresses how close an observed value is to the true value. It answers the question "Is it right?"

ACSI—The American Customer Satisfaction Index is an economic indicator, a cross-industry measure of the satisfaction of U.S. customers with the quality of the goods and services available to them—both those goods and services produced within the United States and those provided as imports from foreign firms that have substantial market shares or dollar sales.

action plan—The detailed plan to implement the actions needed to achieve strategic goals and objectives (similar to, but not as detailed as a *project plan*).

active listening—Listening closely to what others are saying (for example, rather than what you think of what they are saying or what you want to say back to them).

activity—A task that is performed to complete work or steps of a process.

activity attributes—A detailed set of defined characteristics that describe each project activity.

activity-based management/activity-based costing—Managing with an accounting system (activity-based costing) that allocates costs to products based on resources employed to produce the product.

activity list—A list of everything that needs to be accomplished to complete the project.

activity network diagram—See AND.

actual value—The amount of cost or effort actually expended for the project at a point in time.

ADDIE—An instructional design model (*analysis*, *design*, *development*, *implementation*, and *evaluation*).

ad hoc team—See *temporary team*.

adult learning principles—Key principles of how adults learn that have an impact on how education and training of adults should be designed.

Advanced Product Quality Planning (APQP)—Methodology used to guide the process of developing and launching a new product/process (automotive industry). Defines the phases: conceptualize, design, develop, validate, and launch new product and process designs.

affinity diagram—A management and planning tool used to organize ideas into natural groupings in a way that stimulates new, creative ideas. Also known as the *KJ method*.

agile—An approach or method, first implemented in software development, to focus on getting software functionality quickly to customers.

agile approach—Means to change rapidly to meet changing customer and business direction. Also see *lean approach*.

Agile Manifesto—The basic principles and beliefs of agile methods.

AIAG—Automotive Industry Action Group.

alignment—Action taken to ensure that a process or activity allows traceability from an action level upward to support the organization's strategic goals and objectives.

alliance—An alliance can be the first step toward a partnership. See *partnership/alliance*.

alpha risk—Type 1 error; rejecting a process or lot when it is acceptable. Also see *producer's risk*.

analogies—A technique used to generate new ideas by translating concepts from one application to another.

analysis of variance (ANOVA)—A basic statistical technique for analyzing experimental data. It subdivides the total variation of a data set into meaningful component parts associated with specific sources of variation in order to test a hypothesis on the parameters of the model or to estimate variance components. There are three models: fixed, random, and mixed.

analytical thinking—Breaking down a problem or situation into discrete parts to understand how each part contributes to the whole.

AND—activity network diagram. A management and planning tool used to diagram the sequential relationships of events or processes or deliverables. The critical path method (CPM) and the program evaluation review technique (PERT) are derived from the arrow diagram.

andon board—A visual device (usually lights) displaying status alerts that can easily be seen by those who should respond.

AOQ—Average outgoing quality.

AOQL—Average outgoing quality limit.

APICS—American Production and Inventory Control Society.

appraisal cost—Costs incurred to determine the degree of conformance to quality requirements.

AQL—See *acceptable quality limit*.

AS9100—An international quality management standard for the aeronautics industry embracing the ISO 9001 standard.

ASME—American Society of Mechanical Engineers.

ASQ—American Society for Quality, a society of individual and organizational members dedicated to the ongoing development, advancement, and promotion of quality concepts, principles, and technologies.

assessment—An estimate or determination of the significance, importance, or value of something.

assignable cause—See *common cause* or *special cause*.

assumptions log—A list of all of the assumptions and constraints for the project throughout its entire life cycle. These can include product, process, or project assumptions and any restrictions (constraints) on the schedule, cost, or product implementation choices.

ASTD—American Society for Training and Development.

ASTM—American Society for Testing and Materials.

attribute data—Does/does not exist data. The control charts based on attribute data include fraction defective chart, number of affected units chart, count chart, count-per-unit chart, quality score chart, and demerit chart.

audit—A planned, independent, and documented assessment to determine whether agreed-on requirements are being met. Common types of audits are of the quality management system, processes, products, and services. When an audit is to check on conformance to a standard, specifications, contract terms, or regulations, it may be called a *compliance audit*.

auditee—The individual or organization being audited.

auditor—An individual or organization carrying out an audit.

audit program—The organized structure, commitment, schedules, and documented methods used to plan and perform audits.

audit scope—The depth or extent and boundaries within which the audit will be conducted.

audit team—The group of trained individuals conducting an audit under the direction of a team leader, relevant to a particular system, product, process, service, contract, project, or standard.

audit types—*Internal* or *first party* (organization being audited by itself), *external* or *second party* (an organization conducting an audit of a supplier, customer, or other company), and *external* or *third party* (audit conducted by a registrar or another party).

autocratic management—Autocratic managers are concerned with developing an efficient workplace and often have little concern for people (theory X assumptions about people). They typically make decisions without input from subordinates. These managers rely on their positional power.

autonomation—Use of specially equipped automated machines capable of detecting a defect in a single part, stopping the process, and signaling for assistance. See *jidoka*.

availability—The ability of a process or equipment to be in a state to perform its designated function under stated conditions at a given time. Availability can be expressed by the ratio:

$$\frac{\text{Uptime}}{\text{Downtime}}$$

average—The sum of all the pertinent data divided by the number of observations collected. Also see *mean*.

average chart—A control chart in which the subgroup average, *X*-bar, is used to evaluate the stability of the process level.

average outgoing quality (AOQ)—The expected average quality level of outgoing product for a given value of incoming product quality.

average outgoing quality limit (AOQL)—The maximum average outgoing quality over all possible levels of incoming quality for a given acceptance sampling plan and disposal specification.

B

balanced scorecard—Translates an organization's mission and strategy into a comprehensive set of performance measures to provide a basis for strategic measurement and management, typically using four balanced views: financial, customers, internal business processes, and learning and growth.

balance sheet—A financial statement showing the assets, liabilities, and owner 's equity of a business entity.

Baldrige Performance Excellence Program (BPEP)—The Baldrige National Quality Award was established by Congress in 1987 to raise awareness of quality management and to recognize U.S. companies that have implemented successful quality management systems. A *Criteria for Performance Excellence* is published each year. Three awards may be given annually in each of five categories: manufacturing businesses, service businesses, small businesses, education institutions, and healthcare organizations. The award is named after the late secretary of commerce Malcolm Baldrige, a proponent of quality management. The U.S. Commerce Department's National Institute of Standards and Technology manages the award and ASQ administers it. The major emphasis in determining success is achieving results.

basis of estimates—The definition of supporting details for any estimate, including any basic assumptions about what was and was not included in the estimate.

batch processing/batch and queue—Running large batches of a single product through the process at one time, resulting in queues awaiting next steps in the process.

BATF—Bureau of Alcohol, Tobacco, and Firearms.

bathtub curve—Also called *life-history curve* or *Weibull curve*. A graphic demonstration of the relationship of failures over the life of a product versus the probable failure rate. Includes three phases: early or infant failure (break-in), a stable rate during normal use, and wear out.

behavioral theories—Motivational theories, notably those of Abraham Maslow, Frederick Herzberg, Douglas McGregor, and others.

behavior management—The management methodology and practices adapted from B. F. Skinner's theories: a practice used in managing people.

benchmarking—An improvement process in which a company measures its performance against that of best-in-class organizations (or others that are good performers), determines how those organizations achieved their performance levels, and uses the information to improve its own performance. Areas often benchmarked include strategies, operations, processes, and procedures.

benefit-cost analysis—Collection of the dollar value of benefits derived from an initiative and the associated costs incurred, then computing the ratio of benefits to cost.

beta risk—Type 2 error; the possibility that a bad product will be accepted by a consumer. See *consumer's risk*.

bias—A characteristic of measurement that refers to a systematic difference.

Big Q, little q—A term used to contrast the difference between managing for quality in all processes and products (Big Q) and managing for quality in a limited capacity (little q).

binomial distribution—Defines the probability of successes from a given number of trials.

Black Belt—Full-time leader responsible for implementing Six Sigma process improvement projects using pertinent methodologies, such as DMAIC, DOE, and others. Usually, the Black Belt trains the Green Belts and often serves for a two-year assignment overseeing eight to ten Six Sigma projects.

blemish—An imperfection that is severe enough to be noticed but should not cause any real impairment with respect to intended normal or reasonably foreseeable use. (See also *defect*, *imperfection*, and *nonconformity*.)

block diagram—A diagram that shows the operation, interrelationships, and interdependencies of components in a system. Boxes, or blocks (hence the name), represent the components; connecting lines between the blocks represent interfaces. There are two types of block diagrams: a *functional* block diagram, which shows a system's subsystems and lower-level products, their interrelationships, and interfaces with other systems; and a *reliability* block diagram, which is similar to the functional block diagram except that it is modified to emphasize those aspects influencing reliability.

Bloom's Taxonomy (levels of cognition)—See Appendix A.

body language—The expression of thoughts and emotions through movement or positioning of the body.

bottom line—An essential point or primary consideration. The line at the bottom of a financial statement that states the net profit or loss incurred.

boundaryless organization—An organization without the internal or external boundaries limiting traditional structures. (Also known as a *network organization*, a *modular corporation*, or a *virtual corporation*.)

BPR—Business process reengineering. See *reengineering*.

brainstorming—A problem-solving tool that teams use to generate as many ideas as possible related to a particular subject. Team members begin by offering all their ideas; the ideas are not discussed or reviewed until after the brainstorming session.

breakthrough—A method of solving chronic problems that results from the effective execution of a strategy designed to reach the next level of quality. Such change often requires a paradigm shift within the organization.

brownfields—Abandoned, idle, or underused commercial or industrial facilities or sites, often where use is complicated by real or potential environmental contamination.

BSI—British Standards Institute.

budget variance—The difference between budgeted and actual expenditures at a point in time.

burndown chart—A graph that shows the work left to be completed in the project.

business partnering—The creation of cooperative business alliances between constituencies within an organization or between an organization and its customers or suppliers. Partnering occurs through a pooling of resources in a trusting atmosphere focused on continuous, mutual improvement. See also *customer-supplier partnership*.

business processes—Processes that focus on what the organization does as a business and how it goes about doing it; the functional processes (generating output within a single department) and cross-functional processes (generating output across several functions or departments).

C

calibration—The comparison of a measurement instrument or system of unverified accuracy to a measurement instrument or system of a known accuracy to detect any variation from the true value.

capability maturity model (CMM)—Description of key elements of an effective software process, covering planning practices, engineering, management of software development, and maintenance.

capability ratio (C_p)—The specification tolerance width divided by the process capability.

capital expenditure—Money for improvements that will have a useful life of more than a year.

cascading training—Training implemented in an organization from the top down, where each level acts as trainers to those below.

case study—A prepared scenario (story) that, when studied and discussed, serves to illuminate the learning points of a course of study.

cash flow statement—A financial statement showing the flow of cash in and out of an enterprise within a given time period.

catchball—A term used to describe the interactive process of reaching consensus in developing and deploying policies and plans with hoshin planning.

cause-and-effect diagram—A tool for analyzing process variables. It is also referred to as the *Ishikawa diagram* because Kaoru Ishikawa developed it and the *fishbone diagram* because the complete diagram resembles a fish skeleton. The diagram illustrates the main causes and subcauses leading to an effect (symptom). The cause-and-effect diagram is one of the seven tools of quality.

CBT—Computer-based training. Training delivered via computer software.

***c*-chart—**Count control chart. See also *attribute data*.

CDC—Centers for Disease Control and Prevention.

cell—A layout of workstations and/or various machines for different operations (usually in a U shape) in which multitasking operators proceed with a part from machine to machine to perform a series of sequential steps to produce a whole product or major subassembly.

cellular team—The cross-trained individuals who work within a cell.

CE mark—A mark placed on a product signifying that the product complies with the essential/safety requirements of the relevant European regulations; from the French Conformité Européenne.

centralization—Relates to the locus of the decision-making authority within an organization.

central tendency—The propensity of data collected on a process to concentrate around a value situated somewhere midway between the lowest and highest values.

certification—The receipt of a document from an authorized source stating that a device, process, or operator has been certified to a known standard.

certification to a standard—A process in which an accredited, independent third-party organization conducts an on-site audit of a company's operations against the requirements of the standard to which the company wants certification. Upon successful completion of the audit, the company receives a certificate indicating that it has met the standard requirements. The third party (registrar) lists the organization receiving certification (registration). For example, an ISO 9001–based quality management system (QMS) is implemented, audited, passes, and is certified as compliant with the standard. The registrar lists the organization as having received a certificate. The organization is registered.

CFR—Code of Federal Regulations.

cGMP—current good manufacturing practices.

chain reaction—A series of interacting events described by W. Edwards Deming: improve quality > decrease costs > improve productivity > increase market share with better quality and lower price > stay in business, provide jobs, and provide more jobs.

chaku-chaku—(Japanese) Means *load-load* in a cell layout where a part is taken from one machine and loaded into the next.

champion—An individual who has accountability and responsibility for many processes or who is involved in making strategic-level decisions for the organization. The champion ensures ongoing dedication of project resources and monitors strategic alignment (also referred to as a *sponsor*).

chance cause—Same as *common cause*, a random and uncontrollable cause of variation.

change agent—The person who takes the lead in transforming an organization into a quality-focused organization by providing guidance during the planning phase, facilitating implementation, and supporting those who pioneer the changes.

change log—A log that documents all changes that occur during the project, including the approval, status, and/or disposition of each change request related to the project. This log is used to communicate change request information to the stakeholders.

change management—The strategies, processes, and practices involved in creating and managing change.

changeover—Changing a machine or process from one type of product or operation to another.

characteristic—A property that helps to identify or to differentiate between entities and that can be described or measured to determine conformance or nonconformance to requirements.

charter—A documented statement officially initiating the formation of a committee, team, project, or other effort in which a clearly stated purpose and approval is conferred.

checklist—A tool for organizing and ensuring that all important steps or actions in an operation have been taken. Checklists contain items that are important or relevant to an issue or situation. Checklists should not be confused with check sheets and data sheets.

check sheet—A simple data-recording device. The check sheet is custom designed for the particular use, allowing ease in interpreting the results. The check sheet is one of the seven tools of quality. Check sheets should not be confused with data sheets and checklists. Sometimes called a *tally sheet*.

chi-square—A measurement of how well a set of data fits a proposed distribution, such as a normal distribution.

chronic problem—A long-standing adverse situation that can be remedied by changing the status quo. For example, actions such as revising an unrealistic manufacturing process or addressing customer defections can change the status quo and remedy the situation.

clean room—Workplace or process location within which the air is filtered to a specified level and/or additional environmental controls are present to prevent failures due to contamination or to ensure the personal safety of the workers.

cloud computing—A model for enabling convenient, on-demand network access to a shared pool of configurable computing resources—for example, networks, servers, storage, applications, and services—that can be rapidly provisioned and released with minimal management effort or service provider interaction. The cloud model promotes availability and is composed of five essential characteristics, three service models, and four deployment models (National Institute of Standards and Technology, Information Technology Laboratory).

CMI—Certified mechanical inspector (ASQ).

coaching—A continual improvement technique by which people receive one-to-one learning through demonstration and practice and that is characterized by immediate feedback and correction.

code of conduct—The expected behavior that has been mutually developed and agreed on by a team and communicated to the workforce.

comment cards—Printed cards or slips of paper used to solicit and collect comments from users of a service or product.

common causes of variation—Causes that are inherent in any process all the time. A process that has only common causes of variation is said to be stable or predictable or in control. Also called *chance causes.*

companywide quality control (CWQC)—(Japanese origin). Similar to total quality management.

competence—Refers to a person's ability to learn and perform a particular activity. Competence consists of *knowledge*, *experience*, *skills*, *aptitude*, and *attitude* components (KESAA factors).

competency-based training—A training methodology that focuses on building mastery of a predetermined segment or module before moving on to the next.

competitive analysis—The gathering of intelligence relative to competitors in order to identify opportunities or potential threats to current and future strategy.

complaint handling—The process and practices involved in receiving and resolving complaints from customers.

complexity—In an organizational context, the number of different entities (job title, reporting levels, functional departments, and physical work locations) that compose the organization.

complexity theory—The theory concerned with the interaction among the parts of a system, as well as the interaction between the system and its environment.

compliance—An affirmative indication or judgment that the supplier of a product or service has met the requirements of the relevant specifications, contract, or regulation; also the state of meeting the requirements.

computer-based training—Any instruction delivered via a computing device.

concurrent engineering—A process in which an organization designs a product or service using input and evaluations from business units and functions early in the process, anticipating problems and balancing the needs of all parties. The emphasis is on upstream prevention versus downstream correction. Sometimes called *simultaneous engineering*.

conflict resolution—A process for resolving disagreements in a manner acceptable to all parties.

conformance—An affirmative indication or judgment that a product or service has met the requirements of a relevant specification, contract, or regulation.

consensus—Finding a proposal acceptable enough that all team members can support the decision, and no member opposes it.

constancy of purpose—Occurs when goals and objectives are properly aligned to the organizational vision and mission (first of Deming's fourteen steps).

constraint—A constraint may range from the intangible (for example, beliefs, culture) to the tangible (for example, posted rule prohibiting smoking, buildup of work in process awaiting the availability of a machine or operator).

constraint management—Identifying a constraint and working to remove or diminish the constraint while dealing with resistance to change.

construct—A formally proposed concept representing relationships between empirically verifiable events and based on observed facts.

consultative—A decision-making approach in which a person talks to others and considers their input before making a decision.

consumer's risk—For a sampling plan, refers to the probability of acceptance of a lot the quality of which has a designated numerical value representing a level that is seldom desirable. Usually, the designated value will be the lot tolerance percent defective (LTPD). Also called *beta risk* or *type 2 error*.

content analysis—A qualitative analytical technique for categorizing and analyzing the contents of documents.

continual process improvement (CPI)—The actions taken throughout an organization to increase the effectiveness and efficiency of activities and processes in order to provide added benefits to the customer and organization. It is considered a subset of total quality management and operates according to the premise that organizations can always make improvements. Continual improvement can also be equated with reducing process variation.

continuous probability distribution—A graph or formula representing the probability of a particular numeric value of continuous (variable) data, based on a particular type of process that produces the data.

continuous quality improvement (CQI)—A philosophy and actions for repeatedly improving an organization's capabilities and processes with the objective of customer satisfaction.

contract review—Systematic activities carried out by an organization before agreeing to a contract to ensure that requirements for quality are adequately defined, free from ambiguity, documented, and can be realized by the supplier.

control chart—A basic tool that consists of a chart with upper and lower control limits on which values of some statistical measure for a series of samples or subgroups are plotted. It frequently shows a central line to help detect a trend of plotted values toward either control limit. It is used to monitor and analyze variation in a process to see whether the process is in statistical control.

control limits—(1) Calculated boundaries of a process within specified confidence levels, expressed as upper control limit (UCL) and lower control limit (LCL). (2) The limits on a control chart used as criteria for signaling the need for action or for judging whether a set of data does or does not indicate a "state of statistical control."

control plan—The control plan is a document that describes the actions (measurements, inspections, quality checks, or monitoring of process parameters) required at each phase of a process to ensure the process outputs will conform to predetermined requirements.

core competency—Pertains to the unique features and characteristics of an organization's overall capability.

corporate culture—See *organization culture*.

correction—When a problem occurs (1) find out how bad it is, (2) decide what to do to keep it from having a larger impact, and (3) determine what to do with what has already been affected. Doing 1 and 2 is containment action and 3 is remedial action. This is correcting the problem but not the causes.

corrective action—Once a problem has been corrected, decide whether or not it was of enough significant importance (based on frequency, impact, risk, and so on) to warrant investigating the causes and take action to eliminate the root cause(s) and symptom(s) of an existing deviation or nonconformity to prevent recurrence.

correlation—Refers to the measure of the strength of the relationship between two sets of numbers or variables (a *scatter chart* may be used in the analysis).

correlation coefficient—Describes the magnitude and direction of the relationship between two variables.

cost-benefit analysis—Compares the potential or actual benefits with the estimated or real cost associated with a problem solution or process improvement, as a ratio or in dollars.

cost driver—A factor in the project that drives cost within the project.

cost estimate—A quantitative estimate of the cost (typically measured in monetary units) to complete an activity or a set of activities on the project's activities list.

cost forecast—The expected total cost of completing all work, expressed as the sum of the actual cost to date and the estimated cost to complete the work.

cost of poor quality—The costs associated with providing poor-quality products or services.

cost of quality (COQ)—The total costs incurred relating to the quality of a product or service. There are four categories of quality costs: *internal failure costs* (costs associated with defects found before delivery of the product or service), *external failure costs* (costs associated with defects found during or after product or service delivery), *appraisal costs* (costs incurred to determine the degree of conformance to quality requirements), and *prevention costs* (costs incurred to keep failure and appraisal costs to a minimum).

count chart—A control chart for evaluating the stability of a process in terms of the count of events of a given classification occurring in a sample.

count-per-unit chart—A control chart for evaluating the stability of a process in terms of the average count of events of a given classification per unit occurring in a sample.

C_p—A widely used process capability index. It is expressed as:

$$\frac{\text{Upper spec limit} - \text{Lower spec limit}}{6\sigma}$$

C_{pk}—A widely used process capability index. It is expressed as:

$$\frac{\text{(Ratio with smallest answer) Upper specification limit} - X\text{-bar}}{3\sigma}$$

or

$$\frac{X\text{-bar} - \text{Lower specification limit}}{3\sigma}$$

Crawford slip method—A method of anonymously gathering and presenting data from a group.

creativity, stages of—One model gives the following stages: generate, percolate, illuminate, and verify. May also be defined as visualization, exploration, combination, and modification.

criteria—Stated objectives, guidelines, principles, procedures, and/or standards used for measuring a project, process, product, or performance.

criterion—A standard, rule, or test on which a judgment or decision can be based.

critical activity—Any activity in the project plan that must be completed by the specified date or the project will be delayed.

critical incident—An event that has greater than normal significance, often used as a learning or feedback opportunity.

critical path—Refers to the sequence of tasks that takes the longest time and determines a project's completion date.

critical path method (CPM)—An activity-oriented project management tool that uses arrow-diagramming techniques to demonstrate both the time and cost required to complete a project. It provides one time estimate—normal time—and allows for computing the critical path.

critical success factors (CSF)—Factors identified by the organization as critical to the organization's success in achieving its strategic goals and objectives.

critical thinking—The careful analysis, evaluation, reasoning (both deductive and inductive), clear thinking, and systems thinking leading to effective decisions.

critical-to-quality (CTQ)—Characteristics that, from a customer's perception of quality, are critical to the achievement of quality goals, objectives, standards, and/or specifications.

cross-functional team—A group consisting of members from more than one department, work unit, or technical discipline that is organized to accomplish a project.

CSR—Customer service representative.

culture—See *organization culture*.

culture change—Major proposed or actual change in organizational operating principles, behavior, and attitude.

cumulative sum control chart (CUSUM)—A control chart on which the plotted value is the cumulative sum of deviations of successive samples from a target value. The ordinate of each plotted point represents the algebraic sum of the previous ordinate and the most recent deviations from the target.

current reality tree—A technique used in applying Goldratt's theory of constraints to identify undesirable effects (similar to root cause analysis).

customer—Recipient of a product or service provided by a supplier. See also *external customer* and *internal customer*.

customer council—A group usually composed of representatives from an organization's largest customers who meet to discuss common issues.

customer delight—The result achieved when customer requirements are exceeded in unexpected ways the customer finds valuable.

customer loyalty/retention—The result of an organization's plans, processes, practices, and efforts designed to deliver their services or products in ways that create retained and committed customers.

customer-oriented organization—An organization whose mission, purpose, and actions are dedicated to serving and satisfying its customers.

customer relationship management (CRM)—Refers to an organization's knowledge of its customers' unique requirements and expectations and using that knowledge to develop a closer and more profitable link to business processes and strategies.

customer satisfaction—The result of delivering a product or service that meets customer requirements, needs, and expectations.

customer segmentation—Refers to the process of differentiating customers based on one or more characteristics for the purpose of developing a marketing strategy to address specific segments. The intent is to better address customers' needs and improve customer satisfaction and organizational effectiveness.

customer service—Activities dealing with customer questions; also may be the designation of the department that takes customer orders or provides postdelivery services.

customer-supplier partnership—A long-term relationship between a buyer and supplier characterized by teamwork and mutual confidence. The supplier is considered an extension of the buyer's organization. The partnership is based on several commitments. The buyer provides long-term contracts and uses fewer suppliers. The supplier implements quality assurance processes so that incoming inspection can be minimized. The supplier also helps the buyer reduce costs and improve product and process designs.

customer value—There are four factors of influence on customer value: price, product/service quality, innovation, and organization image relative to competition. When customers are satisfied with their perception of the balance of the product/service meeting their need or want, the quality is satisfactory, and the price is right for them, customer value has been achieved.

cycle time—Refers to the elapsed time that it takes to complete a process from the start of the process to completion.

cycle time reduction—To reduce the time that it takes, from start to finish, to complete a particular process.

D

daily stand-up meeting—A short meeting where members are encouraged to stand due to the intended short nature of the meeting. The purpose is to quickly assess the status of the project. Used in the Scrum agile method, as well as other project types.

data—Quantitative or qualitative facts presented in descriptive, numeric, or graphic form. Two types of numerical data are *measured*, or *variable* data, and *counted*, or *attribute* data.

data mining—The process of searching a large computer database (for example, a customer database) for previously undetected patterns and relationships, with the intent to transform the data into information for making decisions about strategy.

decision matrix—A matrix used by teams to evaluate problems or possible solutions. For example, after a matrix is drawn to evaluate possible solutions, the team lists them in the far left vertical column. Next, the team selects criteria to rate the possible solutions, writing them across the top row. Then, each possible solution is rated on a scale of 1 to 5 for each criterion and the rating recorded in the corresponding grid. Finally, the ratings of all the criteria for each possible solution are added to determine its total score. The total score is then used to help decide which solution deserves the most attention.

defect—A product's or service's nonfulfillment of an intended requirement or reasonable expectation for use, including safety considerations. They are often classified, such as:

- Class 1, *critical*, leads directly to severe injury or catastrophic economic loss.
- Class 2, *serious*, leads directly to significant injury or significant economic loss.
- Class 3, *major*, is related to major problems with respect to intended normal or reasonably foreseeable use.
- Class 4, *minor*, is related to minor problems with respect to intended normal or reasonably foreseeable use. See also *blemish*, *imperfection*, and *nonconformity*.

defective—A product that contains one or more defects relative to the quality characteristics being measured.

delighter—Feature of a delivered product or service that unexpectedly pleases a customer.

demerit chart—A control chart for evaluating a process in terms of a demerit (or quality score), such as a weighted sum of counts of various classified nonconformities.

Deming cycle—See *plan-do-check-act cycle*.

Deming Prize—Award given annually to organizations that, according to the award guidelines, have successfully applied companywide quality control based on statistical quality control and will keep up with it in the future. Although the award is named in honor of W. Edwards Deming, its criteria are not specifically related to Deming's teachings. There are three separate divisions for the award: the Deming Application Prize, the Deming Prize for Individuals, and the Deming Prize for Overseas Companies. The award process is overseen by the Deming Prize Committee of the Union of Japanese Scientists and Engineers in Tokyo.

demographics—Variables among buyers in the consumer market, which include geographic location, age, sex, marital status, family size, social class, education, nationality, occupation, and income.

dependability—The degree to which a product is operable and capable of performing its required function at any randomly chosen time during its specified operating life, provided that the product is available at the start of that period. (Nonoperation-related influences are not included.) Dependability can be expressed by the ratio

$$\frac{\text{Time available}}{\text{Time available} + \text{Time required}}$$

deployment—Used in strategic planning to describe the process of cascading *goals*, *objectives*, and *action plans* throughout an organization.

design documentation—The documentation of the product's architecture, describing the components of the system (or product), the internal interfaces between those components, their external interfaces with components outside the system, and the allocation of requirements to those components or interfaces.

design failure mode and effects analysis (DFMEA)—See *FMEA*.

design for manufacturing (DFM)—The design of a product for ease in manufacturing. Also called *design for assembly* (DFA).

Design for Six Sigma (DFSS)—The aim is for a robust design that is consistent with applicable manufacturing processes and ensures a fully capable process that will produce quality products.

designing-in quality versus inspecting-in quality—See *prevention versus detection*.

design of experiments (DOE)—A branch of applied statistics dealing with planning, conducting, analyzing, and interpreting controlled tests to evaluate the factors that control the value of a parameter or group of parameters.

design review—Documented, comprehensive, and systematic examination of a design to evaluate its capability to fulfill the requirements for quality.

desired quality—Refers to the additional features and benefits a customer discovers when using a product or service that lead to increased customer satisfaction. If missing, a customer may become dissatisfied.

deviation—A nonconformance or departure of a characteristic from specified product, process, or system requirements.

diagnostic journey and remedial journey—A two-phase investigation used by teams to solve chronic quality problems. In the first phase, the diagnostic journey, the team moves from the symptom of a problem to its cause. In the second phase, the remedial journey, the team moves from the cause to a remedy.

dimensions of quality—Different ways in which quality may be viewed—for example, meaning of quality, characteristics of quality, or drivers of quality.

DiSC—A profiling instrument that measures characteristic ways in which a person behaves in a particular environment. Four dimensions measured are dominance, influence, steadiness, and conscientiousness.

discrete probability distribution—The measured process variable takes on a finite or limited number of values; no other possible values exist. A discrete variable could be the number of people in a room.

disposition of nonconformity—Action taken to deal with an existing nonconformity; action may include correct (repair), rework, regrade, scrap, obtain a concession, or amend a requirement.

dissatisfiers—Those features or functions that the customer or employee has come to expect, which, if they are no longer present, would result in dissatisfaction.

distance learning—Learning where student(s) and instructor(s) are not colocated; interaction through electronic means.

distribution—Describes the amount of potential variation in outputs of a process; it is usually described in terms of its shape, average, and standard deviation.

DMAIC—A methodology used in a Six Sigma initiative: *define*, *measure*, *analyze*, *improve*, *control*.

Dodge–Romig sampling plans—Plans for acceptance sampling developed by Harold F. Dodge and Harry G. Romig. Four sets of tables were published in 1940: single-sampling lot tolerance tables, double-sampling lot tolerance tables, single-sampling average outgoing quality limit tables, and double-sampling average outgoing quality limit tables.

downsizing—The planned reduction in workforce due to economics, competition, merger, sale, restructuring, or reengineering.

DPMO—Defects per million opportunities.

DPPM—Defective parts per million.

drivers of quality—Crucial factors that when controlled, the product or service will be controlled. These factors might include processes, customers, products, services, employee satisfaction, total organizational focus on providing quality products/services, and so on.

duration estimate—A quantitative estimate of the length of calendar time it will take to complete an activity, a set of activities, a phase, or a project.

E

earned value analysis (EVA)—A methodology used to measure project performance by comparing planned work with actual work accomplished to determine if performance is adhering to plan.

education—Refers to the individual learner's process to acquire new or refreshed knowledge. See also *training*.

efficiency—Ratio of output to the total input in a process, with an objective to use less resources, such as time and cost.

eighty-twenty (80-20) rule—A term referring to the Pareto principle, which suggests that most effects come from relatively few causes; that is, 80% of the effects come from 20% of the possible causes.

eliminate non-value-added steps in the process—Reduce waste and cut costs.

eliminate or reduce buffer stocks and inventories—Smooth process flow, reduce costs, improve quality, and increase customer satisfaction.

employee involvement—A practice within an organization whereby employees regularly participate in making decisions on how their work areas operate, including making suggestions for improvement, planning, objectives setting, and performance monitoring.

empowerment—A condition whereby employees are given the authority to make decisions and take action in their work areas, within stated bounds, without prior approval. For example, an operator can stop a production process upon detecting a problem, or a customer service representative can send out a replacement product if a customer calls with a problem.

end users—External customers who purchase products/services for their own use—*consumers.*

engineering change order (ECO)—An order to make a change in a process, product, or service after the initial release of the product or service design. See *concurrent engineering* for a process for reducing ECOs.

entropy—Tendency of a system or process to run down and collapse.

environmental analysis/scanning—Identifying and monitoring factors from both inside and outside the organization that may have an impact on the long-term viability of the organization.

environmental management system (EMS)—A management system for addressing the environmental policies, objectives, principles, procedures, authority, responsibility, accountability, and implementation of an organization's practices for managing its impact on the environment in which it operates.

EPA—Environmental Protection Agency.

equity theory—A theory that states that job motivation depends on how equitable the individual believes the rewards or punishment to be.

error proofing—See *poka-yoke.*

ethics—An individual or an organization's adherence to a belief or documented code of conduct that is based on moral principles and tries to balance what is fair for individuals and the organization with what is right for society.

EU—European Union.

event—The starting or ending point for a task or group of tasks. An occurrence of some attribute.

executive education—Usually refers to the education (and training) provided to top management.

exit criteria—The activities, deliverables, and elements that must be in place to move to the next phase of the project.

expectancy theory—A motivational theory inferring that what people do is based on what they expect to gain from the activity.

expected quality—Also known as *basic quality*, the minimum benefit or value a customer expects to receive from a product or service.

experimental design—A formal plan that details the specifics for conducting an experiment, such as which responses, factors, levels, blocks, treatments, and tools are to be used.

explicit knowledge—Represented by the captured and recorded tools of the day—for example, procedures, processes, standards, and other like documents. See also *tacit knowledge*.

exponential distribution—A continuous distribution where data are more likely to occur below the average than above it. Typically used to describe the break-in portion of the bathtub curve.

external audit—Audit performed by anyone or any organization outside the organization being audited. See *second-party audit* or *third-party audit*.

external customer—A person or organization who receives a product, a service, or information but is not part of the organization supplying it. See also *internal customer*.

external failure costs—Costs associated with defects found during or after delivery of the product or service.

F

facilitator—A trained individual who is responsible for creating favorable conditions that will enable a team to reach its purpose or achieve its goals by bringing together the necessary tools, information, and resources to get the job done. A facilitator addresses the processes a team uses to achieve its purpose.

factor analysis—A statistical technique that examines the relationships between a single dependent variable and multiple independent variables. For example, it is used to determine which questions on a questionnaire are related to a specific question such as "Would you buy this product again?"

failure mode analysis (FMA)—A procedure for determining which malfunction symptoms appear immediately before or after a failure of a critical parameter in a system. After all the possible causes are listed for each symptom, the product is designed to eliminate the problems.

failure mode and effects analysis (FMEA)—A procedure in which each potential failure mode of every subitem of an item is analyzed to determine its effect on other subitems and on the required function of the item. Typically, two types of FMEAs are used: DFMEA (design) and PFMEA (process).

failure mode effects and criticality analysis (FMECA)—A procedure that is performed after a failure mode and effects analysis to classify each potential failure effect according to its severity and probability of occurrence.

false customer—An individual or group within a process that performs activities that do not add value to the product or service.

fault tree analysis (FTA)—Technique for evaluating the possible causes that might lead to the failure of a product or service.

FDA—Food and Drug Administration.

feasibility study—Examination of technical and cost data to determine the economic potential and practicality of a project or application of equipment. NPV may be used in this analysis.

feedback—The interpersonal communication response to information received (written or oral); it may be based on fact or feeling and helps the party who is receiving the information judge how well he/she is being understood by the other party. More generally, feedback is information about a process or performance and is used to make decisions that are directed toward improving or adjusting the process or performance as necessary.

feedback loops—Pertains to open-loop and closed-loop feedback. Open-loop feedback focuses on how to detect or measure problems in the inputs and how to plan for contingencies. Closed-loop feedback focuses on how to measure the outputs and how to determine the control points where adjustment can be made.

filters—Relative to human-to-human communication, those perceptions (based on culture, language, demographics, experience, and so on) that affect how a message is transmitted by the sender and how a message is interpreted by the receiver.

finding—A conclusion of importance based on observation(s) and/or research, for example, an audit finding.

first-party audit—Audit of a process or product/service by auditing personnel employed by the organization in which the audit is performed. Also called *internal audit*.

fishbone diagram—See *cause-and-effect diagram*.

fitness for use—A term used to indicate that a product or service fits the customer's defined purpose for that product or service.

5S—(Japanese) Five practices for maintaining a clean and efficient workplace. Briefly the term embraces: *seiri* (sort/separate), *seiton* (arrange and identify), *seiso* (clean up), *seiketsu* (standardize), *shitsuke* (develop habit of always following first four *S*s).

five whys—A repetitive questioning technique to probe deeper to surface the root cause of a problem by asking *why* five times (more or fewer, as needed).

flexibility/agility—Concept and practice of configuring facilities, equipment, people, and support services to cope with inevitable change. Enables organization to reduce costs, respond more effectively to reduce costs, respond more effectively to marketplace demands, withstand economic fluctuations, and facilitate continual improvement.

flowchart—A graphic representation of the steps in a process. Flowcharts are drawn to better understand processes. The flowchart is one of the seven basic tools of quality.

focus group—A discussion group consisting of eight to ten participants, usually invited from a segment of the customer base to discuss an existing or planned product or service, led by a facilitator working from predetermined questions (focus groups may also be used to gather information in a context other than customers). Information from a focus group is often used as a basis for forming survey questions.

force field analysis—A technique for analyzing the forces that aid or hinder an organization in reaching an objective.

formal communication—The officially sanctioned information within an organization, which includes publications, memoranda, training materials/events, public relations information, and company meetings.

fourteen (14) points—W. Edwards Deming's fourteen management practices to help organizations increase their quality and productivity. They are:

1. Create constancy of purpose for improving products and services.
2. Adopt a new philosophy.
3. Cease dependence on inspection to achieve quality.
4. End the practice of awarding business on price alone; instead, minimize total cost by working with a single supplier.
5. Improve constantly and forever every process for planning, production, and service.
6. Institute training on the job.
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.
11. Eliminate numerical quotas for the workforce and numerical goals for management.
12. Remove barriers that rob people of pride of workmanship and eliminate the annual rating or merit system.
13. Institute a vigorous program of education and self-improvement for everyone.
14. Put everybody in the company to work to accomplish the transformation.

fraction defective chart (*p*-chart)—An attribute control chart used to track the proportion of defective units.

frequency distribution—Set of all the various values from individual observations and the frequency of their occurrence in the sample population. Statistically, a display of a large volume of data so that the central tendency (average or mean) and distribution are clear.

functional organization—An organization organized by discrete functions—for example, marketing/sales, engineering, production, finance, and human resources.

funnel experiment—An experiment that demonstrates the effects of tampering. Marbles are dropped through a funnel in an attempt to hit a flat-surfaced target below. The experiment shows that adjusting a stable process to compensate for an undesirable result, or an extraordinarily good result, will produce output that is worse than if the process had been left alone.

future reality tree—A technique used in the application of Goldratt's theory of constraints to show what to change and how to identify any new unfavorable aspects to be addressed prior to the change.

G

gage blocks—Standards of precise dimensions, used in combination to form usable length combinations. The blocks are traceable to national standards in the country of use (NIST in the United States).

gage repeatability and reproducibility (GR&R)—The evaluation of a gaging instrument's accuracy by determining whether the measurements taken with the gage are repeatable (that is, there is close agreement among a number of consecutive measurements of the output for the same value of the input under the same operating conditions) and reproducible (that is, there is close agreement among repeated measurements of the output for the same value of input made under the same operating conditions over a period of time). *Repeatability* is the variation in results on a single gage when the same part is measured repeatedly by the same person. *Reproducibility* is the variation from person to person using the same gage. May also go by MSA or measurement systems analysis.

gainsharing—A type of program that rewards individuals financially on the basis of organizational performance.

Gantt chart—A type of bar chart used in process/project planning and control to display planned work and finished work in relation to time. Also called a *milestone chart* when interim checkpoints are added. May be used in the planning stage as well as in tracking progress.

gap analysis—A range of techniques that compares a company's existing state to its desired state (as expressed by its long-term plans) to help determine what needs to be done to remove or minimize the gap between them.

gatekeeper—The role of an individual (often a facilitator) in a group meeting in helping ensure effective interpersonal interactions (for example, someone's ideas are not ignored due to the team moving on to the next topic too quickly).

Gemba (Japanese for workplace)—Management is urged to go to gemba to get out to where the work is being done to better understand a problem and appreciate the process involved in making the product or delivering the service.

geographic information system (GIS)—A computer-based method of collecting and displaying data in relation to a specific point or location on Earth to which each datum is related—the computer program maps the data.

geographic organization—An organization structured by geography, territory, region, or the like.

geometric dimensioning and tolerancing (GDT)—A method used to minimize production costs by considering the functions or relationships of part features in order to define dimensions and tolerances.

goal—A statement of general intent, aim, or desire; it is the point toward which management directs its mission, efforts, and resources; goals are usually nonquantitative. A goal is measured by the objectives supporting the goal.

goal-question-metric (GQM)—A method used to define measurement of a project, process, or product on three levels (conceptual, operational, quantitative).

go/no-go—State of a unit or product. Two parameters are possible: *go* conforms to specifications, and *no-go* does not conform to specifications.

grade—A planned or recognized difference in requirements for quality.

grapevine—The informal communication channels over which information flows within an organization, usually without a known origin and without any confirmation of its accuracy or completeness (sometimes referred to as the *rumor mill*).

Green Belt—An individual trained on the improvement methodology of Six Sigma who will lead a process or quality improvement team.

group dynamics—The interaction (behavior) of individuals within a team.

groupthink—Most or all team members coalesce in supporting an idea or decision that has not been fully explored, or some members secretly disagree but go along with the other members in apparent support.

H

Hawthorne effect—Concept that every change in workplace environment results (initially, at least) in increased productivity. This demonstrates the importance of human factors in motivating the workforce. (Based on studies by Elton Mayo at the Hawthorne Plant of Western Electric Company in Chicago in 1924.)

heijunka—Act of leveling the variety or volume of items produced in a process over time. Used to avoid excessive batching of product types, volume fluctuations, and excess inventory.

hierarchy structure—Describes an organization that is organized around functional departments/product lines or around customers/customer segments and is characterized by top-down management (also referred to as a *bureaucratic model* or *pyramid structure*).

histogram—A graphic summary of variation in a set of data. The pictorial nature of the histogram lets people see patterns that are difficult to see in a simple table of numbers. The histogram is one of the seven tools of quality.

hold point—A point, defined in an appropriate document, beyond which an activity must not proceed without the approval of a designated organization or authority.

horizontal structure—Describes an organization that is organized along a process flow or value-added chain, eliminating hierarchy and functional boundaries (also referred to as a *systems structure*).

hoshin kanri, hoshin planning—Japanese-based strategic planning/policy deployment process that involves consensus at all levels as plans are cascaded throughout the organization, resulting in improved actionable plans and continual monitoring and measurement.

house of quality—A diagram (named for its house-shaped appearance) that clarifies the relationships between customer needs and product features. It helps correlate market or customer requirements and analysis of competitive products with higher-level technical and product characteristics and makes it possible to bring several factors into a single figure. Also known as *quality function deployment* (QFD).

human relations theory—A theory focusing on the importance of human factors in motivating employees.

hygiene factors—A term used by Frederick Herzberg to label dissatisfiers. See *dissatisfiers*.

I

IEEE—Institute of Electrical and Electronics Engineers.

imagineering—Creative process used to develop, in the mind's eye, a process without waste.

imperfection—A quality characteristic's departure from its intended level or state without any association to conformance to specification requirements or to the usability of a product or service. See also *blemish*, *defect*, and *nonconformity*.

implied warranty—Implicit promise, not necessarily documented, that states that a product must reasonably operate or comply with the ordinary purposes for which it is intended or used.

in-control process—A process in which the statistical measure being evaluated is in a state of statistical control; that is, the variations among the observed sampling results can be attributed to a constant system of chance/common causes. The process may also be described as *stable*. See also *out-of-control process*.

incremental improvement—Improvements implemented on a continual basis. See *kaizen.*

indicators—Predetermined measures used to determine how well an organization is meeting its customers' needs and its operational and financial performance objectives. Such indicators can be either *leading* or *lagging* indicators. *Indicators* may also refer to devices used to measure lengths or flow.

indirect customers—Customers who do not receive process output directly but are affected if the process output is incorrect or late.

individual development—A process that may include education and training but also includes many additional interventions and experiences to enable an individual to grow and mature intellectually and emotionally, as well as professionally.

informal communication—The unofficial communication that takes place in an organization as people talk freely and easily; examples include impromptu meetings and personal conversations (verbal or e-mail).

information—Data transformed into an ordered format that makes it usable and allows one to draw conclusions.

information system—Technology-based systems used to support operations, aid day-to-day decision-making, and support strategic analysis. Other names often seen include *management information system*, *decision system*, *information technology* (IT), *data processing*.

input—Material, product, or service that is obtained from an upstream internal provider or an external supplier and is used by the receiver to produce an output.

inspection—Measuring, examining, testing, and gauging one or more characteristics of a product or service and comparing the results with specified requirements to determine whether conformity is achieved for each characteristic.

intellectual property—The concepts, ideas, thought, processes, and programs that are definable, measurable, and proprietary in nature (includes copyrights, patents, trademarks, computer software).

interactive multimedia—A term encompassing technology that allows the presentation of facts and images with physical interaction by the viewers; for example, taking a simulated certification exam on a computer or receiving training embedded in transaction processing software.

interdependence—Shared dependence between two or more items.

interfaces—Interaction between individuals, departments, work units, outside organizations, and so on that allows the meaningful exchange of information.

intermediate customers—Distributors, dealers, or brokers who make products and services available to the end user by repairing, repackaging, reselling, or creating finished goods from components or subassemblies.

internal audit—An audit conducted within an organization by members of the organization to measure its strengths or weaknesses against its own procedures and/or external standards—a first-party audit.

internal capability analysis—A detailed view of the internal workings of the organization; for example, determining how well the capabilities of the organization match to strategic needs.

internal customer—The recipient (person or department) of another person's or department's output (product, service, or information) within an organization. See also *external customer*.

internal failure costs—Costs associated with defects found before the product or service is delivered.

internal rate of return (IRR)—An organization's acceptable rate of return from investments. Also, the discount rate that causes net present value to equal zero.

International Organization for Standardization (ISO)—Based in Geneva, Switzerland, it is the worldwide controller of ISO standards.

interrelationship digraph—A management and planning tool that displays the relationship between factors in a complex situation. It identifies meaningful categories from a mass of ideas and is useful when relationships are difficult to determine. May also be called a relations diagram.

intervention—An action taken by a leader or a facilitator to support the effective functioning of a team or work group.

inventory—A term encompassing all forms of physical accumulation of materials, supplies, work in process, and finished goods held in temporary storage or warehoused. The term is also used by Goldratt to mean "all the money the system invests in things it intends to sell" (see *theory of constraints*).

Ishikawa diagram—See *cause-and-effect diagram.*

is/is not matrix—A tool that helps to differentiate what is distinctive about a problem.

ISO—A prefix for a series of standards published by the International Organization for Standardization. *Iso* also means *equal* in Greek.

ISO 14000 series—A set of standards and guidelines relevant to developing and sustaining an environmental management system.

ISO 9000 series standards—A set of individual but related international standards and guidelines on quality management and quality assurance developed to help companies effectively document the quality system elements to be implemented to maintain an efficient quality system. The standards, initially published in 1987 and revised in 1994, 2000, and 2008–2009, are not specific to any particular industry, product, or service. The standards were developed by the International Organization for Standardization, a specialized international agency for standardization composed of the national standards bodies of countries worldwide.

issue log—A log that documents all of the project's issues, including problems, gaps, inconsistencies, delays, quality concerns, and conflicts that require action. The issue log is used to record, track, and manage issues from creation, through analysis, to resolution.

iterative project management methodology—A project management methodology in which agile or iterative methods are used and where small groups of functionality are implemented quickly, and then the process iterates for the next set of a small group of functionality.

J

jidoka—Japanese method of autonomous control involving the adding of intelligent features to machines to start or stop operations as control parameters are reached and to signal operators when necessary.

job aid—Any device, document, or other media that can be provided to a worker to aid in correctly performing tasks (for example, a laminated setup instruction card hanging on a machine, photos of product at different stages of assembly, or a metric conversion table).

job description—A narrative explanation of the work, responsibilities, and basic requirements of a job.

job enlargement—Expanding the variety of tasks performed by an employee.

job enrichment—Increasing the worker's responsibilities and authority in work to be done.

job specification—A list of the important functional and quality attributes (knowledge, skills, aptitudes, and personal characteristics) needed to succeed in the job.

joint planning meeting—A meeting involving representatives of a key customer and the sales and service team for that account to determine how better to meet the customer's requirements and expectations.

Juran's trilogy—See *quality trilogy*.

JUSE—Union of Japanese Scientists and Engineers.

just-in-time (JIT) manufacturing—An optimal material requirement planning system for a manufacturing process in which there is little or no manufacturing material inventory on hand at the manufacturing site and little or no incoming inspection.

just-in-time training—Providing job training coincidental with, or immediately prior to, an employee's assignment to a new or expanded task.

K

kaikaku—A Japanese term that means a breakthrough improvement in eliminating waste.

kaizen—A Japanese term that means incremental and unending improvement by doing little things better and setting and achieving increasingly higher standards. The term was made famous by Masaaki Imai in his book *Kaizen: The Key to Japan's Competitive Success*.

kaizen blitz/event—An intense, short-time-frame (typically three to five consecutive days) team approach to employ the concepts and techniques of continual improvement (for example, to reduce cycle time or increase throughput).

kanban—A system inspired by Taiichi Ohno's (Toyota) visit to a U.S. supermarket. The system signals the need to replenish stock or materials or to produce more of an item (also called a *pull* approach).

Kano model—A representation of the three levels of customer satisfaction defined as dissatisfaction, neutrality, and delight. Named after Noriaki Kano.

kansei engineering—A Japanese term referring to the translation of consumers' psychological feelings about a product into perceptual design elements (sensory engineering, emotional usability).

KESAA factors—See *competence*.

key result area (KRA)—Critical customer requirements that are important for the organization's success. Also known as *key success factor* (KSF).

KJ method—See *affinity diagram*.

knowledge management—Involves transforming data into information and the acquisition or creation of knowledge, as well as the processes and technology employed in identifying, categorizing, storing, retrieving, disseminating, and using information and knowledge for the purposes of improving decisions and plans.

L

lateral thinking—A process that includes recognizing patterns, becoming unencumbered with old ideas, and creating new ones.

LCALI—A process for operating a listening post system for capturing and using formerly unavailable customer data. LCALI stands for *listen*, *capture*, *analyze*, *learn*, and *improve*.

leader—An individual recognized by others as the person to lead an effort. Normally one cannot be a leader without one or more followers. The term is often used interchangeably with *manager.* A leader may or may not hold an officially designated management-type position. See *manager*.

leadership—An essential factor in a quality improvement effort. Organization leaders must establish a vision, communicate that vision to those in the organization, and provide the tools, knowledge, and motivation necessary to accomplish the vision.

lean approach/lean thinking—A focus on reducing cycle time and waste using a number of different techniques and tools—for example, value stream mapping and identifying and eliminating monuments and non-value-added steps.

lean manufacturing—Applying the lean approach to improving manufacturing operations.

learner-controlled instruction (LCI)—When a learner works without an instructor, at an individual pace, building mastery of a task. Computer-based training is a form of LCI. Also called *self-directed learning*.

learning curve—The time it takes to achieve mastery of a task, a body of knowledge, or a skill.

learning organization—An organization that has a policy to continue to learn and improve its products, services, processes, and outcomes—"an organization that is continually expanding its capacity to create its future" (Senge).

lesson plan—A detailed plan created to guide an instructor in delivering training and/or education.

lessons learned register—A list that documents the knowledge gained from reflecting on activities, processes, or projects after they have been implemented, through performing root cause analysis of identified issues or defects, or through other empirical analysis methods. That knowledge may then be used to prevent future problems or repeat successful actions.

life cycle—A product life cycle is the total time frame from product concept to the end of its intended use; a project life cycle is typically divided into six stages: concept, planning, design, implementation, evaluation, and closeout.

life history curve—See *bathtub curve*.

linear project management methodology—A project management approach where the entire sequence of activities and phases are performed in a linear fashion. The entire set of defined requirements are elicited, designed, developed, tested, implemented, and made operational.

linear regression—The mathematical application of the concept of a scatter diagram where the correlation is actually a cause-and-effect relationship.

linear responsibility matrix—A matrix providing a three-dimensional view of project tasks, responsible person, and level of relationship.

line balancing—A method of proportionately distributing workloads within the value stream to meet *takt* time.

listening post data—Customer data and information gathered from designated organizational listening posts.

little q, Big Q—The difference between managing for quality in a limited capacity (q) to managing for quality across all business processes and products (Q). Attributed to J. M. Juran.

long-term goals—Goals that an organization hopes to achieve in the future, usually in three to five years. They are commonly referred to as *strategic goals*.

lost customer analysis—Analysis to determine why a customer or segment of customers was lost or defected to a competitor.

lot—A defined quantity of product accumulated under conditions that are considered uniform for sampling purposes.

lot tolerance percent defective (LTPD)—See *consumer's risk*.

lower control limit (LCL)—Control limit for points below the central line in a control chart.

M

macroprocesses—Broad, far-ranging processes that often cross functional boundaries.

maintainability—The probability that a given maintenance action for an item under given usage conditions can be performed within a stated time interval when the maintenance is performed under stated conditions using stated procedures and resources. Maintainability has two categories: *serviceability*, the ease of conducting scheduled inspections and servicing, and *repairability*, the ease of restoring service after a failure.

Malcolm Baldrige National Quality Award (MBNQA)—Earned by the organization qualifying under the criteria of the Baldrige Performance Excellence Program of NIST.

management by fact—A business philosophy that decisions should be based on data.

management by policy—The organizational infrastructure that ensures that the right things are done at the right time.

management by walking around (MBWA)—A manager's planned, but usually unannounced, walk-through of the organization to gather information from employees and make observations; may be viewed in a positive light by virtue of giving employees opportunity to interact with top management; has the potential of being viewed negatively if punitive action is taken as a result of information gathered.

management levels—A typical hierarchy of management levels is top management (executive level, upper management, top team), middle management (directors, general managers, plant managers, department managers), and first-level supervision (persons directly supervising workers).

management representative—A person appointed to act on management's behalf to manage the quality/environment system. Also, this person usually handles the interface with a registration body.

management responsibility categories—Planning, organizing, staffing, directing, and controlling (POSDC).

management review—Scheduled formal review and evaluation by management of the status and adequacy of the quality/environmental management system(s) in relation to the organization's strategic objectives and policies.

management styles—The predominant personal styles used by managers; styles may be based on prevalent management theories and assumptions about people. Style categories include authoritarian, autocratic, combative, conciliatory, consensual, consultative, democratic, disruptive, ethical, facilitating, intimidating, judicial, laissez-faire, participative, promotional, secretive, shared, or shareholder management.

management training—Usually refers to training and/or education provided to any management or professional-level person from frontline supervision up to, but usually not including, executives.

manager—An individual who manages and is responsible for resources (people, facilities, equipment, material, money, time). A person officially designated with a management-type position title. A manager is granted authority from above, whereas a leader's role is derived by virtue of having followers. The terms *manager* and *leader* are often and unfortunately used interchangeably.

market-perceived quality—The customer's opinion of your products or services as compared to those of your competitors.

Master Black Belt (MBB)—Six Sigma quality expert responsible for strategic implementation within the organization. The MBB is qualified to instruct other Six Sigma Black Belts and Green Belts on the methodologies, tools, and applications in all functions and levels of the organization, and acts as a resource on process management.

material review board (MRB)—A quality control committee or team, usually employed in manufacturing or other materials-processing installations, that has the responsibility and authority to deal with items or materials that do not conform to fitness-for-use specifications. An equivalent, the *error review board*, is sometimes used in software development.

matrix chart/diagram—A management and planning tool that shows the relationships among various groups of data; it yields information about the relationships and the importance of task/method elements of the subjects. Typically, a matrix displays the relationship between two topics—with, perhaps, the impact of a third element—such as a personnel requirements matrix. There are many varieties of matrices—for example, see *quality function deployment*.

matrix structure—Describes an organization that is organized into functional and product/project departments; it brings together teams of people to work on projects and is driven by product or project scope. Basically, functional departments obtain, train, maintain, and sustain the appropriate people, who are deployed, as needed, to product/project departments or work units. A given person may be based in a functional department (say, software developers) and deployed to one or more product/project work teams (say, a new product development team and also a team working on improving the QMS).

mean—A measure of central tendency, the arithmetic average of all measurements in a data set.

means (in hoshin planning usage)—The step of identifying the ways by which multiyear objectives will be met, leading to the development of action plans.

mean time between failures (MTBF)—The average time interval between failures for repairable product for a defined unit of measure (for example, operating hours, cycles, or miles).

measurement—Refers to the reference standard or sample used for the comparison of properties.

median—The middle number or center value of a set of data when all the data are arranged in sequence.

mentor—A person who voluntarily assumes a role of trusted advisor and teacher to another person. The mentor may or may not be the mentored person's organizational superior or even in the same organization. Usually, the only reward the mentor receives is self-gratification in having helped someone else.

metric—A standard of measurement or evaluation.

metrology—Science and practice of measurements.

micromanaging—Managing every little detail (for example, executive approving requisition for paper clips).

microprocesses—Narrow processes made up of detailed steps and activities that could be accomplished by a single person.

milestone—A specific time when a critical event is to occur; a symbol placed on a milestone chart to locate the point when a critical event is to occur. (An upward-pointing triangle signifies the scheduled time of an event; a downward-pointing triangle signifies completion of an event.)

milestone chart—A Gantt chart on which event starting and ending times are indicated.

milestone list—A list of key scheduled dates for designated project events (milestones) used to determine if key progress checkpoints have been reached on schedule.

mind mapping—A technique for creating a visual representation of a multitude of issues or concerns by forming a map of the interrelated ideas.

mission statement—An explanation of the core purpose or reasons for existing as an organization; it provides the focus for the organization and defines its scope of business. The mission may define customers or markets served, distinctive competence, or technologies used.

mistake proofing—See *poka-yoke*.

mitigation—Risk response strategy that decreases risk by lowering the probability of a risk event's occurrence or reduces the effect of the event should it occur.

mode—The value that occurs most frequently in a data set.

moment of truth (MOT)—An MOT is described by Jan Carlzon, former CEO of Scandinavian Air Services in the 1980s, as "any episode where a customer comes into contact with any aspect of your company, no matter how distant, and by this contact, has an opportunity to form an opinion about your company."

monitoring—Systematic and periodic or continuous surveillance or testing of a product or process to determine the level of compliance with industry, engineering, or regulatory requirements. No action is implied.

monument—The point in a process that necessitates a product waiting in a queue before processing further; a barrier to continuous flow.

motivation—Two types of motivation are *extrinsic* and *intrinsic*. Motivating a person means providing a work environment in which the person feels motivated; that is, one person cannot directly motivate another person.

muda—(Japanese). An activity that consumes resources but creates no value; the seven categories of muda (waste) are correction, processing, inventory, waiting, overproduction, internal transport, and wasted motion.

multi-attribute evaluation—Simpler than QFD, this process rank orders and weights customer requirements relative to the competition. In addition, it estimates the cost of each requirement in order to prioritize improvement actions.

multivariate control chart—A control chart for evaluating the stability of a process in terms of the levels of two or more variables or characteristics.

multivoting—A decision-making tool that enables a group to sort through a long list of ideas to identify priorities.

murmurs—A technique to gather information on consumer behavior by watching customers use the product or service.

Myers-Briggs Type Indicator (MBTI)—A method and instrument for identifying a person's personality type based on Carl Jung's theory of personality preferences.

mystery shopper—A person who pretends to be a regular shopper in order to get an unrestrained view of how a company's service process works.

N

n—Sample size (the number of units in a sample).

NAICS—North American Industry Classification System; a system replacing the Standard Industrial Classification (SIC), used to classify organizations according to the products or services produced.

natural team—A work group having responsibility for a particular process.

***n*-chart**—Number defective chart for attribute data, used where each unit is inspected from a given lot.

negotiation—A process in which individuals or groups work together to achieve common goals.

net present value (NPV)—A discounted cash flow technique for finding the present value of each future year's cash flow.

next operation as customer (NOAC)—Concept that the organization comprises service/product providers and service/product receivers, or internal customers.

NIST—National Institute of Standards and Technology (United States).

nominal group technique—A technique similar to brainstorming, used by teams to generate ideas on a particular subject. Team members are asked to silently come up with as many ideas as possible and write them down. Each member is then asked to share one idea, which is recorded. After all the ideas are recorded, they are discussed and prioritized by the group.

nonconformity—The result of nonfulfillment of a specified requirement. See also *blemish*, *defect*, and *imperfection*.

nondestructive testing (NDT) and evaluation—Testing and evaluation methods that do not damage or destroy the product being tested.

non-value-added—Tasks or activities that can be eliminated with no deterioration in product or service functionality, performance, or quality in the eyes of the customer.

norm (behavioral)—Expectation of how a person or group will behave in a given situation based on established protocols, rules of conduct, or accepted social practices.

normal distribution—A bell-shaped distribution for continuous data where most of the data are concentrated around the average, and it is equally likely that an observation will occur above or below the average.

***np*-chart—**A control chart for attribute data showing the number of defective units in a subgroup. Requires a constant subgroup size.

O

objective—A quantitative statement of future expectations and an indication of when the expectations should be achieved; it supports goals, clarifying and measuring what people must accomplish.

objective evidence—Verifiable qualitative or quantitative observations, information, records, or statements of fact pertaining to the quality of an item or service or to the existence and implementation of a quality system element.

objective setting—See *S.M.A.R.T. W.A.Y.*

observation—An item or incidence of objective evidence found during an audit.

OC (operating characteristic) curve—For a sampling plan, the OC curve indicates the probability of accepting a lot based on the sample size to be taken and the fraction defective in the batch.

one-to-one marketing—The concept of knowing customers' unique requirements and expectations and marketing to these. See also *customer relationship management*.

on-the-job training (OJT)—Training conducted at the workstation, typically done one-on-one.

open book management—An approach to managing that exposes employees to the organization's financial information, provides instruction in business literacy, and enables employees to better understand their role and contribution and its impact on the organization.

operating characteristic curve—See *OC curve*.

operating expense—All the money the system spends turning inventory into throughput (Goldratt's theory of constraints).

optimization—Achieving planned process results that meet the needs of the customer and supplier alike and minimize their combined costs.

organization culture—The collective beliefs, values, attitudes, manners, customs, behaviors, and artifacts unique to an organization.

organization development (OD)—An organization-wide (usually) planned effort, managed from the top, to increase organization effectiveness and health through interventions in the organization's processes using behavioral science knowledge and methodologies.

original equipment manufacturer (OEM)—An organization that uses product components from one or more other outside organizations to build a product it sells under its own name and brand. For example, an organization that furnishes the completed seats that are installed in the automobile that is sold under the auto assembler's brand is an OEM. Sometimes the term is misused to refer to the outside organization that supplies only components.

OSHA—Occupational Safety and Health Administration (United States).

outcome—The measurable result of a project, a quality initiative, or an improvement. Usually, some time passes between the completion of the action and the realization of the outcome—for example, improved productivity, quality, customer satisfaction, profits, and so on.

out-of-control process—A process in which the statistical measure being evaluated is not in a state of statistical control (that is, the variations among the observed sampling results cannot all be attributed to a constant system of chance causes; special or assignable causes exist). See also *in-control process*.

out of spec—A term used to indicate that a unit does not meet a given specification.

output—The deliverables resulting from a process, project, quality initiative, improvement, and so on. Outputs include data, information, documents, decisions, and tangible products. Outputs are generated both from the planning and management of the activity and the delivered product, service, or program. *Output* is also the item, document, or material delivered by an internal provider (supplier) to an internal receiver (customer).

outsourcing—A strategy and an action to relieve an organization of processes and tasks in order to reduce costs, improve quality, reduce cycle time (for example, by parallel processing), reduce the need for specialized skills, and increase efficiency. Often, the primary intent is to save money through cheaper labor costs.

overall equipment effectiveness (OEE)—Method for measuring effectiveness and efficiency of processes.

P

panels—Groups of customers recruited by an organization to provide ad hoc feedback on performance or product development ideas.

paradigm—The standards, rules, attitudes, culture, and so on that influence the way an organization lives and behaves.

paradigm shift—Advent and acceptance of a totally new model that is theory or custom shattering and displaces and/or discredits older theories and models—for example, a major organizational culture change such as adopting the BPEP criteria as the new business model.

parallel structure—Describes an organizational model in which groups, such as quality circles or a quality council, exist in the organization in addition to and simultaneously with the line organization. Also referred to as *collateral structure*.

parameter design (Taguchi)—The use of design of experiments in identifying the major contributors to variation.

Pareto chart—A basic tool used to graphically rank causes from most significant (or frequent) to least significant (or frequent). It utilizes a vertical bar graph in which the bar height reflects the frequency or impact of causes.

Parkinson's law—States that work expands to fit the organization developed to perform it, and there is a tendency for each work unit within the organization to try to build up its importance by expanding the number of jobs and personnel it controls. Sometimes expressed as "work expands to fit the available time."

participative management—A style of managing whereby the manager tends to work from theory Y assumptions about people, involving the workers in decisions made. See *theory Y.*

partnership/alliance—A strategy and a formal relationship between a supplier and a customer to engender cooperation for their mutual benefit, such as reducing costs of ownership, maintenance of minimum stocks, just-in-time deliveries, joint participation in design, exchange of information on materials and technologies, new production methods, quality improvement strategies, and the exploitation of market synergy.

payback period—The number of years it will take the results of a project or capital investment to recover the investment from net cash flows.

***p*-chart**—Fraction defective chart (also called a *proportion chart* or *percent chart*).

PDSA cycle—Plan-do-study-act cycle (a variation of PDCA). See *plan-do-check-act cycle.*

performance appraisal/evaluation—A formal method of measuring employees' progress against performance standards and providing feedback to them.

performance management system—A system that supports and contributes to the creation of high-performance work and work systems by translating behavioral principles into procedures.

performance plan—A performance management tool that describes desired performance and provides a way to assess the performance objectively.

PERT (program/project evaluation and reporting technique) chart—An enhanced AND that graphically demonstrates the relationship among project elements. Unlike the critical path method (CPM), PERT uses three time estimates rather than one.

phase gate review—A periodic review of the project deliverables, typically at the end of the phase, to assess whether the project is making appropriate progress and if it should progress into the next phase.

physical resource assignments—A list of the materials, equipment, supplies, locations, and other physical resources that are planned for use during the project.

pilot test—Small-scale implementation of a process or an operation to test its capability, design, and performance to requirements.

plan-do-check-act (PDCA) cycle—A four-step process for quality improvement. In the first step (*plan*), a plan to effect improvement is developed. In the second step (*do*), the plan is carried out, preferably on a small scale. In the third step (*check*), the effects of the plan are observed. As part of the last step (*act*), the results are studied to determine what was learned and what can be predicted. The plan-do-check-act cycle is sometimes referred to as the Shewhart cycle because Walter A. Shewhart discussed the concept in his book *Statistical Method from the Viewpoint of Quality Control* and as the Deming cycle because W. Edwards Deming introduced the concept in Japan. The Japanese subsequently called it the Deming cycle. Sometimes referred to as *plan-do-study-act* (PDSA).

Poisson distribution—A distribution used for discrete data, applicable when there are many opportunities for occurrence of an event but a low probability (less than 0.10) on each trial.

poka-yoke—(Japanese). A term that means to mistake proof a process by building safeguards into the system that avoid or immediately find errors. It comes from *poka*, which means *error*, and *yokeru*, which means *to avoid*.

PONC—Price of nonconformance: the cost of not doing things right the first time.

population—A group of people, objects, observations, or measurements about which one wishes to draw conclusions.

portfolio analysis—A process of comparing the value of proposed projects or acquisitions relative to the financial impacts on current projects as well as the potential for impact on resources of the proposed projects or acquisitions.

P_{pk}—Potential process capability statistic used in the validation stage of a new product launch (uses the same formula as C_{pk}, but a higher value is expected due to the smaller time span and fewer data from the sample).

ppm—Parts per million.

precision—A characteristic of measurement that addresses the consistency or repeatability of a measurement system when the identical item is measured a number of times.

precontrol—A control process, with simple rules, based on tolerances. It is effective for any process in which a worker can measure a quality characteristic (dimension, color, strength) and can adjust the process to change that characteristic and where there is either continuous output or discrete output totaling three or more pieces.

prerequisite tree—A technique used to identify obstacles in the application of Goldratt's theory of constraints.

prevention costs—Costs incurred to keep internal and external failure costs and appraisal costs to a minimum.

prevention versus detection—A term used to contrast two types of quality activities. *Prevention* refers to those activities designed to prevent nonconformances in products and services. *Detection* refers to those activities designed to detect nonconformances already in products and services. Another phrase used to describe this distinction is *designing-in quality versus inspecting-in quality*.

preventive action—Reviewing procedures, processes, and products/services to evaluate risks and take action to eliminate the potential causes of a nonconformity, defect, or other undesirable situation in order to prevent occurrence.

primary customer—The individual or group who directly receives the output of a process.

principled negotiation—Based on a win-win orientation, it includes:

- Separate the people from the problem.
- Focus on interest, not position.
- Understand what both sides want to achieve.
- Invent options for mutual gain.
- Insist on objective criteria.

priorities matrix—A tool used to choose between several options that have many useful benefits but where not all of them are of equal value.

probability—Likelihood of occurrence.

probability distribution—A mathematical formula that relates the values of characteristics to their probability of occurrence in a population.

problem-solving—A rational process for identifying, describing, analyzing, and resolving situations in which something has gone wrong without explanation.

problem-solving model seven steps—(1) identify the problem; (2) list possible root causes; (3) search out the most likely root causes; (4) identify potential solutions; (5) select and implement a solution; (6) follow up to evaluate the effect; (7) standardize the process.

procedure—A document that answers the questions: What has to be done? Where is it to be done? When is it to be done? Who is to do it? Why do it? (contrasted with a work instruction, which answers, How is it to be done? With what materials and tools is it to be done?) In the absence of a work instruction, the instructions may be embedded in the procedure.

process—An activity or group of activities that takes an input, adds value to it, and provides an output to an internal or external customer; a planned and repetitive sequence of steps by which a defined product or service is delivered.

process analysis—Defining and quantifying the process capability from data derived from mapping and measurement of the work performed by the process.

process capability—A statistical measure of the inherent process variability for a given characteristic. See C_p, C_{pk}, and P_{pk}.

process capability index—The value of the tolerance specified for the characteristic divided by the process capability. There are several types of process capability indexes, including the widely used C_p and C_{pk}.

process control—Methodology for keeping a process within prescribed boundaries and minimizing the inherent variation in the process.

process decision program chart (PDPC)—A management and contingency planning tool that identifies all events that can go wrong and the appropriate countermeasures for these events. It graphically represents all sequences that can lead to an undesirable effect.

process improvement—The act of changing a process to reduce variability and cycle time and make the process more effective, efficient, and productive.

process improvement team (PIT)—A natural work group or cross-functional team whose responsibility is to achieve needed improvements in existing processes. The life span of the team is based on the completion of the team's purpose and specific objectives.

process management—The collection of practices used to implement and improve process effectiveness; it focuses on holding the gains achieved through process improvement and assuring process integrity.

process mapping—The flowcharting of a work process in detail, including key control measurements.

process organization—A form of departmentalization where each department specializes in one phase of the process.

process owner—The manager or leader who is responsible for ensuring that a total process is effective and efficient.

process quality audit—An analysis of elements of a process and appraisal of completeness, correctness of conditions, and probable effectiveness.

process reengineering—See *reengineering*.

process village—Refers to an area where machines are grouped by type of operation performed by the machines (contrast with a cell layout).

producer's risk—For a sampling plan, the probability of not accepting a lot, the quality of which has a designated numerical value representing a level that is generally desirable. Usually, the designated value will be the acceptable quality level. Also called *alpha risk* and *type 1 error*.

production part approval process (PPAP)—Documents used to demonstrate to the customer that the new product/process is ready for full-blown production and to obtain approval to release it for production. Started in the automotive industry and is now moving into usage in other industries.

productivity—The amount of resources used to produce a product.

product life cycle management (PLM)—Concern for a product's viability, reliability, use, and disposition from its design through manufacturing, delivery, customer use, and ultimate discard.

product organization—A departmentalization where each department focuses on a specific product type or family.

product orientation—A tendency to see customers' needs in terms of a product they want to buy, not in terms of the services, value, or benefits the product will produce.

product quality audit—A quantitative assessment of conformance to required product characteristics.

product/service liability—The obligation of a company to make restitution for loss related to personal injury, property damage, or other harm caused by its product or service.

product warranty—The organization's stated policy that it will replace, repair, or reimburse a customer for a defective product, providing the product defect occurs under certain conditions and within a stated period of time.

professional development plan—An individual development tool for an employee. Working together, the employee and management create a plan that coordinates the individual's career needs and aspirations with organizational demands.

profit and loss statement—A financial statement showing the income and expenses resulting in a profit or loss for an organization within a specified period of time.

profound knowledge, system of—As defined by W. Edwards Deming, states that learning cannot be based on experience only; it requires comparisons of results to a prediction, plan, or an expression of theory. Predicting why something happens is essential to understand results and to continually improve. The four components of the system of profound knowledge are appreciation for a system, knowledge of variation, theory of knowledge, and understanding of psychology.

program evaluation and review technique (PERT)—An event-oriented project management planning and measurement technique that utilizes an arrow diagram

(AND) to identify all major project events and demonstrates a range of times needed to complete a project. It uses three time estimates on each project activity: optimistic, most likely, and pessimistic.

project—A temporary endeavor undertaken to create a unique product, service, or result (PMI 2017).

project calendars—Calendars that identify working days and/or shifts that are available for scheduling project activities.

project charter—A formal document that describes the project goals, scope, resources, deliverables, and potential benefits used to gain approval to embark on the project.

project communications—All of the reports, minutes, metrics, and other information products used to communicate with various stakeholders during the project.

project life cycle—Six sequential phases of project management: concept, planning, design, implementation, evaluation, and closeout.

project management—The management of activities and events involved throughout a project's life cycle.

project plan—All the documents that compose the details of why the project is to be initiated, what the project is to accomplish, when and where it is to be implemented, who will have responsibility, how the implementation will be carried out, how much it will cost, what resources are required, and how the project's progress and results will be measured.

project schedule—A listing of the project's activities with each activity's planned start and end dates, duration, assigned staff, and assigned resources. The project schedule may also include milestone dates.

project schedule network diagram—A graphic representation that shows each activity's predecessor/successor relationships (dependencies), including lag times between the activities in a project schedule. (Also called an activity network diagram or AND.)

project scope statement—The description of the project's boundaries, defining what is included within the project, along with a list of the project's major deliverables, assumptions, and constraints. The project scope statement may also describe any identified project limitations, including any items discussed with stakeholders that were determined to be outside the scope of the project.

project team—A designated group of people working together to produce a planned project's outputs and ultimate outcome.

project team assignments—A list of the project team members with their assigned roles and responsibilities.

psychographic customer characteristics—Variables among buyers in the consumer market that address lifestyle issues and include consumer interests, activities, and opinions.

pull system—See *kanban*.

Q

quality—A subjective term for which each person has his or her own definition. In technical usage, quality can have two primary meanings: (1) the characteristics of a product or service that bear on its ability to satisfy stated or implied needs, and (2) a product or service free of deficiencies.

quality assessment—The process of identifying business practices, attitudes, and activities that are enhancing or inhibiting the continual achievement of quality improvement in an organization.

quality assurance/quality control (QA/QC)—Two terms that have many interpretations because of the multiple definitions for the words *assurance* and *control*. For example, *assurance* can mean the act of giving confidence, the state of being certain, or the act of making certain; *control* can mean an evaluation to indicate needed corrective responses, the act of guiding, or the state of a process in which the variability is attributable to a constant system of chance causes. One definition of *quality assurance* is all the planned and systematic activities implemented within the quality system that can be demonstrated to provide confidence that a product or service will fulfill requirements for quality. One definition for *quality control* is the operational techniques and activities used to fulfill requirements for quality. Often, however, *quality assurance* and *quality control* are used interchangeably, referring to the actions performed to ensure the quality of a product, service, or process.

quality audit/assessment—A systematic, independent examination and review to determine whether quality activities and related results comply with planned arrangements and whether these arrangements are implemented effectively and are suitable to achieve the objectives.

quality auditor—A person trained in the auditing/assessing of the appropriate application of quality principles, policies, protocols, and practices supporting the producing of high-quality products or services that meet customer needs and expectations and comply with applicable standards.

quality characteristics—The unique characteristics of products and services by which customers evaluate their perception of quality.

quality circles—Quality improvement or self-improvement study groups composed of a small number of employees—ten or fewer—and their supervisor, who meet regularly with an aim to improve a process.

quality control—See *quality assurance*.

quality control measurement—A document containing the results of quality control activities that provides information about the project's compliance with quality requirements, including regulations and standards.

quality cost reports—A system of collecting quality costs that uses a spreadsheet to list the elements of quality costs against a spread of the departments, areas, or projects in which the costs occur and summarizes the data to enable trend analysis and decision-making. The reports help organizations review prevention costs, appraisal costs, and internal and external failure costs.

quality costs—See *cost of quality*.

quality council—The group driving the quality improvement effort and usually having oversight responsibility for the implementation and maintenance of the quality management system; operates in parallel with the normal operation of the business. Sometimes called *quality steering committee*.

quality engineering—The analysis of a manufacturing system at all stages to maximize the quality of the process itself and the products it produces.

quality function—The entire spectrum of activities through which an organization achieves its quality goals and objectives, no matter where these activities are performed.

quality function deployment (QFD)—A multifaceted matrix in which customer requirements are translated into appropriate technical requirements for each stage of product development and production. The QFD process is often referred to as "listening to the voice of the customer." See also *house of quality*.

quality function mission—Derived from and an input into the organization's mission, the quality function mission statement includes a customer focus, a supplier focus, and an employee focus. The statement represents the basic direction the organization intends to follow regarding quality.

quality improvement—Actions taken in any or all parts of the organization to increase the effectiveness and efficiency of activities and processes in order to provide added benefits to both the organization and its customers.

quality inspection—A number of possible activities used with an intent to ascertain or verify compliance to stated standards, prescribed measurements, or acceptable practices.

quality level agreement (QLA)—Internal service/product providers assist their internal customers in clearly delineating the level of service/product required in quantitatively measurable terms. A QLA may contain specifications for accuracy, completeness, timeliness, usability, service availability, or responsiveness to needs. The QLA provides, in writing, what a service/product receiver expects from an upstream provider, furnishes data to measure whether the quality acceptance level has been met, and is the basis for trending progress toward improvement and ultimate recognition for quality achievement.

quality loss function—A parabolic approximation of the quality loss that occurs when a quality characteristic deviates from its target value. The quality loss function is expressed in monetary units—the cost of deviating from the target increases as a quadratic function the further the quality characteristic moves from the target. The formula used to compute the quality loss function depends on the type of quality characteristic being used. The quality loss function was first introduced in this form by Genichi Taguchi.

quality management—All activities of the overall management function that determine the quality principles, policy, mission, objectives, responsibilities, and practices that when implemented through quality planning, quality assurance, quality control, and continual quality improvement within the quality system provide quality products and services leading to customer satisfaction and organizational benefits.

quality management system (QMS)—The organizational structure, processes, procedures, and resources designed and implemented to maintain and continually improve quality management, products, and services.

quality manual—Document stating the organization's quality policy and describing the quality system of an organization.

quality metrics—Quantitative measurements that give an organization the ability to set objectives and evaluate actual performance versus plan.

quality plan—The document, or documents, stating the specific quality practices, resources, specifications, and sequence of activities relevant to a particular product, project, or contract. The types of documents differ widely depending on the industry, type and size of organization, type of product or service produced, and other factors.

quality planning—The activity of establishing quality objectives and quality requirements.

quality policy—An organization's formally stated beliefs about quality and the acceptable behavior that will lead to the expected result.

quality principles—Rules, guidelines, or concepts that an organization believes in, collectively. The principles are formulated by senior management with input from others and are communicated and understood at every level of the organization.

quality report—A report summarizing the results of one or more quality control activities. A quality report may include items such as: quality related issues; project, process, or product improvement; recommendations; corrective or preventive action recommendations.

quality score chart (Q chart)—A control chart for evaluating the stability of a process in terms of a quality score. The quality score is the weighted sum of the count of events of various classifications in which each classification is assigned a weight.

quality steering committee—See *quality council*.

quality trilogy—A three-point approach to managing for quality. The three points are *quality planning* (developing the products and processes required to meet customer needs), *quality control* (meeting product and process objectives), and *quality improvement* (achieving unprecedented levels of performance). Attributed to Joseph M. Juran.

questionnaire—See *survey*.

queue processing—Processing in batches (contrast with continuous flow processing).

queue time—Wait time of product awaiting the next step in a process.

quincunx—A teaching tool that creates frequency distributions. Beads tumble over numerous horizontal rows of pins, which force the beads to the right or left. After a random journey, the beads are dropped into vertical slots. After many beads are dropped, a frequency distribution results. In the classroom, quincunxes are often used to simulate a manufacturing process. The quincunx was invented by English scientist Francis Galton in the 1890s.

R

radar chart—A visual method to show in graphic form the size of gaps between a number of both current organization performance indicators and ideal performance indicators. The resulting chart resembles a radar screen or a spider's web.

random cause—Cause of variation due to chance and not assignable to any factor. See *common cause*.

random number generator—Used to select a stated quantity of random numbers from a table of random numbers. The resulting selection is then used to pull specific items or records corresponding to the selected numbers to comprise a random sample.

random sampling—A sampling method in which every element in the population has an equal chance of being included.

range—A measure of dispersion, the highest value minus the lowest value.

range chart (*R* chart)—A control chart in which the subgroup range, R, is used to evaluate the stability of the variability within a process.

ratio analysis—The process of relating isolated business numbers, such as sales, margins, expenses, debt, and profits, to make them meaningful.

rational subgroup—A subgroup that is expected to be as free as possible from assignable causes (usually consecutive items).

recognition and reward system—Management's recognition of work done well by individuals or groups and any monetary or nonmonetary reward that is provided to those persons recognized.

record—Document or electronic medium that furnishes objective evidence of activities performed or results achieved—for example, a filled-in form.

red bead experiment—An experiment developed by W. Edwards Deming to illustrate that it is impossible to put employees in rank order of performance for the coming year based on their performance during the past year because performance differences must be attributed to the system, not to employees. Four thousand red and white beads, 20% red, in a bin, and six people are needed for the experiment. The participants' goal is to produce white beads because the customer will not accept red beads. One person begins by stirring the beads and then, blindfolded, selects a sample of fifty beads. That person passes the bin to the next person, who repeats the process, and so on. When everyone has his or her sample, the number of red beads for each is counted. The limits of variation between employees that can be attributed to the system are calculated. Everyone will fall within the calculated limits of variation that could arise from the system. The calculations will show that there is no evidence one person will be a better performer than another in the future. The experiment shows that it would be a waste of management's time to try to find out why, say, John produced four red beads and Jane produced fifteen; instead, management should improve the system, making it possible for everyone to produce more white beads.

reengineering—Completely redesigning or restructuring a whole organization, an organizational component, or a complete process. It's a "start all over again from the beginning" approach, sometimes called a *breakthrough*. In terms of improvement approaches, reengineering is contrasted with incremental improvement (kaizen).

Registrar Accreditation Board (RAB)—An organization that evaluates the competency and reliability of registrar organizations that audit and register client organizations to an appropriate standard, such as ISO 9001 or ISO 14001.

registration—See *certification to a standard*.

regression analysis—A statistical technique for estimating the parameters of an equation relating a particular variable to one or more variables.

reinforcement of behavior—The process of providing positive consequences when an individual is applying the correct knowledge and skills to the job. It has been described as *catching people doing things right and recognizing their behavior*. Caution: Less than desirable behavior can also be reinforced unintentionally.

reliability—In measurement systems analysis, the ability of an instrument to produce the same results over repeated administration—consistency. In reliability engineering it is the probability of a product performing its intended function under stated conditions for a given period of time. See also *mean time between failures*.

reliability engineering—Science of including those factors in the basic design that will ensure the required degree of reliability, availability, and maintainability.

remedial journey—See *diagnostic journey*.

remedy—Something that eliminates or counteracts a problem cause: a solution.

repair—Action taken on a nonconforming product so that it will fulfill the intended usage requirements, although it may not conform to the originally specified requirements. See *rework*.

repeatability and reproducibility (R&R)—A measurement validation process to determine how much variation exists in the measurement system (including the variation in product, the gage used to measure, and the individuals using the gage).

reproducibility—Variation in the average of the measurements made by different appraisers using the same measuring instrument when measuring identical characteristics on the same part.

requirements documentation—Documentation of the requirements to be implemented by the project, including business-level, stakeholder-level and product-level requirements. The definition of what the product or service must do (functional requirements); what the product or service must be (quality and product attributes like reliability, security, safety, performance, usability, accuracy, accessibility, maintainability, supportability, and so on); what restrictions are there on the choices that project staff can make when implementing the product or service (design constraints).

requirements traceability matrix—The documentation of the identified relationships between each requirement's source and the resulting requirement, derived requirements, designs, code, tests, and implemented deliverables.

resistance to change—A person or group's unwillingness to change beliefs, habits, and ways of doing things.

resource breakdown structure—A hierarchical decomposition of the staffing and resources available to the team. When used for staffing, the resource breakdown structure describes the composition of the available staff, which can be used to help identify knowledge availability and identify any potential skill gaps. When used for nonhuman, physical resources, the resource breakdown structure describes the composition of identified resources by category and type.

resource calendar—A resource calendar identifies the availability of specific resources by type or specific attributes. For example, a staffing resource calendar identifies when staff members are available by excluding vacation days and days when staff members are otherwise engaged in other work.

resource requirements—A description of the staff and nonhuman physical resources needed, by types and quantities, to implement an activity, work package, set of work packages, or the entire project.

resource requirements matrix—A tool used to relate the resources required to the project tasks requiring them (used to indicate types of individuals needed, material needed, subcontractors, and so on).

response surface—A graphic representation of the relationship between important independent variables, controlled factors, and a dependent variable.

RETAD—Rapid exchange of tooling and dies; the same concept as *SMED.*

return on assets (ROA)—A measure of the return generated by the earning power of the organization's investment in assets, such as facilities, large equipment, and so on.

return on equity (ROE)—The net profit after taxes, divided by the previous year's tangible stockholders' equity, and then multiplied by one hundred to provide a percentage (also referred to as *return on net worth*).

return on investment (ROI)—An umbrella term for a variety of ratios measuring an organization's business performance and calculated by dividing some measure of return by a measure of investment and then multiplying by one hundred to provide a percentage. In its most basic form, ROI indicates what remains from all money taken in after all expenses are paid.

return on net assets (RONA)—Measure of an organization's earning power from investments in assets calculated by dividing net profit after taxes by the previous year's tangible total assets, multiplied by one hundred to provide a percentage.

return on training investment (ROTI)—A measure of the return generated by the benefits obtained by the organization's investment in training.

reverse engineering—Developing new design specifications by inspection and analysis of the process steps (from last to first) used to produce an existing product.

rework—Action taken on a nonconforming product so that it will fulfill the specified requirements (may also pertain to a service).

right the first time—The concept that it is beneficial and more cost-effective to take the necessary steps up front to ensure that a product or service meets its requirements than to provide a product or service that will need rework or fail to meet customers' needs. In other words, an organization should engage in defect prevention more than defect detection.

risk—A probable event that could have an impact on the successful completion of a project or a product.

risk assessment/management—The process of determining what present or potential risks are possible in a situation (for example, project plan) and what actions might be taken to eliminate or mitigate them.

risk priority number (RPN)—The priority of risks assessed expressed as a number.

risk probability—The likelihood that the risk will occur.

risk register—A list that describes detailed information about the threats and opportunities that may have an impact on the success of the project.

risk report—A report on the sources of overall project risks, with a summary of information about identified risks.

robustness—The condition of a product or process design that remains relatively stable with a minimum of variation even though factors that influence operations or usage, such as environment and wear, are constantly changing.

role playing—A training technique whereby selected participants, designated to assume a particular role, spontaneously interact in an assigned scenario.

root cause analysis (RCA)—A set of quality techniques that can be used to distinguish the cause of defects or problems. It is a structured approach that focuses on finding the decisive or original source of a problem or condition.

run—Consecutive points on one side of the centerline on an SPC chart.

run chart—A line graph showing data collected during a run or an uninterrupted sequence of events. A trend is indicated when the series of collected data points up or down.

S

sales leveling—A strategy of establishing a long-term relationship with customers to lead to contracts for fixed amounts and scheduled deliveries in order to smooth the flow and eliminate surges.

sample—A finite number of items of a similar type taken from a population for the purpose of examination to determine whether all members of the population would conform to quality requirements or specifications.

sample plan—Documented plan showing the scheduled number of samples to be taken from a lot for the purpose of acceptance or rejection of the lot. There are several predesigned sampling plans available.

sample size—The number of units in a sample chosen from a population.

sampling—The process of drawing conclusions about a population based on a part of the population.

satisfier—Term used to describe the quality level received by a customer when a product or service meets requirements.

SCAMPER—A list of seven questions used by a team to stimulate creativity. *S* for Substitute, *C* for Combine, *A* for Adapt, *M* for Modify/Magnify, *P* for Put to another use, *E* for Eliminate (or Minimize), *R* for Rearrange or Reverse.

scatter diagram—A graphic technique used to analyze the relationship between two variables. Two sets of data are plotted on a graph, with the y-axis being used for the variable to be predicted and the x-axis for the variable being used to make the prediction. The graph will show possible relationships (although two variables might appear to be related, they might not be; those who know most about the variables must make that evaluation). The scatter diagram is one of the seven tools of quality.

scenario planning—A strategic planning process that generates multiple stories/scenarios about possible future conditions, allowing an organization to look at the potential impact on them and different ways they could respond.

schedule data—Measurements and information collected and used to describe and control the project's schedule.

schedule forecast—The expected total schedule for completing all work, expressed as the sum of the actual schedule to date and the estimated future schedule to complete the work.

schedule variance—A measure of the difference between the planned schedule to date and the actual work accomplished to date.

scientific management—Finding the one best way to perform a task so as to increase effectiveness, quality, productivity, and efficiency.

scope—The total number of products, services, processes, people, and operations that will be affected by an initiative, project, or other action.

scope creep—In a project, job, or other work situation, the gradual expansion of responsibilities and workload, often invisible in early stages until the additional time and cost appear as a variation from estimates.

scorecard—Any evaluation device that formally specifies criteria and a means for rating performance.

Scrum—An agile framework that focuses on achieving complex projects quickly.

Scrum development team—the team of participants that work on a project applying the Scrum approach. It is a self-organizing team.

Scrum master—The person in charge of facilitating and guiding the Scrum team to understand the use of the Scrum method.

secondary customer—Individuals or groups from outside the process boundaries who receive process output but who are not the reason for the process's existence.

second-party audit/assessment—An action carried out by a customer on its suppliers.

segmentation—See *customer segmentation*.

SEI capability maturity model—A model used to determine current process capabilities and identify critical software issues for improvement.

selective listening—One hears what one is predisposed to hear.

self-control—Three elements comprise workers' self-control: knowing what they are supposed to do, knowing what they are actually doing and how well, and being able to control the process.

self-directed learning—See *learner-controlled instruction*.

self-inspection—The process by which employees inspect their own work according to specified rules.

self-managed team—A team that requires little supervision and manages itself and the day-to-day work it does; self-directed teams are responsible for whole work processes, with each individual performing multiple tasks.

sensor—In an inspection or monitoring system, a device that detects a condition out of the normal and provides a notification signal of the changed condition.

service level agreement (SLA)—See *quality level agreement*.

setup time—The time taken to change over a process to run a different product or service.

seven basic tools of quality—Tools that help organizations understand their processes in order to improve them. The tools are the cause-and-effect diagram, check sheet, control chart, flowchart, histogram, Pareto chart, and scatter diagram. See individual entries.

seven management tools of quality—The tools used primarily for planning and managing are the activity network diagram (AND), or arrow diagram, affinity diagram (KJ method), interrelationship digraph, matrix diagram, priorities matrix, process decision program chart (PDPC), and tree diagram.

shape—(1) Pattern or outline formed by the relative position of a large number of individual values obtained from a process; (2) removal of material from an item using a shaper or shaver tool.

shared leadership—Management approach in which the manager believes that the many functions of management can be effectively spread among various teams or individuals.

Shewhart cycle—See *plan-do-check-act cycle.*

shift—Abrupt change in an important variable in a process. Examples include broken tools, dropped gages, parts slipping, oil stops flowing, missed ingredient in a mix.

ship-to-stock program—An arrangement with a qualified supplier whereby the supplier ships material directly to the buyer without the buyer's incoming inspection; often a result of evaluating and approving the supplier for certification.

SIC—Standard Industrial Classification. Replaced by *NAICS.*

sigma—Greek letter (Σ) that stands for the standard deviation of a process.

silo—(as in functional silo). An organization where cross-functional collaboration and cooperation is minimal and where the functional silos tend to work toward their own objectives, sometimes to the detriment of the organization as a whole. The allusion to *silo* is the mental picture of a vertical farm structure dedicated to serving one purpose without due regard to its relation to the farm as a whole entity.

single-minute exchange of die (SMED)—A goal to be achieved in reducing the setup time required for a changeover to a new process; the methodologies employed in devising and implementing ways to reduce setup.

single-piece flow—A method whereby the product proceeds through the process one piece at a time rather than in large batches, eliminating queues and costly waste.

SIPOC analysis—A macrolevel analysis of the suppliers, inputs, processes, outputs, and customers.

situational leadership—Leadership theory that maintains that leadership style should change based on the person and the situation involved, with the leader displaying varying degrees of directive and supportive behavior.

Six Sigma approach—A quality philosophy; a collection of techniques and tools for use in reducing variation; a program of improvement.

Six Sigma quality—Term generally used to indicate that a process is well controlled—that is, within process limits ±3Σ from the centerline in a control chart and requirements/tolerance limits ±6Σ from the centerline. The term was originated by Motorola.

skewness—Measure of a distribution's symmetry, a skewed distribution has a longer tail on the right or left side, with its hump (probability) pushed to the opposite side.

skip-level meeting—Evaluation technique that occurs when a member of senior management meets with persons two or more organizational levels below, without the intervening management present, to allow open expression about the effectiveness of the organization.

skip-lot sampling—An acceptance sampling plan in which some set number of lots in a series is accepted without inspection. When the set number of lots is received without inspection, the next lot is inspected unless problems surface that merit all lots being inspected until the problem is eliminated and confidence is restored.

slack time—The time an activity can be delayed without delaying the entire project; it is determined by calculating the difference between the latest allowable date and the earliest expected date. Also called *float*.

S.M.A.R.T. W.A.Y.—A template for setting objectives—*specific*, *measurable*, *achievable*, *realistic*, *time*, *worth*, *assign*, *yield*.

Society of Automotive Engineers (SAE)—International society for the exchange of ideas advancing the engineering of powered transportation systems.

spaghetti chart—A before-improvement chart of existing steps in a process, with lines showing the many back-and-forth interrelationships (the resulting chart resembles cooked spaghetti). It is used to identify the redundancies and other wasted movements of people and material.

span of control—How many subordinates a manager can effectively and efficiently manage.

special causes—Causes of variation that arise because of special circumstances. They are not an inherent part of a process. Special causes are also referred to as *assignable causes*, as contrasted with *common causes*.

special characteristics—Any characteristics that may affect safety and/or regulatory requirements, degradation, customer satisfaction, annoyance, and/or other criteria.

specification—The engineering requirement used for judging the acceptability of a particular product/service based on product characteristics such as appearance, performance, and size. In statistical analysis, specification refers to the document that prescribes the requirements to which the product or service has to conform.

sponsor—The person who supports a team's plans, activities, and outcomes—the team's "backer." The sponsor provides for resources and helps define the mission and scope to set limits. The sponsor may be the same individual as the "champion."

sprint—A short iteration, usually a month or less, to deliver some functionality.

sprint retrospective—A Scrum meeting at the end of the sprint used to identify improvements to the Scrum and sprint processes.

sprint review meeting—A Scrum meeting held to inspect the product or output of the sprint.

stable process—Process that is in control, with only common causes of variation present.

stakeholder—People, departments, and outside organizations that have an investment or interest in the success of—or may be affected by actions taken by—the organization.

stakeholder analysis—The identification of stakeholders and delineation of their needs.

stakeholder requirements matrix—A matrix for capturing and categorizing the needs of identified stakeholders.

standard—A statement, specification, or quantity of material against which measured outputs from a process may be judged as acceptable or unacceptable.

standard deviation—A calculated measure of variability that shows how much the data are spread around the mean.

standardized work—Documented and agreed-on work instructions and practices that embody the present best-known methods and work sequence to be followed by all performers of each manufacturing or assembly step in a process.

statement of work (SOW)—A description of the actual work to be accomplished. It is derived from the work breakdown structure and, when combined with the project specifications, becomes the basis for the contractual agreement on the project. See also *scope*.

statistical confidence—The level of accuracy expected of an analysis of data. Most frequently it is expressed as either a "95% level of significance" or "5% confidence level." Also called *statistical significance*.

statistical process control (SPC)—The application of statistical techniques to control a process.

statistical quality control (SQC)—The application of statistical techniques to control quality. Often, the term *statistical process control* is used interchangeably with *statistical quality control*, although statistical quality control includes acceptance sampling as well as statistical process control.

statistical thinking—A philosophy of learning and action based on fundamental principles:

- All work occurs in a system of interconnected processes.
- Variation exists in all processes.
- Understanding and reducing variation are vital to improvement.

steering committee—A special group established to guide and track initiatives or projects.

storyboarding—A technique that visually displays thoughts and ideas and groups them into sequenced categories (scenes), making all aspects of a process visible at once. Often used to communicate to others the activities performed by a team as they improve a process.

strategic fit review—A process by which senior managers assess the future of each project or initiative proposed for a particular organization in terms of its ability to advance the mission, strategies, goals, and objectives of the organization.

strategic planning—A process for identifying and setting an organization's long-range vision, mission, goals, and objectives and identifying the actions needed to ultimately achieve the goals.

stratified random sampling—A technique for segmenting (stratifying) a population prior to drawing a random sample from each strata, the purpose being to increase precision when members of different strata would, if not stratified, cause an unrealistic distortion.

structural variation—Variation caused by regular, systematic changes in output, such as seasonal patterns and unaccustomed "blips" in long-term trends.

suboptimization—The result occurring when an individual business function fails to focus on the overall organizational objectives for producing higher efficiency and effectiveness of the entire system and instead focuses on the individual function's improvement.

supplier—Source of materials, services, or information input provided to a process. Internal suppliers provide materials or services to internal customers.

supplier audits—Reviews that are planned and carried out to verify the effectiveness of a supplier's quality program, drive improvement, and increase value.

supplier certification—Process of evaluating the performance of a supplier with the intent of authorizing the supplier to self-certify shipments if such authorization is granted.

supplier performance—The monitoring and measurement of supplier conformance to standards, good manufacturing practices, industry norms, and the customer's purchase contract, often with the use of specialized performance metrics and/or supplier audits.

supplier quality assurance—Confidence that a supplier's product or service will fulfill its customers' needs. This confidence is achieved by creating a relationship between the customer and supplier that ensures that the product will be fit for use with minimal corrective action and inspection. According to J. M. Juran, there are nine primary activities needed: (1) define product and program quality requirements, (2) evaluate alternative suppliers, (3) select suppliers, (4) conduct joint quality planning, (5) cooperate with the supplier during the execution of the contract, (6) obtain proof of conformance to requirements, (7) certify qualified suppliers, (8) conduct quality improvement programs as required, and (9) create and use supplier quality ratings.

supplier selection strategy and criteria—Selection of new suppliers is based on the type and uniqueness of the product or service to be purchased and the total cost. Suppliers of commodity-type items and basic supplies may be selected from directories and catalogs. For more sophisticated products and services, stringent evaluation criteria may be established.

supply chain—The series of processes and/or organizations that are involved in producing and delivering a product to the final user.

supply chain management (SCM)—The process of effectively integrating and managing components of the supply chain.

support systems—Starting with top management commitment and visible involvement, support systems are a cascading series of interrelated practices or actions aimed at building and sustaining support for continual quality improvement.

surveillance—Continual monitoring of a process.

surveillance audit—The regular audits conducted by registrars to confirm that a company registered to the ISO 9001 standard still complies; usually conducted on a six-month or one-year cycle.

survey—Act of examining a process or of questioning a selected sample of individuals to obtain data about a process, product, or service. A survey is generally conducted on a selected sample of a population to collect information about predetermined questions. A customer satisfaction survey is one example. Surveys may be conducted orally by a survey taker, by paper and pencil, by computer online, and so on. Responses are tabulated and analyzed to surface significant areas for change.

SWOT analysis—An assessment of an organization's key *strengths*, *weaknesses*, *opportunities*, and *threats*. It considers factors such as the organization's industry, competitive position, functional areas, and management.

symptom—An indication of a problem or opportunity.

system—A network of interdependent actions, processes, or events that work together to accomplish a common mission and goal.

system of profound knowledge (SoPK)—See *profound knowledge*.

systems approach to management—A management theory that views the organization as a unified, purposeful combination of interrelated parts; managers must look at the organization as a whole and understand that activity in one part of the organization affects all parts of the organization (also known as *systems thinking*).

T

tacit knowledge—Unarticulated heuristics and assumptions used by any individual or organization. The knowledge that comes from experience over time.

tactical plans—Short-term plans, usually of one- to two-year duration, that describe actions the organization will take to meet its strategic business plan.

tactics—The techniques and processes that help an organization meet its objectives.

Taguchi loss function—Pertains to where product characteristics deviate from the target intended and losses increase according to a parabolic function. Merely attempting to produce a product within specifications does not prevent loss (loss that is inflicted on society after shipment of a product). Any points beyond the center of the process, in either direction, even though within specifications, Taguchi considers a loss.

Taguchi methods—The American Supplier Institute's trademarked term for the quality engineering methodology developed by Genichi Taguchi. In this engineering approach to quality control, Taguchi calls for off-line quality control, online quality control, and a system of experimental design to improve quality and reduce costs.

takt time—The available production time divided by the rate of customer demand. Operating to takt time sets the production pace to customer demand.

tally sheet—Another name for check sheet.

tampering—Action taken to compensate for variation within the control limits of a stable system. Tampering increases rather than decreases variation, as evidenced in the funnel experiment.

TARP—U.S. Office of Consumer Affairs/Technical Assistance Research Programs.

task—A specific, definable activity to perform an assigned function, usually within a specified time frame.

taxonomy—Classification of terms or objects.

team—A group of two or more people who are organized to work together and held accountable for the accomplishment of a task and specific performance objective.

team-based organization/structure—A function or entire entity that consists primarily of multiple teams.

team building/development—The process of transforming a group of people into a coordinated team and developing the team to achieve its purpose.

team charter—A document that established the team and defines the values, agreements, scope of work, processes, and guidelines of the team.

team dynamics—Interactions that occur among team members under different conditions.

team facilitation—Process of dealing with both the role of the facilitator on the team and the techniques and tools for facilitating the team. See *facilitator*.

team growth, stages of—Refers to the four development stages through which groups typically progress: *forming*, *storming*, *norming*, and *performing*. Knowledge of the stages helps team members accept the normal problems that occur on the path from forming a group to becoming a team. It is suggested that *adjourning* be added to the list to deal with closing down a team's work.

team leader—A person designated to be responsible for the ongoing work and success of the team and keeping the team focused on the task assigned.

team performance evaluation, recognition, and rewards—Special metrics are needed to evaluate the work of a team (to avoid focus on any individual on the team) and as a basis for the recognition and reward for team effort and achievements.

telecommuting—Working individually, or as part of a group, performing at least some work away from the organization's primary location and accomplishing tasks with the aid of electronic technologies.

temporary/ad hoc team—A team, usually small, formed to address a short-term objective or emergency situation.

test and evaluation documents—Documents that define the inputs to the quality control activities, including checklists, requirements traceability, acceptance criteria, test plans, test cases, test procedures, and so on.

theory of constraints (TOC)—Eliyahu Goldratt's theory deals with techniques and tools for identifying and eliminating the constraints (bottlenecks) in a process to achieve greater flow of money.

theory of knowledge (TOK)—A belief that management is about prediction, and people learn not only from experience but also from theory. When people study a process and develop a theory, they can compare their predictions with their observations; profound learning results.

theory X and theory Y—A theory developed by Douglas McGregor that maintains that there are two contrasting assumptions about people, each of which is based on the manager's view of human nature. Theory X managers take a negative view and assume that most employees do not like work and try to avoid it. Theory Y managers take a positive view and believe that employees want to work, will seek and accept responsibility, and can offer creative solutions to organizational problems.

third-party audit—External audits conducted by personnel who are neither employees of the organization nor a supplier but are usually employees of certification bodies or of registrars.

three-sixty-degree (360°) feedback process—A people performance evaluation method that provides feedback from the perspectives of self, peers, direct reports, superiors, customers, and suppliers.

throughput—The rate at which the entire system generates money through sales of product or service (Goldratt's theory of constraints).

throughput time—The total time required (processing + queue) from concept to launch, or from order received to delivery, or raw materials received to delivery to customer.

TickIT—A certification of quality management systems that conform to the requirements of the ISO 9001 standard, specifically pertaining to software development.

tier—Level, rank, sequence.

TJC—The Joint Commission, formerly the Joint Commission on Accreditation of Healthcare Organizations (JCAHO).

TL 9000—Quality management standard series for the telecommunications industry.

tolerance—The variability of a parameter permitted and tolerated above or below a nominal value.

tolerance design (Taguchi)—Provides a rational grade limit for components of a system; determines which parts and processes need to be modified and to what degree it is necessary to increase their control capacity; a method for rationally determining tolerances.

tolerance limit—The maximum and minimum limit values a product may have and still meet engineering or customer requirements.

tool—Any implement or technique used for making a desirable change to materials, process, product, or approach that contributes to a quality product or service. (A narrow definition—a device used by hand, or a fixture in a machine, that cuts, strikes, shapes, marks/tags, positions, polishes, or heat-treats material in a process.)

tool life—Minimum amount of useful production that can be expected from a tool.

top management commitment—Participation and visible involvement of the organization's highest-level officials in their organization's quality improvement efforts.

total productive maintenance (TPM)—Methodologies for reducing and eventually eliminating equipment failure, setup and adjustment, minor stops, reduced speed, product rework, and scrap; preventive maintenance.

total quality management (TQM)—A term initially coined by the Naval Air Systems Command (United States) to describe its management approach to quality improvement. Total quality management (TQM) has taken on many meanings. Simply put, TQM is a management approach to long-term success through customer satisfaction. TQM is based on the participation of all members of an organization in improving processes, products, services, and the culture in which they work. TQM benefits all organization members and society. Various methods for implementing TQM are found within the teachings of such quality leaders as Philip B. Crosby, W. Edwards Deming, Armand V. Feigenbaum, Kaoru Ishikawa, J. M. Juran, and others. The Baldrige Performance Excellence Program (United States) and other criteria-based programs embody the principles of TQM.

traceability—The ability to track the history, application, or location of an item or activity, and like items or activities, by means of recorded identification.

training—The skills that employees need to learn in order to perform or improve the performance of their current job or tasks and the process of providing those skills.

training evaluation—The techniques and tools used and the process of evaluating the effectiveness of training.

training needs assessment—The techniques and tools used and the process of determining an organization's training needs.

transactional leadership—A style of leading whereby the leader sees the work as being done through clear definition of tasks and responsibilities and the provision of resources as needed.

transformational leadership—A style of leading whereby the leader articulates the vision and values necessary for the organization to succeed.

transition tree—A technique used in applying Goldratt's theory of constraints.

tree diagram—A management and planning tool that shows the hierarchy of subtasks required to achieve an objective.

trend—Consecutive points plotted against a time period that show a pattern and help to identify any unexpected occurrences. Trend plotting of sequential data points shows the direction and rate of change of an organization, work unit, or process over time.

trend analysis—The charting of data over time to identify a tendency or direction.

trilogy—See *quality trilogy*.

TRIZ—(Russian). A theory of problem-solving that aids in the solution of inventive problems. A set of analytical and knowledge-based tools that are typically hidden subconsciously in the minds of creative inventors.

***t*-test—**A method for testing hypotheses about the population mean; the *t*-statistic measures the deviation between the sample and population means, in terms of the number of standard errors.

type I error—An incorrect decision to reject something (such as a statistical hypothesis or a lot of products) when it is acceptable. Also known as *producer's risk* and *alpha risk*.

type II error—An incorrect decision to accept something when it is unacceptable. Also known as *consumer's risk* and *beta risk*.

U

***u*-chart—**Count per unit chart. Attribute control chart used to show the average number of defects in a sample; uses variable sample size. A *c*-chart uses a fixed sample size.

unconditional guarantee—An organizational policy of providing customers unquestioned remedy for any product or service deficiency.

unity of command—The concept that a subordinate should be responsible to only one superior. Note: A matrix-type organization negates this concept.

upper control limit (UCL)—Control limit for points above the central line in a control chart.

upper specification limit (USL)—Maximum limit for dimensions as specified for a product to be acceptable.

USDA—U.S. Department of Agriculture.

V

validation—Confirmation by examination of objective evidence that specific requirements and/or a specified intended use are met.

validity—Refers to the ability of a feedback instrument, and validation action taken, to measure what it was intended to measure. Validity may be measured three ways: (1) criterion related, (2) construct related, and (3) content related.

value-added—Parts of the process that add worth from the external customers' perspective.

value chain—See *supply chain*.

values—Statements that clarify the behaviors that the organization expects in order to move toward its vision and mission. Values reflect an organization's personality and culture.

value stream—The primary actions required to bring a product from concept to placing the product in the hands of the end user.

value stream mapping—The technique for mapping the value stream, typically done for the present perception and then the future perspective.

variable control chart—Data resulting from the measurement of a parameter or a variable. Control charts based on variable data include average (*X-bar*) chart, individuals (X) chart, range (R) chart, sample standard deviation (s) chart, and CUSUM chart.

variable cost—Cost that varies with production quantity, such as material and direct labor.

variables—Quantities that are subject to change.

variable sampling plan—A plan in which a sample is taken and a measurement of a specified quality characteristic is made on each unit. The measurements are summarized into a simple statistic, and the observed value is compared with an allowable value defined in the plan.

variance—The difference between a planned amount (usually money or time) and the actual amount. In math, the measure of dispersion of observations based on the mean of the squared deviations from the arithmetic mean. The square of the standard deviation, given by formula.

variation—A change in data, a characteristic, or a function that is caused by one of four factors: *special causes*, *common causes*, *tampering*, or *structural variation*. See individual entries.

velocity—The average rate of productivity per day.

verification—The act of reviewing, inspecting, testing, checking, auditing, or otherwise establishing and documenting whether items, processes, services, or documents conform to specified requirements.

vertically integrate—To bring together more of the steps involved in producing a product in order to form a continuous chain owned by the same firm; typically involves taking on activities that were previously in the external portion of the supply chain.

virtual team—A boundaryless team functioning without a commonly shared physical structure or physical contact, using electronic technology to link the team members.

vision—A statement that explains what the company wants to become and what it hopes to achieve.

visual control—A technique of positioning all tools, parts, production activities, and performance indicators so that the status of a process can be understood at a glance by everyone; providing visual cues to aid the performer in correctly processing a step or series of steps to reduce cycle time, to cut costs, to smooth flow of work, and to improve quality.

vital few, useful many—A term used by J. M. Juran to describe his use of the Pareto principle, which he first defined in 1950. (The principle was used much earlier in economics and inventory control methodologies.) The principle suggests that most effects come from relatively few causes; that is, 80% of the effects come from 20% of the possible causes. The 20% of the possible causes are referred to as the *vital few*; the remaining causes are referred to as the *useful many*. When Juran first defined this principle, he referred to the remaining causes as the *trivial many*, but realizing that no problems are trivial in quality assurance, he changed it to *useful many*.

voice of the customer—The perceived understanding of the customers' needs and expectations (*voice*) interpreted and passed downward throughout the organization to ensure, at all levels, that the organization is responding to the customers' voice.

W

walkabout—A visual group technique used during strategic planning for resolving resource planning conflicts among organizational components.

walk the talk—Not only talking about what one believes in but also being observed acting out those beliefs. Employees' buy-in to the TQM concept is more likely when management is seen involved in the process every day.

warranty—A manufacturers' published statement that defective or deficient product or service experienced by the customer, within a prescribed time period, will be remedied by the manufacturer.

waste—Activities that consume resources but add no value; visible waste (for example, scrap, rework, downtime) and invisible waste (for example, inefficient setups, wait times of people and machines, inventory).

Weibull distribution—A distribution of continuous data that can take on many different shapes and is used to describe a variety of patterns; in relation to the bathtub curve, used to define when the "infant mortality" rate has ended and a steady state has been reached (decreasing failure rate).

WIIFM—"What's in it for me?" Ask and answer WIIFM before suggesting that a change/improvement will be acceptable to affected persons.

win-win—Outcome of a negotiation that results in both parties being better off.

wisdom—The culmination of the continuum from data to information to knowledge to wisdom.

work analysis—The analysis, classification, and study of the way work is done. Work may be categorized as value-added (necessary work), or non-value-added (rework, unnecessary work, idle). Collected data may be summarized on a Pareto chart showing how people within the studied population work. The need for and value of all work is then questioned and opportunities for improvement identified. A time use analysis may also be included in the study.

workbook—A collection of exercises, questions, or problems to be solved during training; a participant's repository for documents used in training (for example, handouts).

work breakdown structure (WBS)—A project management technique by which a project is divided into tasks, subtasks, and units of work to be performed, displayed on a chart.

work group—A team type composed of people from one functional area who work together on a daily basis and whose goal is to improve the processes of their function.

work instruction—A document that answers the question "How is the work to be done?" See *procedure*.

world-class quality—A term used to indicate a standard of excellence; the best of the best.

X

x-axis—Horizontal axis on a control chart, run chart, or other chart.

***X*-bar chart**—Average chart.

Y

y-axis—Vertical axis on a control chart, run chart, or other chart.

yield—Ratio between salable goods produced and the quantity of raw materials and/or components input at the beginning of the process.

Z

zero defects—A performance standard popularized by Philip B. Crosby to address a dual attitude in the workplace: people are willing to accept imperfection in some areas, while in other areas they expect the number of defects to be zero. This dual attitude has developed because of the conditioning that people are human and humans make mistakes. The zero-defects methodology states, however, that if people commit themselves to watching details and avoiding errors, they can move closer to the goal of perfection.

zero investment improvement—Another name for a *kaizen blitz*.

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About the Editors

Sandra L. Furterer is an Associate Professor and Department Chair at the University of Dayton in the Department of Engineering Management, Systems, and Technology. Dr. Furterer has over 25 years of experience in business process and quality improvements in multiple service industries, including healthcare, retail, consulting, information systems, and financial services. She previously was a VP of Process Improvement for two financial services firms in Columbus, Ohio. She also was the Enterprise Performance Excellence leader that deployed Lean Six Sigma in a hospital system in south Florida. She holds a PhD in Industrial Engineering from the University of Central Florida, an MBA from Xavier University, and bachelor's and master's degrees in Industrial and Systems Engineering from Ohio State. She is an ASQ Certified Manager of Quality/Organizational Excellence, an ASQ Certified Six Sigma Black Belt, an ASQ Certified Quality Engineer, an ASQ fellow, and a certified Six Sigma Master Black Belt. Dr. Furterer is an author or coauthor of several textbooks and journal articles. She has refereed conference papers and proceedings publications on systems engineering, Lean Six Sigma, process improvement, operational excellence, and engineering education. Her research interests include Lean Six Sigma, quality management, and systems engineering applied to service industries.

Douglas C. Wood is President of DC Wood Consulting, LLC, and an instructor for ASQ. He has over 35 years of experience in process engineering and quality systems planning and design in food and printing industries. His experience covers project justification, information systems design, equipment capacity, supply chain measurement and management, new product quality planning, teaching university at a master of engineering level, Lean and Six Sigma teaching and applications, and cost of quality design and operation. He holds a master of science degree in Industrial Management from the University of Central Missouri and a bachelor of science degree in Industrial Engineering from Western Michigan University. He is an ASQ Certified Manager of Quality/Organizational Excellence, an ASQ Certified Six Sigma Black Belt, an ASQ Certified Quality Engineer, and an ASQ Certified Quality Auditor. He has authored or edited books and papers on numerous quality subjects. His interests include virtual instruction, meeting facilitation, research in Cost of Quality, and psychological aspects of organizational culture development.

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