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CHAPTER 2

Total Quality In Organizations

Teaching Notes

This chapter introduces the concept of quality in production and service systems and develops the idea that quality is central to effective operation of these systems. Students should be encouraged to develop an understanding of the fact that quality is not an "add-on" to organizational processes, but that it is "a way of doing business." Key objectives should be:

- To understand and appreciate the contributions of W. Edwards Deming, Joseph Juran, and Philip Crosby who are recognized as the most influential thinkers and leaders of modern quality management. A. V. Feigenbaum and Kaoru Ishikawa have also made significant contributions to modern quality management practices.

- To learn Deming's philosophy, based on improving products and services by reducing uncertainty and variation in design, manufacturing, and service processes, driven by the leadership of top management.

- To appreciate Deming's key tenets, encompassed in **The Deming Chain Reaction**, his **14 Points** representing the practices that Deming advocated for achieving quality excellence, and the four simple elements that he called a **System of Profound Knowledge**:
    - Appreciation for a system
    - Understanding variation
    - Theory of knowledge
    - Psychology

- To define a **system** as a set of functions or activities within an organization that work together for the aim of the organization. Systems thinking is critical in applying quality principles because the organizational linkages among various functions of an organization must be in alignment to meet the needs of customers and other stakeholders.

- To understand that variation exists in any production and service process, generally due to factors inherent in the design of the system, which cannot easily be controlled. Excessive variation results in products that fail or perform erratically and inconsistent service that does not meet customers' expectations. Statistical methods are the primary

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tools used to identify and quantify variation. Deming suggested that management first understand, and then work to reduce variation through improvements in technology, process design, and training.

- To know the concepts developed by Joseph Juran. Juran's philosophy sought to provide change within the current American management system by focusing on quality as *fitness for use*; his **Quality Trilogy**—planning, control, and improvement— which provided a direction for quality assurance in organizations; and his specifications for a detailed program for quality improvement, called the **breakthrough sequence.**

- To know the concepts of Philip Crosby's approach to quality, as summarized in his **Absolutes of Quality Management** – conformance to requirements, no such thing as a quality problem, doing the job right the first time, cost of quality measurement, and zero defects as the only performance standard – and **Basic Elements of Improvement** – determination, education, and implementation. He places more emphasis on behavioral change rather than on the use of statistical techniques as advocated by Deming and Juran.

- To know the concepts of two global quality thinkers, A. V. Feigenbaum and Karou Ishikawa. Feigenbaum, who views quality as a strategic business tool and coined the phrase "total quality control," developed cost of quality approaches and proposed **Three Steps to Quality**, consisting of leadership, technology, and organizational commitment. Ishikawa, who was instrumental in the Japanese quality movement, and who advocated a company-wide quality control approach, use of employee teams, and the use of problem-solving tools for quality improvement.

- To understand that total quality can be characterized by its principles, practices, and techniques. **Principles** are the foundation of the philosophy, **practices** are activities by which the principles are implemented, and **techniques** are tools and approaches that help managers and workers make the practices effective. All are vital for achieving high quality and performance excellence.

- To learn that the three core principles of TQ are customer focus, teamwork, and continuous improvement.

- To develop the capability to apply **statistical thinking**, which is is a philosophy of learning based on principles of understanding that all work occurs in a system of interconnected processes, variation exists in all processes, and variation must be understood and reduced.

- To learn that **Common causes of variation** are inherent to a process, generally account for most observed variation, and cannot be identified on an individual basis or controlled. **Special (assignable) causes of variation** are sporadic in nature and result from external

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disturbances that can usually be identified statistically and either explained or corrected. A system governed only by common causes is called a stable system.

- To appreciate that not understanding the differences between common and special causes can result in increasing the variation through tampering with stable systems, or missing opportunities to reduce special cause variation when it exists. Deming's **Red Bead experiment** and **Funnel experiment** can help clarify the differences between common and special causes and improve managers' abilities to make effective decisions. Management can make two fundamental mistakes in attempting to improve a process: 1. To treat as a special cause any fault, complaint, mistake, breakdown, accident, or shortage when it actually is due to common causes. 2. To attribute to common causes any fault, complaint, mistake, breakdown, accident, or shortage when it actually is due to a special cause.

- To consider the requirements for a **quality management system (QMS)** which is defined as a mechanism for managing and continuously improving core processes to "achieve maximum customer satisfaction at the lowest overall cost to the organization." A quality management system represents a specific implementation of quality concepts, standards, methods and tools, and is unique to an organization. A QMS provides a basis for documenting processes used to control and improve operations.

- To understand that QMS's rely on quality policies, use quality manuals for references in implementing the system, may be built on the **ISO 9000 family of standards, and** needs to be integrated with enterprise systems such as ERP, MES, and SCM, while focusing on actionable decision making, seeking the root causes of problems, and improving processes and systems.

ANSWERS TO QUALITY IN PRACTICE KEY ISSUES

<u>Bringing Quality Principles to Life at KARLEE</u>

1. Karlee seems to have a focus on their definition of quality from the user perspective. This is evidenced by their practices of carefully selecting customers that support its values—particularly a systematic approach to business and performance management, desire for long-term partnerships, and global leadership. Management and Team Leaders work with each customer to establish current requirements and future needs, and each customer is assigned a three-person Customer Service team that is on call 24 hours a day for day-to-day production issues.

The three basic principles of quality management: customer focus, focus on quality people at every level, and continuous improvement based on sound infrastructure, are obviously very important at Karlee. The company's quality focus starts with *Leadership*, including the Senior Executive Leaders (SELs) and the KARLEE Leadership Committee (KLC) who set the strategic direction of the company, and communicate and reinforce values and expectations through performance reviews, participation in improvement or strategic projects, regular interactions with customers and team members, and recognition of team member achievements.

Their quality approach depends on deployment centered on the *Involvement of People*, where teams are responsible for knowing their customer's requirements and producing according to those requirements. They use a *Process Approach*., where processes such as prototype development, scheduling, production setup, fabrication, assembly, and delivery require process owners to be responsible for maintaining the process to customer requirements. All of this is a part of their *System Approach to Management*, where strategic planning includes a strategic assessment of the entire company, and aligns corporate objectives and goals with its key business drivers. This alignment of objectives, goals and drivers leads to the need for *Continual Improvement*, a *Factual Approach to Decision Making*, and development of *Mutually Beneficial Supplier Relationships*.

2. Deming's philosophy, based on improving products and services by reducing uncertainty and variation in design, manufacturing, and service processes, driven by the leadership of top management. Karlee exemplifies these qualities through their leadership system, process design and improvement, systematic management, and employee involvement and commitment.

   Juran's "Quality Trilogy," consists of three parts: Quality planning--the process for preparing to meet quality goals; quality control--the process for meeting quality goals during operations; and quality improvement--the process for breaking through to unprecedented levels of performance. Karlee can be seen applying the Trilogy through their *System Approach to Management, Factual Approach to Decision Making, and* their approach to *Continual Improvement.*

   The concepts of Philip Crosby's approach to quality were summarized in his Absolutes of Quality Management – conformance to requirements; no such thing as a quality problem; doing the job right the first time; cost of quality measurement; and zero defects as the only performance standard – and Basic Elements of Improvement – determination, education, and implementation. He places more emphasis on behavioral change rather than on the use of statistical techniques as advocated by Deming and Juran. Once again, Karlee can be seen as adhering to these absolutes through the use of teams at every level and every interface with customers. As examples:

- Production and delivery processes are designed around cell manufacturing.Teams are empowered to change targets recommended during strategic planning if they believe it will help them achieve higher performance, as well as to schedule work, manage inventory, and design the layout of their work areas.

- Processes such as prototype development, scheduling, production setup, fabrication, assembly, and delivery require process owners to be responsible for maintaining the process to customer requirements. A Quality Assurance team member works with manufacturing teams to create process documentation.

- KARLEE uses information and data to set goals, align organizational directions and manage resource at the operating, process, and organizational levels.

- Teams use a structured approach to evaluate and improve their processes, documenting them and presenting a status report of improvements to senior leaders and the KARLEE Steering Committee. Teams benchmark competitors, "best practice" companies, and customers to learn from others.

- Teams analyze defect data, customer-reported problems, and control charts generated during production to identify problems and opportunities for improvement. Every business goal and project has defined methods for measurement, and senior leaders meet weekly to review company performance and ensure alignment with directions and plans.

- KARLEE selects and develops suppliers that share their commitment to customer satisfaction to ensure they have the materials and services needed to support their customers. Supplier performance issues and expectations are discussed with individual suppliers and presented at the annual Supplier Symposium.

<u>ISO 9000 and Sears' Quality Management System</u>

1. It is likely that Sears had to face a number of issues when it began to implement ISO 9000. The company wanted a consistent process for improving customer satisfaction and enhancing service capabilities. It no doubt needed a way to develop process standardization across the company. Sears had to overcome the hurdle of communicating the value of a QMS within a retail and service environment to all affected employees. It was also searching for fundamental tools to provide the company with a safe base for continued improvements.

2. Sears probably had to review and revise all management and operating practices to conform to the Quality Management Principles of ISO 9000, including:

   Principle 1: Customer Focus - understanding current and future customer needs, meeting customer requirements, and striving to exceed customer expectations.

Principle 2: Leadership - leaders establishing unity of purpose and direction of the organization.

Principle 3: Involvement of People - full involvement of people at all levels to enable their abilities to be used for the organization's benefit.

Principle 4: Process Approach – achieving desired results more efficiently by managing activities and related resources as a process.

Principle 5: System Approach to Management- identifying, understanding, and managing interrelated processes as a system, thus contributing to the organization's effectiveness and efficiency in achieving its objectives.

Principle 6: Continual Improvement – ensuring that continual improvement of the organization's overall performance becomes a permanent objective.

Principle 7: Factual Approach to Decision Making – basing decisions on the analysis of data and information.

Principle 8: Mutually Beneficial Supplier Relationships – ensuring that all associates understand that an organization and its suppliers are interdependent and a mutually beneficial relationship enhances the ability of both to create value.

These principles were seen in operation as Sears made dramatic improvements in such areas as calibrating the tools used for repairs and service calls. The company began 100-percent tool calibration for safety purposes, which led to opening and registering its own calibration lab to ISO/IEC 17025. Sears improved its existing hazardous-materials program by implementing a comprehensive program on refrigerant handling. Efficiency in completing repairs in the Chattanooga, Tennessee, carry-in facility was doubled. Sears' district office in Houston improved its technician recall rate, which was reduced from about 12 percent to 7.9 percent. Finally, ISO 9001 was instrumental in helping to standardize the manner in which technicians record field observations. To ensure consistency, technicians use a special tool kit for recording the event, including a disposable camera and standardized forms.

The issues of customer satisfaction and enhancing service capabilities have improved as indicated by quicker service times and reduced callback rates. Process standardization across the company is reflected in the tool calibration and technician record-keeping processes. The hurdle of communicating the value of a QMS within a retail and service environment to all affected employees has taken place as improvements have been successfully implemented. And, the search for fundamental tools to provide the company with a safe base for continued improvements seems to have been successful, as ISO 9000 requirements have driven the improvement process.

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ANSWERS TO REVIEW QUESTIONS

1. Deming's (assumed) definition of quality is perhaps closest to the user perspective and to the definition of quality as "fitness for intended use."

   Unstated, but implied, is the fact that (as Deming spelled out in his 14 Points): quality is the result of action taken by management, acting as leaders, with the willing cooperation of knowledgeable workers, to constantly and forever improve products and services by reducing variability and uncertainty in processes, thereby remaining competitive and providing profits and enough jobs for everyone.

2. The Deming "chain reaction" theory states that by (a) improving quality, a firm can (b) decrease costs because of less rework, fewer mistakes, delays, and snags, and better use of time and materials, thus (c) improving productivity. The firm will therefore be able to (d) capture the market with better quality and lower prices, and thus, not only (e) stay in business, but also (f) provide and create more jobs.

3. As will be explained in more detail in the answer to question 4, below, Deming's System of Profound Knowledge consists of four interrelated parts: (1) appreciation for a system; (2) understanding of variation; (3) theory of knowledge; and (4) psychology. There are a number of ways to classify his 14 Points, which could include these as categories.

   Under appreciation for a system, points 1, 2, 4, 5, 9, 13, and 14 are most oriented towards systems. Numbers 1 and 2, relating to vision, commitment, and development of a new philosophy of leadership require a "big picture" view of the organization and its place in business and society. Number 4 relates to the requirement that total costs, not incremental costs, must be optimized throughout an organizational system. Number 5 is a call to make improvements continuously throughout the system. Number 9 requires the development of teamwork and breaking down of artificial barriers between departments and organizational units. Number 13 relates to broad education to benefit both the organization and society, in the long run. Point 14 calls for a major cultural change within the organization, and is similar to point 2.

   To understand variation, Deming established points 3, 5, 10, and 11. Point 3 requires that everyone understand inspection and use it to understand variation by avoiding mass inspection. Point 5 advises to "improve constantly and forever," thus eliminating the causes of excessive variation and waste. Number 10 suggests that improvement does not take place by exhorting workers to do a better job, but by understanding the cause of poor quality and eliminating them. Point 11 makes a similar point that quotas and management by objectives are approaches that do not encourage improvement, but instead, create fear. As Scholtes explained, when people don't understand the theory of knowledge, they don't know how to plan, accomplish learning, improve, change, or solve problems, despite their best efforts. Thus points 1, 2, 5, 6, and 13 may be seen as falling under

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theory of knowledge category. Deming's concept in points 1 and 2 of constancy of purpose and learning his "new philosophy" are needed in order to effectively plan, learn and change. Point 5 relating to constant improvement is also essential to knowledge, as is point 6 on instituting training, so that workers will be able to understand their work processes, predict the result of changes, and actively participate in problem solving and improvement. Point 13 is related in that it advises that education and self-improvement will assist the organization in learning, changing, improving and reaching organizational goals.

An understanding and appreciation of psychology is a requirement for points 7 through 13. Each of these has leadership and motivational characteristics that are essential to Deming's new philosophy and to improved quality and productivity. Numbers 7 and 11 are related to improving leadership; points 8, 9, 10, 11, and 12 advise removing barriers that keep workers from doing their best, most effective work; and number 13 advises that workers should be educated, not just trained.

4. Deming's System of Profound Knowledge consists of four interrelated parts: (1) appreciation for a system; (2) understanding of variation; (3) theory of knowledge; and (4) psychology. Appreciating a system involves understanding how each component of the system works to produce the end product or service, and understanding how the system may be optimized for better or smoother performance. Understanding of variation involves knowing and anticipating factors (i.e. increasing personnel, the wearing out of tools) that may cause the system to change, for better or worse. Theory of knowledge involves understanding the system and current and possible variations within, to the point where past and present events and performance can suggest possible outcomes of future courses of action within the system. Psychology involves understanding what motivates people, including the facts that people must enjoy their work, be treated with respect, work within a system that promotes dignity and self-esteem, receive adequate recognition, not just financial remuneration, and feel that they are part of a winning, high quality team that makes a difference. The four support each other, because if you don't understand systems, then you often overlook the importance of variation. The theory of knowledge points out that understanding theory and building on experience is essential for learning to take place. Finally, an essential part of the system, people and their motivations, must be studied in theory and in practice, and that knowledge (including variations in how people respond to each other and the work environment) is integral to an effective and efficient system.

5. A system is the set of functions or activities within an organization that work together for the aim of the organization. Systems thinking is critical to the application of quality, because it supplies organizational linkages that help to align various functions, in order to meet the needs of customers and other stakeholders.

6. Variation exists in any production and service process, generally due to factors inherent in the design of the system, which cannot easily be controlled. Today, modern technology

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has improved our ability to produce many physical parts with very little variation; however, the variation that stems from human behavior and performance continues to hamper quality efforts. Deming suggested that management first understand, and then work to reduce variation through improvements in technology, process design, and training. With less variation, both the producer and consumer benefit. The producer benefits by needing less inspection, experiencing less scrap and rework, and having more consistent human performance, resulting in higher productivity and customer satisfaction. The consumer has the advantage of knowing that all products and services have similar quality characteristics and will perform or be delivered consistently. This advantage can be especially critical when the consumer is another firm using those products.

Excessive variation results in products that fail or perform erratically and inconsistent service that does not meet customers' expectations. Statistical methods are the primary tools used to identify and quantify variation. Deming proposed that every employee in the firm be familiar with statistical techniques and other problem-solving tools.

7. As Scholtes explained, lack of understanding of the components of Profound Knowledge can have a profound impact on the health of organizations. To briefly summarize the multiple points that Scholtes made is difficult. However, he pointed out that when people don't understand **systems**, they basically don't understand that incidents, interventions, and control are the net result of many actions and interdependent forces. When people don't understand **variation**, they don't understand the difference between prediction, forecasting, and guesswork, thus being unable to distinguish between fact and opinion. When people don't understand **psychology**, they don't understand motivation or why people do what they do, which causes them to misunderstand change and resistance to it. When people don't understand the **theory of knowledge**, they don't know how to plan, accomplish learning, improve, change, or solve problems, despite their best efforts.

8. Juran's "Quality Trilogy," like all trilogies, consists of three parts: Quality planning--the process for preparing to meet quality goals; quality control--the process for meeting quality goals during operations; and quality improvement--the process for breaking through to unprecedented levels of performance.

   Quality planning begins with identifying customers, both external and internal, determining their needs, and developing product features that respond to customer needs. Quality goals are then established that meet the needs of customers and suppliers alike, and do so at a minimum combined cost.

   Quality control involves determining what to control, establishing units of measurement so that data may be objectively evaluated, establishing standards of performance, measuring actual performance, interpreting the difference between actual performance and the standard, and taking action on the difference.

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Juran specifies a program for quality improvement which involves proving the need for improvement, identifying specific projects for improvement, organizing guidance for the projects, diagnosing the causes, providing remedies for the causes, proving that the remedies are effective under operating conditions, and providing control to maintain improvements.

9. According to Juran, all breakthroughs follow a commonsense sequence of discovery, organization, diagnosis, corrective action, and control, which he formalized as the **breakthrough sequence**, and which can be summarized as follows:

Proof of the need: Managers, especially top managers, need to be convinced that quality improvements are simply good economics. Through data collection efforts, information on poor quality, low productivity, or poor service can be translated into the language of money—the universal language of top management—to justify a request for resources to implement a quality improvement program.

Project identification: All breakthroughs are achieved project-by-project, and in no other way. By taking a project approach, management provides a forum for converting an atmosphere of defensiveness or blame into one of constructive action. Participation in a project increases the likelihood that the participant will act on the results.

Organization for breakthrough: Organization for improvement requires a clear responsibility for guiding the project. The responsibility for the project may be as broad as an entire division with formal committee structures or as narrow as a small group of workers at one production operation. These groups provide the definition and agreement as to the specific aims of the project, the authority to conduct experiments, and implementation strategies. The path from problem to solution consists of two journeys: one from symptom to cause (the diagnostic journey) and the other from cause to remedy (the remedial journey), which must be performed by different individuals with the appropriate skills.

Diagnostic journey: Diagnosticians skilled in data collection, statistics, and other problem-solving tools are needed at this stage. Some projects will require full-time, specialized experts (such as Six Sigma Black Belts) while the workforce can perform others. Management-controllable and operator-controllable problems require different methods of diagnosis and remedy.

Remedial journey: The remedial journey consists of several phases: choosing an alternative that optimizes total cost (similar to one of Deming's points), implementing remedial action, and dealing with resistance to change.

Holding the gains: This final step involves establishing the new standards and procedures, training the workforce, and instituting controls to make sure that the breakthrough does not die over time.

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10. Like Deming, Juran advocated company-wide quality management, with a never-ending process of quality improvement, involving such activities as market research, product development, production process control, inspection and testing, and customer feedback. He emphasized the need for management commitment to quality improvement, and the need for training of all employees in quality techniques. Juran also asked workers to get to know their external and internal customers, and to identify and reduce causes of variation by determining the difference between standard and actual performance and taking action on the difference.

    Unlike Deming, Juran did not propose major cultural changes in the organization, but sought to improve quality within the system familiar to U.S. managers. His detailed plan was based on identifying areas for improvement and acting accordingly. Juran also recognized the different "languages," or trains of thought, which occupy different levels of an organization, and advocated communication between these "languages," where Deming proposed that statistics should be shared as a common language.

11. Crosby's Absolutes of Quality Management are:

    (1) Quality means conformance to requirements, not elegance. Crosby sees requirements as being ironclad; they are communication devices which must be clearly stated so that they cannot be misunderstood. Once this is done, a company can take measurements to determine conformance to those requirements.

    (2) Crosby maintains there is no such thing as a quality problem. Those individuals or departments that cause them, so there are accounting problems, manufacturing problems, logic problems, etc, must identify problems.

    (3) There is no such thing as the economics of quality; it is always cheaper to do the job right the first time. Most of us will remember this one as a frequent and sometime annoying axiom, used by our mothers every time we had to perform some complicated chore. Crosby supports the premise that "economics of quality" has no meaning. Quality is free. What costs money are all actions that involve not doing jobs right the first time.

    (4) The only performance measurement is the cost of quality. The cost of quality is the expense of nonconformance. Crosby's program calls for measuring and publicizing the cost of poor quality.

    (5) The only performance standard is "Zero Defects." Zero Defects is a performance standard, NOT a motivational program. The idea behind ZD is to do it right the first time, to concentrate on preventing defects rather than just finding and fixing them.

    (6) People are conditioned to believe that error is inevitable; thus they not only accept error, they anticipate it. Each of us has limits within which we can accept errors.

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Eventually we reach a point where the errors are unacceptable. This usually occurs when the errors affect us personally, such as when you discover that your bank has made a $100 error in your account, in *their* favor.

Crosby's Basic Elements of Improvement include determination, education, and implementation. According to Crosby, most human error is caused by lack of attention rather than lack of knowledge. Lack of attention is created when we assume that error is inevitable. By determination, Crosby means that top management must be serious about quality improvement. Everyone must understand the Absolutes; this can be accomplished only through education. Finally, every member of the management team must understand the implementation process.

Like Deming, Crosby advocated interior searches by individual departments (i.e. manufacturing, accounting) within a firm for sources of negative variation and acting to reduce these. He also advocated the policy of doing the job right the first time. Unlike Deming, Crosby's plan focuses on managerial thinking, calling for change within the current system, holding employees, as well as management, accountable for reducing defects, and not requiring a complete organizational overhaul.

12. A.V. Feigenbaum was primarily known for three contributions to quality -- his international promotion of the quality ethic, his development of the concept of total quality control, and his development of the quality cost classification.

    Kaoru Ishikawa was instrumental in the development of the broad outlines of Japanese quality strategy, the concept of CWQC, the audit process used for determining whether a company will be selected to receive the Deming award, the quality control circle, and cause-and-effect diagrams--a principle tool for quality management.

13. Quality *principles* are the foundation of the philosophy, *practices* are activities by which the principles are implemented, and *techniques* are tools and approaches that help managers and workers make the practices effective. All are vital for achieving high quality and performance excellence.

14. *Principle 1: Customer Focus* - Organizations depend on their customers and therefore should understand current and future customer needs, should meet customer requirements, and strive to exceed customer expectations.

    Principle 2: Leadership - Leaders establish unity of purpose and direction of the organization. They should create and maintain the internal environment in which people can become fully involved in achieving the organization's objectives.

    Principle 3: *Involvement of People* - People at all levels are the essence of an organization and their full involvement enables their abilities to be used for the organization's benefit.

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Principle 4: Process Approach - A desired result is achieved more efficiently when activities and related resources are managed as a process.

Principle 5: System Approach to Management - Identifying, understanding, and managing interrelated processes as a system contributes to the organization's effectiveness and efficiency in achieving its objectives.

Principle 6: Continual Improvement - Continual improvement of the organization's overall performance should be a permanent objective of the organization.

Principle 7: Factual Approach to Decision Making - Effective decisions are based on the analysis of data and information.

Principle 8: Mutually Beneficial Supplier Relationships - An organization and its suppliers are interdependent and a mutually beneficial relationship enhances the ability of both to create value.

15. Practices associated with quality principles include:

Principle 1: Customer Focus

- Researching and understanding customer needs and expectations.
- Ensuring that the objectives of the organization are linked to customer needs and expectations.
- Communicating customer needs and expectations throughout the organization.
- Measuring customer satisfaction and acting on the results.
- Systematically managing customer relationships.
- Ensuring a balanced approach between satisfying customers and other interested parties (such as owners, employees, suppliers, financiers, local communities and society as a whole).

Principle 2: Leadership

- Considering the needs of all interested parties including customers, owners, employees, suppliers, financiers, local communities and society as a whole.
- Establishing a clear vision of the organization's future.
- Setting challenging goals and targets.
- Creating and sustaining shared values, fairness and ethical role models at all levels of the organization.
- Establishing trust and eliminating fear.
- Providing people with the required resources, training and freedom to act with responsibility and accountability.
- Inspiring, encouraging and recognizing people's contributions.

Principle 3: Involvement of People

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- People understanding the importance of their contribution and role in the organization.
- People identifying constraints to their performance.
- People accepting ownership of problems and their responsibility for solving them.
- People evaluating their performance against their personal goals and objectives.
- People actively seeking opportunities to enhance their competence, knowledge and experience.
- People freely sharing knowledge and experience.
- People openly discussing problems and issues.

Principle 4: Process Approach

- Systematically defining the activities necessary to obtain a desired result.
- Establishing clear responsibility and accountability for managing key activities.
- Analyzing and measuring of the capability of key activities.
- Identifying the interfaces of key activities within and between the functions of the organization.
- Focusing on the factors such as resources, methods, and materials that will improve key activities of the organization.
- Evaluating risks, consequences and impacts of activities on customers, suppliers and other interested parties.

Principle 5: System Approach to Management

- Structuring a system to achieve the organization's objectives in the most effective and efficient way.
- Understanding the interdependencies between the processes of the system.
- Structured approaches that harmonize and integrate processes.
- Providing a better understanding of the roles and responsibilities necessary for achieving common objectives and thereby reducing cross-functional barriers.
- Understanding organizational capabilities and establishing resource constraints prior to action.
- Targeting and defining how specific activities within a system should operate.
- Continually improving the system through measurement and evaluation.

Principle 6: Continual Improvement

- Employing a consistent organization-wide approach to continual improvement of the organization's performance.
- Providing people with training in the methods and tools of continual improvement.
- Making continual improvement of products, processes and systems an objective for every individual in the organization.
- Establishing goals to guide, and measures to track, continual improvement.
- Recognizing and acknowledging improvements.

Principle 7: Factual Approach to Decision Making

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- Ensuring that data and information are sufficiently accurate and reliable.
- Making data accessible to those who need it.
- Analyzing data and information using valid methods.
- Making decisions and taking action based on factual analysis, balanced with experience and intuition.

Principle 8: Mutually Beneficial Supplier Relationships

- Establishing relationships that balance short-term gains with long-term considerations.
- Pooling of expertise and resources with partners.
- Identifying and selecting key suppliers.
- Clear and open communication.
- Sharing information and future plans.
- Establishing joint development and improvement activities.
- Inspiring, encouraging and recognizing improvements and achievements by suppliers.

16. Statistical thinking is a philosophy of learning and action based on these principles:
    1. All work occurs in a system of interconnected processes.
    2. Variation exists in all processes.
    3. Understanding and reducing variation are keys to success.

    Understanding processes provides the context for determining the effects of variation and the proper type of managerial action to be taken. By viewing work as a process, we can apply statistical tools to establish consistent, predictable processes, study them, and improve them. While variation exists everywhere, many business decisions do not often account for it, and managers frequently confuse common and special causes of variation.

17. Operational problems created by excessive variation include:
    - *Variation increases unpredictability:* If we don't understand the variation in a system, we cannot predict its future performance.
    - *Variation reduces capacity utilization:* If a process has little variability, then managers can increase the load on the process because they do not have to incorporate slack into their production plans.
    - *Variation contributes to a "bullwhip" effect:* This well-known phenomenon occurs in supply chains; when small changes in demand occur, the variation in production and inventory levels becomes increasingly amplified upstream at distribution centers, factories, and suppliers, resulting in unnecessary costs and difficulties in managing material flow.
    - *Variation makes it difficult to find root causes:* Process variation makes it difficult to determine whether problems are due to external factors such as raw materials or reside within the processes themselves.

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- *Variation makes it difficult to detect potential problems early:* Unusual variation is a signal that problems exist; if a process has little inherent variation, then it is easier to detect when a problem actually does occur.

18. Common causes of variation occur as a natural part of the process and are difficult to change without making a major change in the system of which they are a part. Special causes of variation arise from sources outside the system and can generally be traced back to a specific change that has occurred and needs correction. For example, a process may be stable and running well until the supplier of a critical material is changed. The new vendor's material causes the process to go out of control (becomes unstable), so the "solution" to the special cause is to have the vendor correct the deficiency, or return to the previous supplier for materials.

19. The two fundamental mistakes which managers can make in attempting to improve a process are: (1) To treat as a special (or outside) cause any fault, complaint, mistake, breakdown, accident, or shortage which is actually due to common causes, and (2) to attribute to common causes any fault, complaint, mistake, breakdown, accident, or shortage which is actually due to a special cause. In the first case, tampering with a stable system can increase the variation in the system. In the second case, the opportunity to reduce variation is missed because the amount of variation is mistakenly assumed to be uncontrollable.

20. The Red Bead experiment emphasizes that little, if anything, can improve quality in a poorly-managed production system. In the experiment, managers control incoming material (white and red beads) and work procedures so rigidly that there is little room for change. It is their mistake that there is an input of red bead (defective) production material which the workers cannot stop from coming. Management inspects the beads only *after* they (and the mistakes involved) have been made. No amount of encouragement, threats, or promises of rewards will improve quality production when it is inevitable, by the nature of the process, that red beads will be produced. Furthermore, the managers have mistakenly believed that the variables in the process *are* controllable, and therefore that the workers are simply not trying hard enough in their labors. The final point of the Red Bead experiment is that *all factors* of a process must be examined to locate and correct negative variations.

    The Funnel experiment is designed to show how people can and do affect the outcome of a process and create unwanted variation by "tampering" with the process, or indiscriminately trying to remove common causes of variation. The system of dropping the ball through the funnel towards the target is damaged by the variation of each participant moving the funnel around to "get a better aim" at the target. The lesson is that once a plan or process is determined to be correct and is set in motion, no components of the process should be tampered with. The process should be adjusted only if the entire process has been thoroughly examined and found to be in need of change in some way.

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21. According to the ASQ online glossary, a **quality management system (QMS)** can be considered a mechanism for managing and continuously improving core processes to "achieve maximum customer satisfaction at the lowest overall cost to the organization." It applies and synthesizes standards, methods and tools to achieve quality-related goals. Thus, a quality management system represents a specific implementation of quality concepts, standards, methods and tools, and is unique to an organization. A QMS provides a basis for documenting processes used to control and improve operations, and achieve the following objectives:
    - Higher product conformity and less variation.
    - Fewer defects, waste, rework, and human error.
    - Improved productivity, efficiency and effectiveness.
    - Drive innovation.

22. The ISO 9000 family of standards are a set of standards and guidelines for quality management systems that represents an international consensus on good quality management practices. They provide a comprehensive framework for designing and managing a quality management system and help organizations establish a process orientation and the discipline to document and control key processes.

    The original objectives of the ISO 9000 standards were to:
    1. Achieve, maintain, and seek to continuously improve product quality (including services) in relationship to requirements.
    2. Improve the quality of operations to continually meet customers' and stakeholders' stated and implied needs.
    3. Provide confidence to internal management and other employees that quality requirements are being fulfilled and that improvement is taking place.
    4. Provide confidence to customers and other stakeholders that quality requirements are being achieved in the delivered product.
    5. Provide confidence that quality system requirements are fulfilled.

    In the year 2000, ISO 9000:2000 was structurally changed and simplified versus the original ISO 9000 standard. It placed much more emphasis on quality management concepts, as contrasted with procedural correctness of the previous standard.

    The key requirements of ISO 9000 include:

    Quality management system
    Management responsibility
    Resource management
    Product realization
    Measurement, analysis and improvement

23. The three principal benefits of ISO 9000 are:

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- *It provides discipline*. The ISO 9001 requirement for audits forces an organization to review its quality system on a routine basis. If it fails to maintain the quality system, audits should recognize this and call for corrective action.
- *It contains the basics of a good quality system*. ISO 9001 includes basic requirements for any sound quality system, such as understanding customer requirements, ensuring the ability to meet them, ensuring people resources capable of doing the work that affects quality, ensuring physical resources and support services needed to meet product requirements, and ensuring that problems are identified and corrected.
- *It offers a marketing program*. ISO certified organizations can use their status to differentiate themselves in the eyes of customers.

In addition to improving internal operations, the most important reasons why companies seek ISO 9000 certification include:
a. *Meeting contractual obligations*-- Some customers now require certification of all their suppliers. Suppliers that do not pursue registration will eventually lose customers.
b. *Meeting trade regulations*-- Many products sold in Europe, such as telecommunication terminal equipment, medical devices, gas appliances, toys, and construction products require product certifications to assure safety. Often, ISO certification is necessary to obtain product certification.
c. *Marketing goods in Europe*--ISO 9000 is widely accepted within the European Community. It is fast becoming a *de facto* requirement for doing business in the region.
d. *Gaining a competitive advantage*--Many customers use ISO registration as a basis for supplier selection. Companies without it may be at a market disadvantage.

24. A primary reason why not all quality management systems are effective is, as one practitioner has observed: many quality management systems focus more on compliance rather than improving quality. This is an easy trap to fall into, when applying ISO 9000 or other compliance processes such as those in life-science manufacturing, which are regulated by the Food and Drug Administration. The goals of the quality department often become disconnected from the quality processes across the organization if the focus evolves toward simply maintaining data and documentation to display an ISO certificate or to meet regulatory requirements. For example, studies in the life-sciences industry have shown that less than 40% of organizations have integrated their QMS with enterprise resource planning (ERP), less than 30% with manufacturing execution systems (MES), and only about 25% with supply chain management (SCM).

To make QMS's effective, the entire section on Management Responsibility in ISO 9000:2000 should be studied and heeded. It is concerned with the role of leadership in driving a quality system. For example, the standards require that "Top management shall provide evidence of its commitment to the development and implementation of the quality management system and continually improving its effectiveness by a) communicating to the organization the importance of meeting customer as well as statutory and regulatory requirements, b) establishing the quality policy, c) ensuring that

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quality objectives are established, d) conducting management reviews, and e) ensuring the availability of resources."

ANSWERS TO DISCUSSION QUESTIONS

1. When one compares the Deming Chain Reaction (Figure 2.1) with Figure 1.3, which suggests the relationships between quality and profitability one can see that Deming's model emphasizes quality of conformance on the right-hand side of the quality and profitability model (Figure 1.3). Although "the market" is mentioned in Deming's model, quality of design is not explicitly treated. Lower prices in his model also imply cost reductions which are passed on to customers, as opposed to higher prices in Figure 1.3. The case could be made for using either model in a presentation to senior managers. A VP of operations could appreciate the need for, and advantages of, reducing scrap, rework, and snags in production in order to reduce costs and increase profitability. A "big-picture" VP of marketing or CEO might appreciate the balanced view of quality of design and quality of conformance, and the role that each play in producing a quality product. The VP of finance would also "salivate" at the prospect of increasing margins by both charging higher prices and lowering cost of conformance, simultaneously! A different model to capture both might "graft" the Deming model onto the right-hand side of Figure 1.3 to show the impact of quality of conformance.

2. Deming's 14 points are interrelated as part of a complete system. They support each other as part of a complete system for managing. For example, Point #1 requires that managers publish a statement of the aims and purposes of the organization. Point #9 states that management must optimize the efforts of teams, groups, and staff areas toward meeting the aims and purposes of the organization. Deming felt that a company - the whole company - must commit to quality as a total effort, as published in their aims and purposes. This means that all 14 points must be adopted as a package. You can't embrace the quality philosophy in one area of work and ignore it in another. If each person is responsible for their own quality, then you don't need many of the rules, regulations, and external controls that have been the "norm" in many organizations for decades. This suggests that management must take on a new leadership role to foster innovation, change, improvement and high quality at every level in the organization.

3. Deming's 14 points may be put into the six categories listed, but it should be realized that some of his 14 points apply to more than one category.

   a. Organizational purpose and mission: Points 1, 7, 9, and 14. These relate the need to develop a mission statement (aims and purposes), publish the statement, develop leadership to carry out the purpose, focus the efforts of <u>everyone</u> on the mission, and <u>act</u> to ensure that the transformation happens.
   b. Quantitative goals: Points 3, 4, 8, 10, 11.a. & 11.b. These points may not be chosen by everyone, but several have "hidden agendas" that relate to quantitative goals. Inspection (point 3) is frequently used to develop quantitative goals and to "catch"

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problems (and the people who supposedly caused them) after they have occurred. Price tags (point 3), rather than overall quality levels, are the quantitative goal used to measure the efficiency, rather than effectiveness of the purchasing function. Fear (point 8) has been heightened, as workers are exhorted (point 10) to "do better" and meet their quotas and goals (points 11a. and b.).

c. The revolution in management philosophy: Points 2, 7, and 14. These points are keys to the change in management philosophy, but all 14 points really are needed to encompass the philosophy. Deming said that leadership, training, appropriate uses of inspection, purchasing based on quality (instead of cost, alone), self-development, and continuous improvement go hand-in-hand.

d. Elimination of seat-of-the-pants decisions. Points 3, 4, 5, and perhaps 11. Seat-of-the-pants decisions seem to flow from faulty logic and the short-term pressure to meet goals in order to make the "bottom line" look good. The best decisions seem to be made when the system is thoroughly understood, workers are taught personal responsibility and problem-solving skills, and the focus is on long-term objectives and constant long-term commitment to quality.

e. Build cooperation. Points 1, 2, and 6-13. All of the development of a common philosophy, leadership, training, and casting out fear is aimed toward improving cooperation.

f. Improve manager-worker relations. Points 7, 8, 9, 12, and 13. These points cover management-worker relations in more detail, but building cooperation, as covered by the points in part (e), above, also contributes to improved worker-manager relations.

4. In the year 2000, Deming proposed a “newer” version of the 14 Points versus the “original” 14 Points. This version showed more of a “systems” emphasis than the original. For a number of points, Deming shortened and simplified them, perhaps to eliminate the obvious duplications, and perhaps to make them easier to remember.

The team of quality professionals who suggested the revised version of Deming's 14 Points "for the 21st century," as given in Table 2.4 seemed to take a more “process” view, while attempting to retain some of the concepts of Deming’s systems view. It is not easy to compare these points with Deming's version in Table 2.1, because they do not match, point for point.

Deming constantly questioned the “mind-set” of managers, and challenged them to “adopt a new philosophy.” Deming was not afraid to suggest that management actions or inactions were at the heart of quality problems, and that behavioral goals needed to be set. The new 21st century version of the 14 points seem to recognize that there are process problems that management can correct, but the critical tone that Deming took, and the management behaviors that he advocated, are avoided by the 21st century version.

21st Century Version

1. Increase value through products and services that delight customers.

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2. Connect customer requirements to key process variables.
3. Prevent, where possible; inspect where necessary; implement process management.
4. Pick the vital few suppliers based on total cost and fit with the organization.
5. Improve processes now; find those that will need it later; sustain gains over time.
6. Build training into jobs so employees can improve their performance.
7. Know employees, listen to them and give them what they need to excel.
8. Set clear expectations for reasonable standards, and hold all accountable.
9. Build cooperation from the top down by reducing barriers between departments.
10. Connect targets and metrics to customer needs; train employees to understand them.
11. Avoid arbitrary goals; prefer ones in which metrics encourage "right the first time."
12. Measure employees against their personal best; use metrics they can track.
13. Help leaders model the right behaviors, and support the firm's goals for training.
14. Align employees with jobs, suppliers with the firm and the firm with the future.

<u>Deming's Version (Abbreviated)</u>

1. *Create a Vision and Demonstrate Commitment*. Originally, in Deming's earlier version, commitment to aims and purposes of the organization by senior leaders was something that might or might not be made clear to employees throughout the organization. In the newer version, Deming urged that it be "published" to all employees.
2. *Learn the New Philosophy*. Again, the older version suggested that it was primarily the job of management to adopt the new philosophy and provide leadership for change. The new version emphasizes the need for communication of values, expectations, customer focus, and learning as a key area for everyone.
3. *Understand Inspection*. In the old version, it appeared that Deming wanted to end inspection (although a closer reading showed that he did not advocate ending all inspection). The newer version suggests the need to develop appropriate measurement plans and to understand where measurement should and should not be used.
4. *End Price Tag Decisions*. The new version makes the simple statement, without prescribing how this should be done, as the old version did.
5. *Improve Constantly*. This statement is a simplification of his old version of this point, as are the points 6, 7, 8, 10, 12, 13, and 14. He seemed to be willing to let the statements speak for themselves, rather than drawing out their implications or results. Thus it is obvious (he might say) that continuous improvement is to be done so that it will increase quality and reduce costs.
6. *Institute Training*. Recognizes the critical importance of training.
7. *Teach and Institute Leadership*. The new version states that leadership should be *taught*, as well as instituted.
8. *Drive Out Fear and Innovate*. The new version of this point expands the emphasis to include developing trust and innovation, which is an interesting confluence. Deming implies that when fear is driven out, it is replaced by trust, which then can create a climate for innovation.

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9. *Optimize the Efforts of Teams and Staff*. This point has been broadened considerably to imply that teamwork is the activity required to deploy and optimize the aims and purposes of the organization. The older version indicated that the need for teamwork was related to removing barriers between departments so that problems could be foreseen and solved. This is not negated in the new version, but a vertical dimension is introduced, to complement the horizontal dimension.
10. *Eliminate Exhortations*. Once again, Deming simplifies the old wording, to eliminate the (to him) obvious statements.
11. *Eliminate Quotas and MBO; Institute Improvement; and Understand Processes*. Deming saw no need for work standards, quotas, and management by objectives approaches. He assumed that if everyone was working constantly toward process understanding and quality improvement, that there would be no need to exhort workers to work harder to meet numerical goals.
12. *Remove Barriers*. This is a simplification of his previous point, which had two parts to cover workers and managers.
13. *Encourage Education*. This point is similar to point 6, but takes a broader view that education, as well as training, is essential for all employees.
14. *Take Action*. This is the role of leadership, but everyone has to be involved in the transformation process.

Opinions of students about the 21st century revision will vary. Some may think that the revised version is more practical than Deming's version. Others may share Deming's view that without a change in the mind-set of management, many quality improvement efforts are doomed to failure. Organizations today may use them to improve quality, but should examine their systems to see if Deming's philosophy and aims have also been incorporated.

5. Fear can become apparent in many ways in organizations. Workers will tend to do only what they are told to do. They will be afraid to "stick their necks out." Managers will be the last to hear of a quality or production problem, because there is a tendency to "shoot the messenger," who brings bad news. Rules, both for managers and workers, will become more important than producing a quality products or services. Turnover will be high and morale will be low. If there is a union, grievances will probably be high, due to the lack of union-management trust and cooperation. It is difficult to "root out" fear, once it has become established. Trust must be rebuilt, and workers must be rewarded for bringing problems forward before they become crises. Workers must also be encouraged and rewarded for developing innovative ideas and improving processes.

6. Deming's philosophy can be applied to an academic environment, but only with concerted efforts on the part of faculty, administrators, and students. Professors obviously serve in a key role in transforming the classroom to a "total quality" environment. Unless they "adopt the new philosophy," change will never come about. Many classes operate on a "control" model and the professor must work hard to "cast out fear." Administrators have a long way to go in learning how to "Improve constantly and forever the system of

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production and service." Students must learn to work together in teams to "Optimize toward the aims and purposes of the [organization]..." Still, there are a number of departments, colleges of business and engineering, and even universities that are trying and succeeding in applying the Deming principles to improve classroom performance.

7. Deming's classic example of the woman on the airplane is an illustration of sub-optimization -- optimizing goals of a sub-unit of an organization while undermining the goals of the larger organization. It shows that the people in the Travel Department did not understand the concept of the system in which they worked. Thus, the components of any system must work together if the system is to be effective. As pointed out in the answer to question 5, suboptimization results in losses to everybody in the system. The Travel Department wins, the traveler's department loses, etc. Management must have an aim, a purpose toward which the system continually strives and must understand the interrelationships among the systems' components and among the people that work in it. Deming believed that the aim of any system should be optimization for everybody—stockholders, employees, customers, community—and the environment to gain over the long term.

   This example also illustrates to danger of ignoring Deming's Point 4 of the 14 Points: *Stop making decisions purely on the basis of cost.* Purchasing departments have long been driven by cost minimization without regard for quality. By tradition, the purchasing manager's (and probably the Travel Department manager's) performance is evaluated by cost. What is the true cost of purchasing substandard airline tickets? The direct costs of poor quality performance of the executive when she arrived at her destination, as well as the possible loss of customer goodwill, can far exceed the cost "savings" perceived by purchasing. The Travel Department must understand its role as a supplier to the traveler. This relationship should cause individuals to rethink the meaning of an "organizational boundary." It is not simply the four walls around the department. The supplier and traveler must be considered as a "macro organization."

8. Melissa's job is to *satisfy customers* who are trying to obtain information or make reservations, while she simultaneously attempts to satisfy her internal customers, the supervisor and the account manager. Using Deming's principles, her supervisor (and the supervisor's customer, the account manager) need to "adopt the new philosophy" of quality, to remove the barriers in the system that are preventing Melissa from satisfying her customers and to provide the encouragement and support that she needs so that she can take pride in her work. These include analyzing the problems with the slow computer; the missing information in the system; the quota that often prevents her from giving adequate customer service; and the fact that she may need training on use of printed directories and guides (if they must be used), as well as how to courteously handle customers.

9. Understanding of Deming's Profound Knowledge concept might have a profound impact if applied diligently to transactions on stock exchanges around the world. Theory of

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knowledge is the branch of philosophy concerned with the nature and scope of knowledge, its presuppositions and basis, and its general reliability of claims to knowledge. In Deming's system, this involves understanding the complete system and current and possible variations within it to the point where past and present events and performance can suggest possible outcomes of future courses of action within the system.

For the Wall Street analyst, the theory of knowledge raises severe questions as to whether the Stock Market is a stable system whose operations are subject to "knowledge" about what makes prices rise and fall. If the complete system and what drives it cannot be known with a fairly high degree of certainty, then it is foolish to try to predict earnings of a company or group of companies on a quarterly basis.

10. See Review Question 3, above, for a discussion of how optimization relates to Profound Knowledge from which to begin discussion. Answers will vary, depending on the organization chosen. Optimization requires recognizing the fact that there are interactions among the parts of a system and managers cannot manage the system well by simply managing them in isolation; they must understand that processes that cross functional boundaries, align these processes toward a common vision or goal, and optimize their interactions. Suboptimization (doing the best for individual components) results in losses to everybody in the system.

11. Answers will vary, depending on the experiences of the student. See the answer to Review questions 4, 8 and 11 for a frame of reference for this discussion.

12. The Quality Profiles in Chapter 1 for Motorola and PricewaterhouseCoopers and in Chapter 2 for Texas Nameplate, and Medrad show consistent use of the quality management principles in Table 2.2.

    Motorola cites respect for people and uncompromising integrity as it guiding values. This corresponds to the quality principles of involvement of people and leadership. Motorola also shows that it takes a process approach, uses continuous improvement, and has a factual approach to decision-making. For example, employees in every function of the business measure defects and use statistical techniques to analyze the results, products that once took weeks to make are now completed in less than an hour, and the time needed for closing the financial books has been reduced substantially.

    PricewaterhouseCoopers, Public Sector Practice, is extremely customer focused. PwC PSP shows it by aligning its workforce into a framework that delivers value to clients while encouraging individual staff career and leadership development. PwC PSP uses its formal Pursuit process to systematically capture business and engage customers. Pursuit integrates methods by which staff can better listen to potential, current, and former customers at various points in each relationship.

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Texas Nameplate, a small business, has taken a systems approach to their processes, used factual decision-making, developed employee involvement and commitment through teams, all as a result of senior leaders, who changed the organizational structure from a traditional top-down approach to a bottom-up approach. This has had multiple benefits, including the fact that TNC reduced its defects from 3.65 percent to about 1 percent in four years. Also, customers consistently give the company an "excellent" rating (5 to 6 on a scale of 6) in 12 key business areas, including product quality, reliable performance, on-time delivery, and overall satisfaction. In its employee survey, the satisfaction ratings in five areas employees say are the most important: fair pay, job content satisfaction, recognition, fairness/respect, and career development, exceed national norms by a significant margin.

Medrad, Inc. is also known for its customer focus, fact-based decision-making, and systematic approaches to process improvement. When applied to customer processes, Medrad has systematically captured customers' expectations and preferences through various listening posts, trade associations, and other mechanisms and communicated them to the appropriate sales team for analysis. Their Customer Complaint Process focuses on timely response and successful resolution of customer issues and ensures that the organization determines causes and completes corrective actions. Because of its customer-focused practices, MEDRAD's measurement of customer loyalty, defined by the level of repeat sales and referrals, have been consistently remained at 60 percent or higher, compared to the 50 percent or higher marks for other organizations over the same time periods. In the area of service support, MEDRAD consistently scored 80 percent or higher compared to 50 percent for the best-in-class benchmark.

13. Answers will vary, depending on the experiences of the student. See the answer to Review questions 14 and 15 for a frame of reference for this discussion.

14. Common causes of variation occur as a natural part of any process and are difficult to change without making a major change in the system of which they are a part. Special causes of variation arise from sources outside the system and can generally be traced back to a specific change that has occurred and needs correction. For example, a process may be stable and running well until the supplier of a critical material or information is changed. An example of such a system that affects us all is the structure of health care insurers in the U.S., today. A change in providers, which now happens very frequently in many organizations, causes the process to go out of control (become unstable) almost every year. A possible "solution" to the special cause is to have the organization work with the vendor to correct deficiencies, and to provide incentives for the vendor to remain the supplier of choice via multi-year contracts and other strategies.

15. In this chapter, statistical thinking is defined as a philosophy of learning and action based on these principles:

    1. All work occurs in a system of interconnected processes.

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2. Variation exists in all processes.
3. Understanding and reducing variation are keys to success.

The student has learned to see her sewing work in the context of a system of interconnected processes (material, thread, machine characteristics, and her own work in the system). Like the Deming funnel experiments, she has also observed that making adjustments in the process when only common cause variation is present is counter-productive. She has learned to understand the process, observe when the process goes out of control (the stitching becomes clearly bad), and to correct the problem when an adjustment is necessary.

Students might profitably apply this line of statistical thinking to home or work situations, or even to their study habits.

16. In examining the ISO 9001 requirements of:

a. "The organization shall determine requirements specified by the customer"

b. "Records from management reviews shall be maintained."

c. ". . .documentation shall include . . . documents needed . . . to ensure the effective planning, operation and control of its processes. . ."

d. ". . .shall determine the monitoring and measurement to be undertaken. . .to provide evidence of conformity of product to determined requirements."

e. "The quality management system. . .shall include a quality manual."

f. ". . .establish and implement the inspection or other activities necessary for ensuring that purchased product meets specified requirements."

It could be argued that only items d. and f., and perhaps c., are *directly* involved in quality control. However that only addresses the issue of quality of conformance. To develop a system of quality design and continuous improvement, the "voice of the customer" (item a.), standardization of processes (item e.), and record-keeping for control and improvement purposes (items b. and c.) must be implemented.

SUGGESTIONS FOR PROJECTS, ETC.

1. This project is designed to allow students to determine for themselves if companies that they are familiar with emphasize total quality. As can be seen from the Deere and Company case, some companies have continuing references to their total quality efforts. Others may mention it "in passing" or not at all.

2. Students could use principles from the next chapter (Chapter 3 - see information on survey design) to design the questionnaire and content from Deming's 14 Points to perform this project.

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3. This project is similar to project 1, above, except that students are asked to gather information from face-to-face interviews. It is also similar to project 4, below. Students may actually find that the organization's QMS is based on ISO 9000.

4. This exercise is designed to expose students to the use of ISO 9000:2000 (or its newest successor, ISO 9000-2015) in organizations. Students may find that managers perceive that ISO 9000 is going to be more costly and difficult to attain and keep, based on the need for a more comprehensively deployed system required by the new standards.

5. The International Organization for Standardization (IOS) website www.iso.org is an interesting website and first source of information on the current ISO registrations. Now that the ISO 9000:2015

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requirements are fully in place, it will be interesting to see whether the trend will be toward increasing or decreasing numbers of registrations. Note that new standards are being finalized (see Question 6, following)

6. Current information about the new ISO 9001:2015 standards can be found in various publications from ASQ and from The International Organization for Standardization (IOS) website www.iso.org. (see overview and timeline for revision at: http://www.iso.org/iso/home/standards/management-standards/iso_9000/iso9001_revision.htm Accessed 8/10/15).The implications of using it as the basis for a quality management system will depend on what changes are finally approved, toward the end of 2015. Nigel Croft, Chair of the ISO subcommittee revising the standard is quoted as saying: "The new version is very strongly based on three basic core concepts: that process approach which was very successful in the 2008 version of the standard superimposed on that system of processes is the plan-do-check act methodology, and a third core concept which is new in the 2015 version is risk based thinking, aiming at preventing undesirable outcomes." (Source: http://www.iso.org/iso/home/news_index/news_archive/news.htm?refid=Ref1905. Accessed 12/10/14.)

ANSWERS TO CASE QUESTIONS

I. The Disciplinary Citation

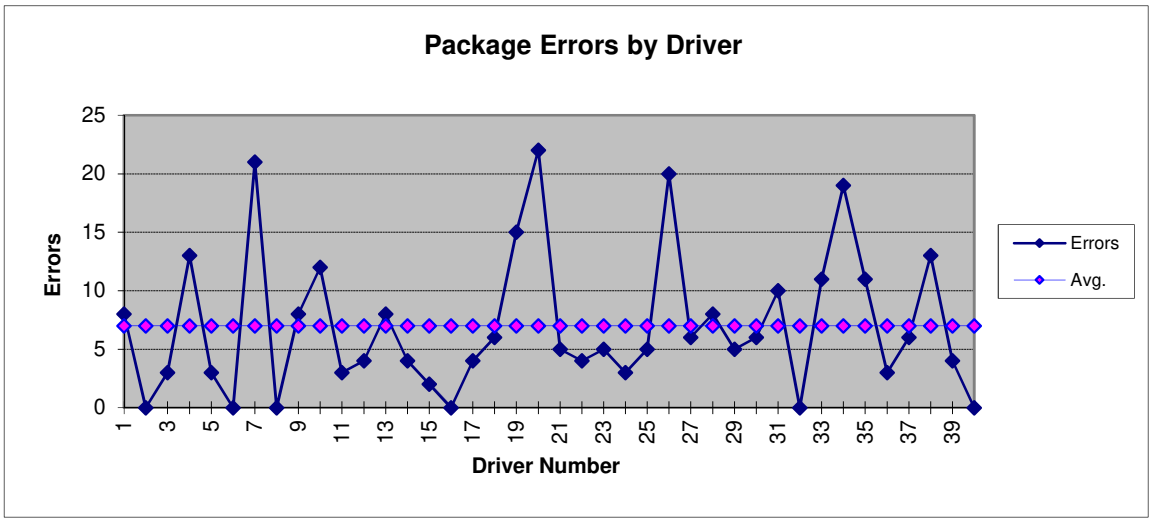
1. This case study shows Deming's "Red Bead" Experiment in action. Drivers are being blamed for conditions that are not under their control. The problem could be addressed by process measurement, eliminating "special causes" and reducing common causes.

2. Note that this part of the case solution uses techniques which are not discussed until later chapters. Students, of course should not be expected to take any more than an intuitive approach to the analysis. A run chart (see C02DiscCase.xlsx for details) would appear to be a way to begin to understand the process and to determine if it is in control or not. Based on the available data, we have:

   Center Line (average) for the chart = 280/40 = 7.0 mistakes

   The data show that 15 drivers have exceeded the average. Also, 6 drivers had "no defects". A Pareto chart (in C02 DiscCase.xlsx, sheet 3) also shows that only 5 drivers have 15 or more errors. The characteristics of drivers who are having difficulty should be examined to explain their higher error rates. Are their errors far above normal, or just a little above? Are they well trained? Are they overworked, with more than the average number of difficult orders? Do they have poor equipment? A useful control chart cannot be established, unless "special causes" are dealt with. Analysis should also be done to determine what the good drivers are doing right. Are they more experienced, drive newer cars, have better hearing and vision, etc.?

After corrections, a new chart (called a "c-chart" and discussed in Chapter 8) on the stable process can be set up. Then those who consistently do well can be rewarded and the performance of those who have an unsatisfactory level of errors can be improved.



II. Nashville Custom Guitars

Based on the narrative tour of The Nashville Custom Guitars, it is easy to identify how the operations and quality practices reflect Deming's 14 points. Almost every point can be matched with a specific practice followed by NCG.

1. *Create a Vision and Demonstrate Commitment*. This principle is exemplified in the small staff of 14 craftsmen, known as luthiers, who apply care and attention to detail while hand-crafting the major components of each instrument. Also, the company recruits only those who desire to work in a team environment and have a passion for guitar making. The following Deming principles can be applied to NCG.

2. *Learn the New Philosophy*. Experienced luthiers, who are empowered to make their own quality decisions, staff each station.

3. *Understand Inspection*. The manufacturing department inspects what it produces.

4. *End Price Tag Decisions*. This makes the simple statement, without prescribing how this should be done. It seems obvious that NCG does not "cut corners" when it comes to using quality materials. This is shown by: The guitar body is finished with 12 protective layers of a specially formulated lacquer composed primarily of nitrocellulose and plasticizers to preserve the wood surfaces.

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5. *Improve Constantly*. These opportunities for training and improvement (reference points 10. 11. And 14, below) allow the craftsmen to explore new techniques in guitar building and become familiar with the entire guitar building process.

6. & 7. *Institute Training* and *Teach and Institute Leadership*. Teamwork and mentoring of new and seasoned luthiers show how training, teraching and leadership through mentoring is " built in" to the process. The guitar does not move to the next station until the luthier and another more senior luthier are satisfied with the quality of the work.

8. *Drive Out Fear and Innovate*. Although modern computer numerical controlled (CNC) equipment is used to manufacture minor parts of the guitar, the secret of NCG's success lies in the small staff of 14 craftsmen.

9. *Optimize the Efforts of Teams and Staff*. The shop floor is divided into six workstations at which the guitars are progressively assembled as they move from station to station.

10. & 11. *Eliminate Exhortations* and *Eliminate Quotas and MBO; Institute Improvement; and Understand Processes*. NCG is a small-scale manufacturing operation, producing fewer than 800 instruments a year. Since the true sound of the instruments will not be fully realized until they are assembled, the luthiers write down what they did while building the top. After final assembly, if a guitar produces a sound so special it knocks the player's socks off, the luthier who built the top will immediately be notified and asked to check his notes to see how this was accomplished so the sound can be duplicated in the future.

12. *Remove Barriers*. NCG workers are even encouraged to go out on their own to open a luthier business someday.

13. *Encourage Education*. At NCG, workers are encouraged to further enhance their skills either by taking external courses or by a practice that allows them to build two instruments a year for personal use.

14. *Take Action*. This is the role of leadership, but everyone has to be (and appears to be) involved in the transformation process at NCG.

Note that there are several guitar companies that have provided detailed descriptions of their handcrafted and semi-automated manufacturing processes for guitars via YouTube videos on the Internet. Some of these include:
https://www.youtube.com/watch?v=8XSIXxfFdEc

https://www.youtube.com/watch?v=Cylr2aG6zAw

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https://www.youtube.com/watch?v=VbU1R4KDymw

III. Walker Auto Sales and Service

1. Issues that Darren is encountering or may encounter include:

   - Customer needs and performance standards are often difficult to identify and measure in services, primarily because the customers define what they are and each customer is different.
   - The production of services usually requires a higher degree of customization, so employees must tailor their services to individual customers
   - The output of many service systems is intangible, so service quality can only be assessed against customers' subjective, nebulous expectations and past experiences. (What is a "good" sales experience?)
   - Services are produced and consumed simultaneously, and many services must be performed at the convenience of the customer. Attention must be paid to training and building quality into the service as a means of quality assurance.
   - Customers often are involved in the service process and are present while it is being performed, or at least, in specifying their problems and needs prior to work being done on their car.
   - Services are generally labor intensive, and the quality of human interaction is a vital factor for services that involve human contact. Thus, the behavior and morale of service employees is critical in delivering a quality service experience.
   - Many service organizations must handle large numbers of customer transactions. Such large volumes increase the opportunity for error.

2. Action plans that Darren might consider developing must tailor the systems to the needs of various types of customers. He must ensure that he develops appropriate infrastructure, practices and tools to support his vision. These might include:

   a. Customer relationship management
   b. Leadership and strategic planning
   c. Human resources management
   d. Process management
   e. Information and knowledge management

   For example, car buyers have different needs from those who are coming in for shop service to their cars. For car buyers to be able to obtain a wide range of vehicles and options to evaluate, have access to available salespeople, enjoy a prompt greeting, and feel comfortable and un-pressured in reaching a buying decision, Darren must plan on exercising leadership and strategic planning to develop the required infrastructure. Because customers expect salespeople to be courteous, to be knowledgeable about the cars, to respect their time, and to honor verbal promises, courteous salespeople must be

hired and trained to support customer relationship management, develop good processes, and work to improve systems through information and knowledge management.

For repair and maintenance service, customers want to have the work explained appropriately, to be fully informed of any additional necessary work, and to have all work reviewed on completion. They want good time estimates and communications with the service department. Thus repair service people must not only be technically proficient, but also be customer focused, and understand and support the need for continuous improvement through information and knowledge management.

IV. The Quarterly Sales Report

Obviously, Hagler has got to look beyond the quarterly sales reports to find out what is really going on in his regions. Two simple scatter diagrams (see spreadsheet C02Salecase.xls for details) that plot the entire 5 years of data, divided into large regions and small regions, are very revealing. He might start with those graphs to see what the general trend has been.

The Northeast, Southwest, and Northwest regions show basically flat sales for the 5 year period. The Southwest region had a strange jump in sales in the second quarter of 2014 and again in the first quarter of 2015, possibly due to inventory reduction sales. Otherwise, the three regions showed no consistent trend, while still managing to increase sales in the last quarter of 2016.

Two of the three smaller regions, North Central and Mid-Atlantic, showed upward trends from the third quarter of 2014 to the third quarter of 2016. Unfortunately, Hagler concentrated on the one quarter when sales went down for both of them, while also decreasing for the South Central region, which had been "holding its own" in a tough market.

To apply concepts of statistical thinking, Hagler must: 1) look at the big picture, graphically, rather than at quarter to quarter variations, 2) find out what each region's unique characteristics are, rather than treating all regions the same, 3) determine what causes variation within and among the regions, 4) determine if variations are due to common causes or special causes (probably the former), and 5) train, help, and support the regional managers if he expects to see different results over the coming year.

See spreadsheet C02SaleCase for further analysis.

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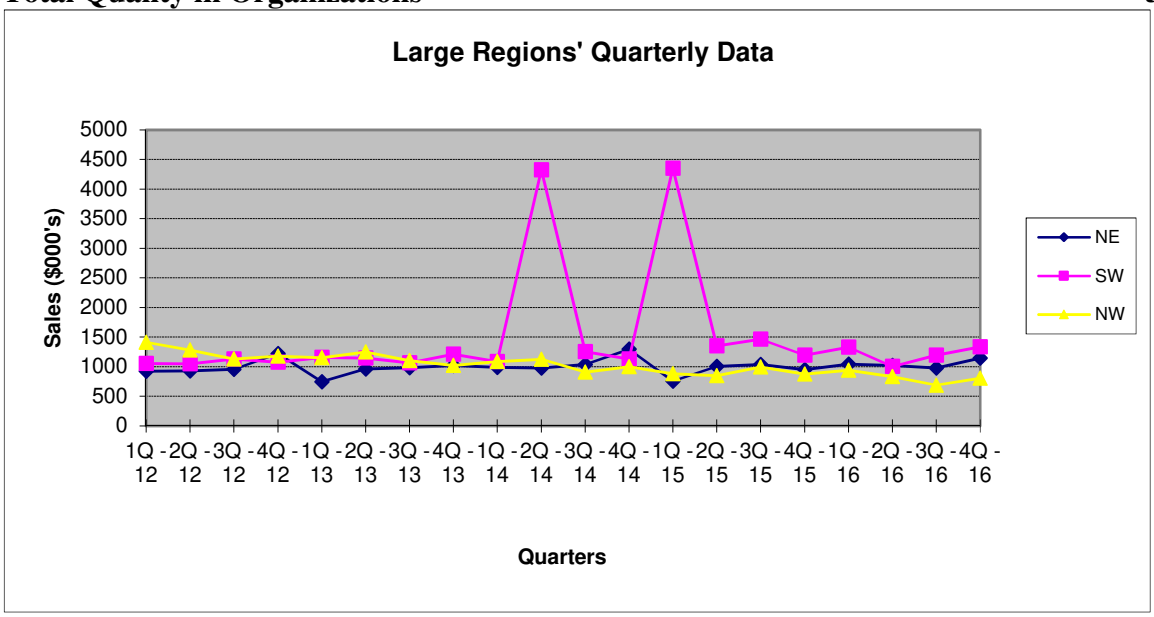
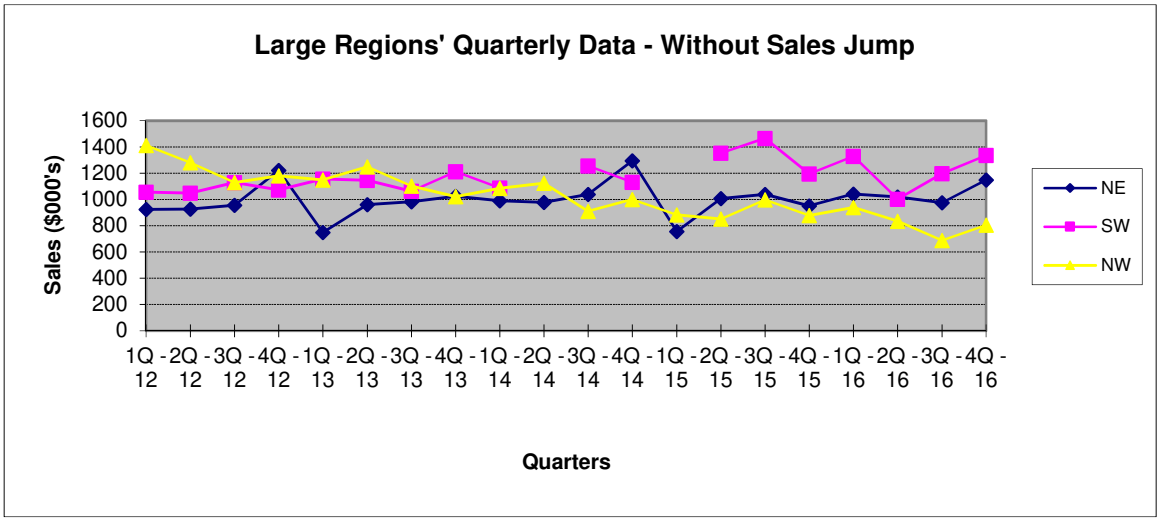
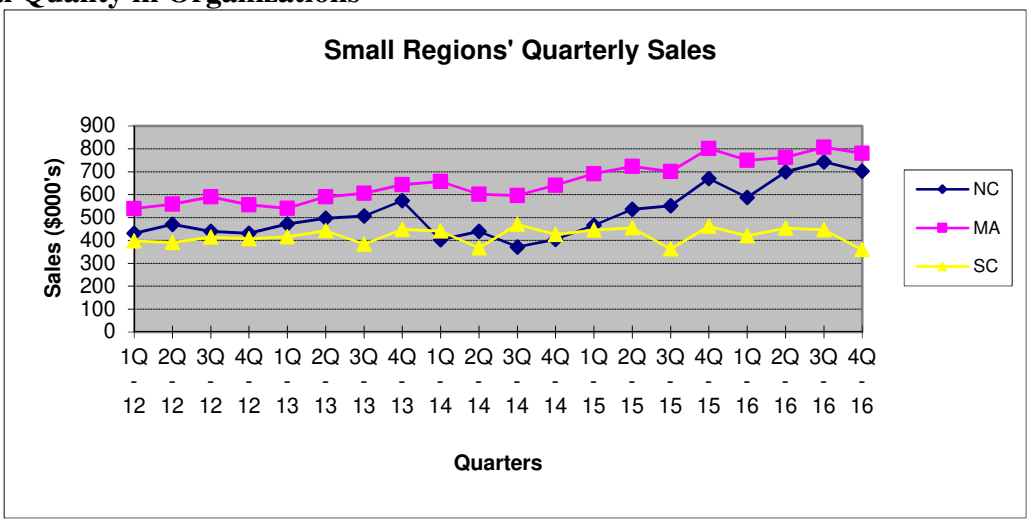

Large Regions' Quarterly Data
Sales ($000's)
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
1Q - 12
2Q - 12
3Q - 12
4Q - 12
1Q - 13
2Q - 13
3Q - 13
4Q - 13
1Q - 14
2Q - 14
3Q - 14
4Q - 14
1Q - 15
2Q - 15
3Q - 15
4Q - 15
1Q - 16
2Q - 16
3Q - 16
4Q - 16
Quarters
NE
SW
NW


Large Regions' Quarterly Data - Without Sales Jump
Sales ($000's)
1600
1400
1200
1000
800
600
400
200
0
1Q - 12
2Q - 12
3Q - 12
4Q - 12
1Q - 13
2Q - 13
3Q - 13
4Q - 13
1Q - 14
2Q - 14
3Q - 14
4Q - 14
1Q - 15
2Q - 15
3Q - 15
4Q - 15
1Q - 16
2Q - 16
3Q - 16
4Q - 16
Quarters
NE
SW
NW



Instructor Reserve Materials

<u>Quality in Practice - Kenneth W. Monfort College of Business</u>

1. Monfort College of Business' (MCB) mission and vision are stated as:

   MCB's Mission - Our mission is to deliver excellent undergraduate business programs and related learning opportunities that prepare students for successful careers and responsible leadership in business.

   MCB's Vision - Our vision is to build a reputation of excellence in Colorado and beyond for preparing future business leaders and professionals.

   Their mission and vision drive their two long-term strategies that guide its actions: a positioning strategy of high-quality and low-cost (i.e., exceptional value), and a program delivery framework of *high- touch, wide-tech*, and *professional depth*.

   It is important for any business to link its mission and vision to organizational processes in order to achieve alignment that assists employees in knowing how to make daily decisions that advance organizational goals and plans, as well as giving customers and stakeholders assurance that the organization will focus on their importance in achieving performance excellence, as well.

2. MCB's philosophy of continuous improvement guides employee behavior and has been key to attaining the mission and vision of the College. MCB's commitment to an overall organizational focus on continuous performance improvement and the significant progress made toward development and deployment of this systematic approach, has been driven externally and internally. Externally, UNC requires a regular cycle of program review and evaluation, and AACSB accreditation maintenance (which also requires continuous improvement) are both strong external drivers. Internally, drivers

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include the commitment of MCB leadership to performance improvement and a strategic planning system, including Key Performance Indicator (KPI) goal sets, the Educational Testing Service and Educational Benchmarking, Inc. survey feedback, and the integration of a Malcolm Baldrige-based assessment system. Also included in this framework is the development of a student-centered process, the availability of emerging and existing technologies, the encouragement and support from university leadership, and a series of program accomplishments that have been contagious in creating expectations for continued performance improvement.

3. A visit to the Baldrige web site (www.nist.gov/baldrige) helps to identify several "best practices" that MCB employs that might be useful to any college or university for improving quality. Some of these are:

   a. Clearly state mission, vision, and values focused (in the case of MCB) on undergraduate education. Values are "spelled out" for each academic component of instruction, scholarship, and service.
   b. Combine hi-touch and wide-tech – small class sizes combined with technology infrastructure. This provides for many opportunities for experiential learning, while helping students to learn about using the latest existing and emerging technologies enabling them to make a seamless transition into the workplace after graduation.
   c. Recruit faculty with professional depth – professors have a mix of academic credentials and professional experience, with executives-in-residence having had senior leadership positions in business and industry.
   d. Build and maintain facilities that support and enhance the mission and vision of the college. Up-to-date offices, classrooms, meeting spaces, auditorium, and dining facilities are supported by technology infrastructure features such as computer labs, electronic finance trading center, and a wi-fi system throughout the building.
   e. Develop governance and administrative systems that meet or exceed local, state and federal guidelines, in addition to those of regional and national accrediting agencies, such as the Association to Advance Collegiate Schools of Business (AACSB).
   f. Design processes and standards for excellence that serve to allow the organization to recruit and retain high quality, seasoned, and professionally experienced faculty; recruit, retain, and satisfy high-quality students; and develop and uphold a reputation in the marketplace through managing external relations, effective communications, and strengthening partnerships.
   g. Develop an effective performance improvement system through regular cycles of review and improvement, designed around the Baldrige process.

<u>Quality in Practice - Toyota Motor Corporation, Ltd.</u>

1. Toyota's guiding principles include:

   1) Honor the language and spirit of the law of every nation and undertake open and fair corporate activities to be a good corporate citizen of the world.

2) Respect the culture and customs of every nation and contribute to economic and social development through corporate activities in the communities.
3) Dedicate ourselves to providing clean and safe products and to enhancing the quality of life everywhere through all our activities.
4) Create and develop advanced technologies and provide outstanding products and services that fulfill the needs of customers worldwide.
5) Foster a corporate culture that enhances individual creativity and teamwork value, while honoring mutual trust and respect between labor and management.
6) Pursue growth in harmony with the global community through innovative management.
7) Work with business partners in research and creation to achieve stable, long-term growth and mutual benefits, while keeping ourselves open to new partnerships.

As stated in the chapter: "The TQ philosophy was based initially on three core principles: *customer focus*, *teamwork*, and *continuous improvement*. "
It's interesting to note that Toyota's Guiding Principles focus on being a socially responsible, "world entity." Customers and stakeholders are seen to be part of the society in which they live. Five of the seven principles speak explicitly of a global mission.

Participation and teamwork is emphasized in Principles 2, 5, and 7.

The process focus and process improvement is not explicitly mentioned, but underlies Principles 3, 4, and 6.

Toyota has shown itself to be capable of using total quality principles by establishing consistent standards of excellence, setting and communicating clear expectations, continuous improvement (as opposed to finding fault and blaming), looking at a work task as a process, involving all who have a stake in the outcome in the improvement process, measuring results, and recognizing and rewarding success – for bringing about change. Using a set of quality "tools," teams define a system (under the broad umbrella of the "Toyota Production System"), assess a situation, analyze causes, try out improvement theories, study results, standardize improvement, and plan continuous improvement.

The three principles of total quality appear to be well supported by an integrated organizational infrastructure, a set of management practices, and a set of tools and techniques, which all work together.

2. Just as SSM Health Care learned from manufacturing, other non-profit organizations might also learn from Toyota. Their constancy of purpose and customer focus is exemplary. Their attention to detail and use of kaizen continuous improvement methods has been documented time and time again. They use best practices and share new approaches rapidly among organizational units. They treat their workers as associates, and constantly seek suggestions for improvements from their partners. Education could pick up some ideas on how to become a "learning organization" from Toyota.

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Government could use some lessons in how to become more "customer friendly" and how to develop more effective and efficient processes. (See the SSM media case in the Bonus Materials).

Case - Child Focus, Inc.

1. Just as in any organization, profit or non-profit, it would be necessary to understand the environment, the infrastructure, and the degree of commitment to building a quality organization. I would want to ask:

   - What support for quality do you have from your leadership team and board of directors?
   - How have your mission and vision been developed, and how do associates see their impact on the organization?
   - How does your continuous strategic and tactical planning system work, who is involved, and what types of goals are set?
   - How do you train, empower, and reward your employees?
   - How do you develop and reward leadership in the organization?
   - What do you do in order to carry out continuous improvement of your processes?
   - How do you encourage and reward innovation among employees?
   - How do you measure performance versus goals, and provide feedback and correction?
   - What are the greatest three strengths and the three most challenging OFI's at this point in the organization?

   The advice to be given to the CEO would depend heavily on the answers to the questions above. For example, if she/he very knowledgeable about quality performance management systems, such as the Baldrige process, it might be beneficial to look into using that approach for quality planning and control. Otherwise, I might suggest that organizational leaders begin an intensive learning process, and look into having a quality consultant help the organization design a performance management system.

Case - Mercantile Stores

1. Mercantile views quality as part of their mission. Two aspects of this are to provide the highest level of customer service and a broad assortment of fashionable high-quality, high-value products. Information technology (*Quick Response*) was implemented to improve point-of-sale information needed by salespeople and inventory planning and control. This technology allows higher efficiency in "back-room" operations and also serves the customer better by ensuring that the right amount and type of inventory will be on the shelves when needed. Through the University Business School, everyone from sales associates to managers are trained and empowered to take responsibility and to make customer satisfaction a priority.

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2. The emphasis in this case appears to be on internal quality, although a customer focus is evident. Components of *time, timeliness, consistency and accuracy* are certainly addressed by the new information system. However, *completeness, courtesy, accessibility and convenience, and responsiveness* are the responsibilities of people, more than technology. Thus internal quality is a necessary, but never a "sufficient" condition for excellent external quality. One must complement the other, based on a consistent mission and a customer focus.

Case: Nightmare on Telecom Street

1. This experience seems all too familiar to most of us. The points of failure are: 1) the number of phone rings before pickup; 2) possibly, the annoyance of having to deal with an automated system, rather than a human operator; 3) use of overlapping categories at the first two stages [What if you're going with a company group? going to an international conference?]; 3) long delays on hold; 4) asking for a card number that you were not warned earlier that you would need; 5) requiring highly personal information (4 digits of a social security number), for no apparent reason; 6) having an emergency number, without defining what an "emergency" is; 7) requiring re-statement to the human representative of the card number and social security codes that were already used by the system; 8) being told at the end of the automated process that he has reached the wrong human representative, through no fault of the customer's; 9) being transferred back into the automated loop by the human operator, rather than being given preferential treatment, due to a harassing experience.

2. The answer to this is straightforward -- toss out the system and start over again! Given that an automated system is felt to be essential, each of the above failure points should be addressed and corrected.

Case - Shiny Hills Farms

1. The case describes the quality assurance (QA) function of Shiny Hills Farms, which seems to take a very traditional approach to "inspecting quality into" the product. The activities include controlling product weight, appearance and shelf life of the product. The emphasis is on QA specifications, monitoring procedures and temperatures, weights, USDA standards, and charting performance. Other departments do seem to have a concept of modern quality methods that could contribute to TQ. For example, R&D uses focus groups to help design products that meet customer needs. Engineering personnel are replacing lines with ergonomically correct designs, although this may be pointed toward productivity improvement, as opposed to quality improvement.

2. The case narrative and the answer to Question 1 show that the QA department sees quality as a "control" function. The TQ concept, with a high level of employee involvement and commitment, QA personnel serving as trainers and technical support people and the concept of internal customers seem to have little place at Shiny Hill.

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3. Shiny Hill could improve its quality by focusing on both internal and external customer needs, reducing reliance on inspection, implementing continuous improvement concepts, promoting employee involvement. The culture of inspecting quality into the product and preventing defective products from reaching the customer should be replaced by the process control and self-monitoring to prevent any defective product from reaching the *next operation*, rather than the final consumer. However, the use of quality standards, sampling inspection, new product development with customer input, and continued progress toward ergonomic equipment design should not be discarded.

Case: U.S. Water Resource Agency - Flagstaff District

1. Even though the Flagstaff District is a public, non-profit government agency, it still has customers. These include virtually everyone in their geographic region who uses water. Some specific examples are commercial and recreational users of the waterways, locks and dams; people who live along the waterways, including farmers and resident who may be impacted by flood control and environmental protection actions; organizations for which it performs reimbursable projects; those affected by regulations; and, perhaps, indirectly, any organization or individual who uses water from the waterways.

2. The district might define quality in terms of meeting and exceeding customer expectations. In many ways, they operate a service business similar to utilities, such as a waterworks, gas and electric utility, etc. Their customers want to be able to use their services with the assurance that they will be treated politely, by knowledgeable client service people, with a minimum expenditure of time, using an easy-to-understand process, which is dependable and accurate, at an affordable cost. How could USWRA-Flagstaff use this definition to evaluate its success in “competing” with other entities? They could develop a customer-focused approach to delivering services such as regulatory oversight by developing streamlined operations for working with the regulated clients, putting requirements on a website (along with applicable forms), employee empowerment, reducing "red tape," surveying customers to determine satisfaction levels, and reducing costs.

WML/JRE- 8-10-15

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Quality in Practice: Toyota Motor Corporation, Ltd. [1]

The Toyota brand name has earned an international reputation for quality. The roots of Toyota Motor Corporation, founded in 1937, stem from the Toyoda Automatic Loom Works. Sakichi Toyoda invented a loom with an automatic stopping function; whenever a thread broke or the machine ran out of thread, it stopped automatically. This approach was built into automotive assembly lines to improve quality and productivity and led to the development of the "Toyota Production System," which has commonly become known as lean production. A significant feature of lean production is the practice of continuous improvement by every worker, demanding the questioning of every process and testing of all assumptions. Errors and defects are viewed as learning opportunities to remove waste and improve efficiency. In 1951, Eiji Toyoda instituted a system of creative suggestions based on the motto "Good Thinking, Good Products," which is prominently displayed in every production facility. One example is the Rakuraku seat, a comfortable work chair mounted on the tip of an arm that allows a line worker to easily get into and out of cramped car-body interiors. In 2000, more than 650,000 suggestions were submitted—almost 12 per employee—and 99 percent were adopted.

At Toyota, everybody helps whenever they can. Even top and middle managers are well-known for getting their "hands dirty" by helping workers on the production line when necessary. Toyota uses games, competitions, and cultural events to promote its 3 C's: creativity, challenge, and courage. It trains workers extensively, not only in job skills, but also in personal development that focuses on positive attitudes and a sense of responsibility. Toyota's education system includes formal education, on-the-job training, and informal education.

Toyota is implementing a direct monitoring system that supports quality. For example, its French plant is connected by a broadband system to the head office, enabling it to transmit video, audio, and facility performance data. Engineers in Japan can monitor the data of the plant's operation in real time, check machinery utilization rates, diagnose malfunctions, and provide ideas for improvement. Information technology and e-commerce are also used to expand relationships with suppliers and customers. For example, customers may request quotes and gather information that previously was only available to dealers.

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[1] Our thanks go to a former student, Boris Méndez Rojas, for his research in developing the information in this case.

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Shotaro Kamiya, first president of Toyota Motor Sales, stated, "The priority in receiving benefits from automobile sales should be in the order of the customer, then the car dealer, and lastly the maker. This attitude is the best approach in winning the trust of customers and dealers and ultimately brings growth to the manufacturer." The guiding principles of Toyota are as follows:

1. Honor the language and spirit of the law of every nation and undertake open and fair corporate activities to be a good corporate citizen of the world.
2. Respect the culture and customs of every nation and contribute to economic and social development through corporate activities in the communities.
3. Dedicate ourselves to providing clean and safe products and to enhancing the quality of life everywhere through all our activities.
4. Create and develop advanced technologies and provide outstanding products and services that fulfill the needs of customers worldwide.
5. Foster a corporate culture that enhances individual creativity and teamwork value, while honoring mutual trust and respect between labor and management.
6. Pursue growth in harmony with the global community through innovative management.
7. Work with business partners in research and creation to achieve stable, long-term growth and mutual benefits, while keeping ourselves open to new partnerships.

Toyota has approximately 40 production facilities in more than 20 countries and regions outside Japan. When Toyota began expanding outside of Japan, many believed that the culture could not be copied or applied to foreign cultures, especially in the United States. With a focus of incorporating the best elements of Japanese and local traditions, while avoiding the weaknesses of both, Toyota as proven that its approaches and culture can work everywhere.

One popular phrase at Toyota is "change or die." The company continually seeks to redefine itself to adapt to changes in society and the business environment. Toyota's recent vision is captured by the phrase harmonious growth—a harmony between man, society, and the environment.

> *We wish to make Toyota not only strong but a universally admired company, winning the trust and respect of the world. We must be a company that is accepted wholeheartedly by people around the world, who would think it natural if Toyota became No. 1 in size, since we provide attractive products that excel in environmental protection and in safety and*

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thus contribute immensely to local communities. That is the goal of "Harmonious Growth" and what I regard as corporate virtue. - Hiroshi Okuda, Chairman

Key Issues for Discussion

1. What do Toyota's guiding principles mean for its management system? In particular, how do they reflect the principles of total quality?

2. We noted that SSM Health Care learned from manufacturing companies in their quality journey. What can nonmanufacturing companies learn and apply from Toyota's philosophy and practices? Suggest specific things that education and government might learn.

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Child Focus, Inc.[i]

Child Focus, Inc. (CFI), whose mission is to join with communities in strengthening families and improving the quality of life for children, offers a wide variety of programs in Clermont, Hamilton, and Brown counties in Ohio. With an agency budget in excess of $11 million dollars, the spectrum of services includes Head Start programs for children ages 0–5, parenting education, family literacy, GED test preparation, substance abuse prevention, partial hospitalization, mental health prevention and counseling services in schools, foster care, independent living, case management, outpatient individual, family, and group therapy, diagnostic testing, psychiatric services, and professional training. CFI's 240 employees have a broad range of professional education including high school, associate's, bachelor's, master's, Ph.D., R.N., and M.D. degrees. All staff share the authority, dedication, and commitment to promote the mission of serving children and families. Facilities include intranet, Internet, a Web site (http://www.child-focus.org), specifically designed management information systems with necessary office equipment, 22 vehicles to provide client transportation, and two commercial kitchens that serve more than 800 meals a day. Facilities and programs are supervised by a volunteer Board of Trustees and by the accreditation standards of the National Association for the Education of the Young Child, Day Care Licensing Regulations, Head Start Performance Standards, and Ohio Departments of Education, Mental Health, Alcohol and Drug Addiction Services, and Job and Family Services.

As CFI continues to expand its programs through new and larger contracts, the biggest challenge is to provide quality services. Personnel and human resources issues are another challenge. They continually strive to find qualified staff who are willing to work with some of the most challenging children and dysfunctional families. Although their turnover rate is approximately 15 percent, most of it is in less-skilled positions. Consequently, this loss of staff increases training costs. Training existing staff to meet higher educational standards and continuing to find office and service space to meet growing needs is also a challenge.

CFI's diversity of programming, reporting, and funding to multiple agencies and organizations requires continuous management at all levels within the agency. The governing Board of Trustees for Child Focus is a diverse group of volunteers that have

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experience as attorneys, teachers, homemakers, and CFI consumers. Federal, state, and county legislative and regulatory changes can affect programming or present financial challenges. These entities, in turn, may have competing philosophies, which complicate administration or delay program implementation.

CFI management has several procedures in place to identify and manage these organizational challenges. Customer, staff, and collaborators' recommendations and complaints are identified through evaluation and administrative programs in both the Early Childhood and Behavioral Health divisions and are continuously monitored by staff, management, and the Board of Trustees. Through a continuous strategic planning process, CFI identifies ways in which to improve and expand its services through program modification or development.

The CEO is committed to building a total quality organization. If you were asked to help in this quality journey, what questions would you want answered? What advice would you provide?

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[i] Acknowledgement: Child Focus, Inc., 2003 Greater Cincinnati Chamber of Commerce Small Business Awards Application. Our thanks go to Tara Dawson for providing this information and granting permission to use it for this case.

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Case - Mercantile Stores

During the 1980s, Mercantile Stores was a major retail organization located throughout the Southeast, Midwest, and Gulf Coast regions and included seven divisions: Gayfers, Maison, Blanche, Castner Knott, McAlpin's, Jones, Joslins, and J. B. White. Mercantile's mission statement was "Mercantile Stores is dedicated to creating excitement in merchandising by providing the highest level of service to our customers and a broad assortment of fashionable products that offer superior quality and value." In 1983 Mercantile initiated a program for processing incoming merchandise at regional distribution centers. This was seen as more efficient than receiving merchandise in the individual stores. In 1986 the company remodeled and expanded existing stores to accommodate a greater selection of fashion merchandise. Designer apparel offerings were increased in 1987.

In 1989 a major technological initiative called Quick Response was instituted. It integrated all facets of operations, from inventory planning to purchasing and inventory control, to provide customers with better service. Some of the technologies introduced were price look-up and point-of-sale laser scanning systems, electronic purchase ordering and replenishment, and electronic invoicing and funds transfer. Stronger partnerships were developed with suppliers to help ensure that suppliers have sufficient merchandise for stocking the stores. The company was in constant contact with its suppliers for mutual benefit. For example, Hanes hosiery used selling information furnished electronically and shipped 97 percent of Quick Response orders. Sales increased 17 percent, and the inventory level decreased by 15 percent.

The Quick Response program eliminated bottlenecks within the merchandise processing functions. Previously, shipments had required a high amount of labor-intensive efforts: opening cartons, physical counts, sorting, and manual ticketing. Advance shipping notice capability provided the means of knowing exactly what was coming and when. Shipments arrived preticketed by suppliers with external shipping container marking. Entire containers were scanned for contents and matched to purchase orders.

Mercantile Stores also established a University Business School for training its management associates to implement quality practices within the company The school's motto, Investing in Excellence Through Education, reflected the company's commitment to the development of its people. Sales associates, department managers, and store managers were empowered and challenged to embrace ownership and responsibility in their jobs. For example, they planned and monitored their own forecasts from start to finish. Complete customer

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satisfaction was seen as the responsibility of all associates. Decisions were made as close to the customer as possible, and promotions were made from within the company.

Discussion Questions

1. How does Mercantile view quality? Explain the roles of people and information technology in achieving quality in the Mercantile organization.
2. Compare the importance of "internal quality" (what the company sees) and "external quality" (what the customer sees). Do they conflict? What is needed to ensure that they are consistent?

Case – Shiny Hill Farms

Shiny Hill Farms is a major pork processor, specializing in smoked meats, hams, sausages, and luncheon meats. The firm's largest facility slaughters more than 5,000 hogs each day. Throughout the food industry, quality is a high priority, and Shiny Hill Farms is no exception. The quality assurance department (QA) seeks to prevent any defective products from reaching the consumer. QA's primary concern is for controlling product weight, appearance, and shelf life throughout the manufacturing operations. Production operators are held accountable for their cuts on specific meat products. The cuts must be performed according to quality assurance specifications in order to obtain high yields. (Yield is the percentage of the live weight of the hog that can be sold.)

Quality assurance monitors all operations, from the killing of hogs through packaging. QA personnel inspect incoming animals, work with USDA inspectors, and monitor cooking temperatures. They check scales daily to ensure they are providing correct weights. If products fall outside specifications, it is the responsibility of QA personnel to notify operators that changes need to be made to bring quality up to standard. Many QA personnel monitor weights of packaged boxes continuously to ensure that they conform to weight specifications. They open boxes and weigh the packages as well as checking them for defects such as rips, leaks, and pinholes. Weights of packages near the bottom, mid and top of each skid (pallet) are inspected. If these packages conform to weight specifications, then the entire skid is accepted and sent to the warehouse. If not, the skid is tagged for 100 percent in on, and the process is studied to determine why the variations occurred. QA personnel analyze graphs of yields and packaging waste weekly.

Other functions throughout the company focus on quality. The sanitation department, for example, sanitizes all manufacturing machines and work surfaces before initial production runs each day. The research and development department plays an important role in improving quality. For example, it is continually seeking out and testing new methods of curing meat and of killing bacteria more effectively and efficiently. R&D also helps to develop new packaging that may improve consumers' perception of quality In addition, it develops new products, such as "lite" luncheon meats that contain less fat and cholesterol, enlisting the aid of focus groups and taste panels.

A food processing plant is an intense, high-speed manufacturing setting. Shiny Hill Farms operators may have to make as many as 10 cuts each minute on a conveyor line. Engineering personnel replaced all old manufacturing fines with ergonomically correct lines. The

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production line was redesigned to a standard height with adjustable height work stations to better meet operators' needs. Turnover of meat cutters averages between 30 and 40 percent. New cutters are shown a video on how to use machines and knives correctly in order to make quality cuts. On the line, they are expected to learn from experience-watching others and learning from their mistakes.

Discussion Questions

1. Describe the scope of quality efforts in this organization.
2. What is the role of the quality assurance department at Shiny Hill Farms? Does it promote the concept of total quality?
3. What suggestions do you have for improving Shiny Hill Farms' quality effort?

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The Nightmare on Telecom Street[i]

H. James Harrington, a noted quality consultant, related the following story in *Quality Digest* magazine:

I called to make a flight reservation just an hour ago. The telephone rang five times before a recorded voice answered. "Thank you for calling ABC Travel Services," it said. "To ensure the highest level of customer service, this call may be recorded for future analysis." Next, I was asked to select from one of the following three choices: "If the trip is related to company business, press 1. Personal business, press 2. Group travel, press 3." I pressed 1.

I was then asked to select from the following four choices: "If this is a trip within the United States, press 1. International, press 2. Scheduled training, press 3. Related to a conference, press 4." Because I was going to Canada, I pressed 2.

Now two minutes into my telephone call, I was instructed to be sure that I had my customer identification card available. A few seconds passed and a very sweet voice came on, saying, "All international operators are busy, but please hold because you are a very important customer." The voice was then replaced by music. About two minutes later, another recorded message said, "Our operators are still busy, but please hold and the first available operator will take care of you." More music. Then yet another message: "Our operators are still busy, but please hold. Your business is important to us." More bad music. Finally the sweet voice returned, stating, "To speed up your service, enter your 19-digit customer service number." I frantically searched for their card, hoping that I could find it before I was cut off. I was lucky; I found it and entered the number in time. The same sweet voice came back to me, saying, "To confirm your customer service number, enter the last four digits of your social security number." I pushed the four numbers on the keypad. The voice said: "Thank you. An operator will be with you shortly. If your call is an emergency, you can call 1-800-CAL-HELP, or push all of the buttons on the telephone at the same time. Otherwise, please hold, as you are a very important customer." This time, in place of music, I heard a commercial about the service that the company provides.

At last, a real person answered the telephone and asked, "Can I help you?" I replied, "Yes, oh yes." He answered, "Please give me your 19-digit customer service number, followed by the last four digits of your social security number so I can verify who you are." (I thought I

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gave these numbers in the first place to speed up service. Why do I have to rattle them off again?)

I was now convinced that he would call me Mr. 5523-3675-0714-1313-040. But, to my surprise, he said: "Yes, Mr. Harrington. Where do you want to go and when?" I explained that I wanted to go to Montreal the following Monday morning. He replied: "I only handle domestic reservations. Our international desk has a new telephone number: 1-800-1WE-GOTU. I'll transfer you." A few clicks later a message came on, saying: "All of our international operators are busy. Please hold and your call will be answered in the order it was received. Do not hang up or redial, as it will only delay our response to your call. Please continue to hold, as your business is important to us."

Discussion Questions

1. Summarize the service failures associated with this experience.
2. What might the travel agency do to improve its customers' service experience?

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[i] Source: H. James Harrington, "Looking for a Little Service," Quality Digest, May 2000; http://www.qualitydigest.com.

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U.S. Water Resource Agency - Flagstaff District[i]

The Flagstaff District (FD) is one of 41 districts within the U.S. Water Resource Agency (USWRA—an Agency in the Department of Renewable Resources—DoRR) charged with the responsibility to develop, protect and administer water resources within the United States. The Flagstaff District provides six major product lines of goods and services: (1) the development of new infrastructure and projects; (2) management of the operation and maintenance of existing infrastructure; (3) the performance of reimbursable work for others; (4) administration of regulatory requirements; (5) provision of emergency response and recovery; and (6) the delivery of defense, environmental, and restoration programs.

The Flagstaff District's purpose, vision, mission, and values are:

Purpose—To be effective stewards of the public trust

Vision—The Flagstaff District embraces the Agency's vision as its own. This vision can be summed up in terms of our commitment to protect and promote our nation's water resources to be second to none.

Mission—To ensure and protect water resources for economic and recreation benefit to the nation, partner states, and local governments. FD's principal mission areas include

- development and management of projects and programs to provide for inland navigation, flood-damage reduction, environmental protection, recreation, water supply, and other public benefits
- protection of the region's waterways and wetlands
- support for emergency preparedness, natural-disaster relief, and recovery work worldwide
- provision of a broad range of engineering and technical support for other organizations

Values—The District achieves its mission by means of five core values that serve as the foundation of the organization's overall operations and the behavior of every employee.

- Honor and Respect
- Selfless Service and Courage
- Integrity
- Sharing Knowledge
- Working Safely

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Field employees operate 24 multi-purpose dam projects and six lock-and-dam complexes, an equipment-repair station, and a fleet of maintenance vessels. Field offices are connected to the District Office by a radio network and Wide Area Network, or WAN. Computer-Aided Design (CAD) is used in all design projects, as well as Global Positioning System techniques and, most recently, Tele-engineering. Tele-engineering is a critically important advance in state-of-the- art engineering practices in that many projects support international efforts, such as mapping the hydrology of Iraq in just two weeks using a simultaneous combination of U.S.- based and on-site engineering capabilities.

One of the hardest concepts to translate from the private sector into the public sector is that of "competition." In many cases, the services provided to the public by an agency of the Federal Government can be obtained from only that Government agency. Historically, this has led to the unfortunate perception that Government service providers are "the only game in town," lessening the concern for, or need to understand, customer needs, desires, or drivers of satisfaction. In recent years, however, nothing could be further from reality. This realization has served to strengthen the USWRA commitment to providing exceptional value for its customers and continuously improving every aspect of its business. As a Government agency, FD "competes" in three major ways: (1) with private companies for projects or portions of projects; (2) with other districts for reimbursable work; and (3) through outsourcing studies that determine whether work will continue to be accomplished by Government employees or will be contracted to private companies.

Discussion Questions

1. As a public not-for-profit agency, who are Flagstaff District's customers?
2. How might the district define quality? How could it use this definition to evaluate its success in "competing" with other entities?

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[i] Adapted from Baldrige National Quality Program, 2006 Flagstaff Case Study. This is a fictional agency and was used for training purposes for the not-for-profit Baldrige Award process.

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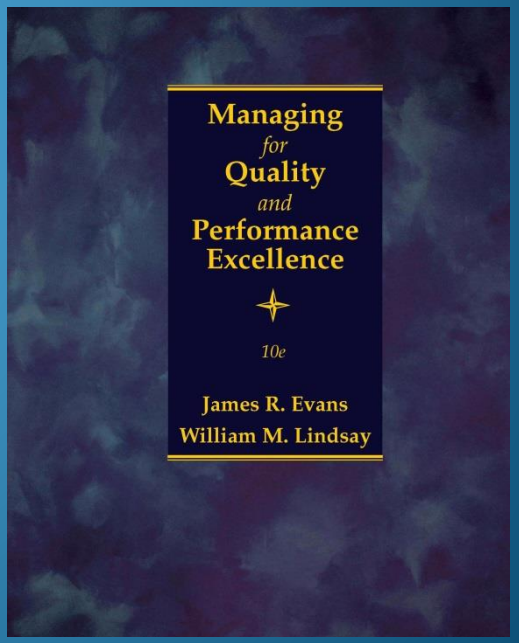
Chapter 2

Foundations of Quality Management



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Quality Culture at The Ritz-Carlton Hotel Company

- "Ladies and Gentlemen Serving Ladies and Gentlemen"— anticipating the wishes and needs of the guests, resolving their problems, and exhibiting genuinely caring conduct toward guests and each other.
- Create a "Skilled and Empowered Work Force Operating with Pride and Joy."

Quality Profile – Texas Nameplate Company, Inc.

- "Fear is useless; what is needed is trust."
- A continuous learning environment that enables empowered teams of workers to take charge of processes and to deliver products and services with a "star quality."
- Reduced its defects from 3.65 percent to about 1 percent in four years.
- satisfaction rates in five areas employees say are the most important exceed national norms by a significant margin.

Quality Profile: MEDRAD

- A culture of high performance.
- Systematic approaches to capture customers' expectations and preferences.
- The Customer Complaint Process focuses on timely response and successful resolution of customer issues
- MEDRAD's overall Net Promoter (NP) scores (a loyalty metric defined by the level of repeat sales and referrals) have been consistently 60 percent or higher, compared to the 50 percent or higher marks for other organizations over the same time periods.

Leaders in the Quality Revolution

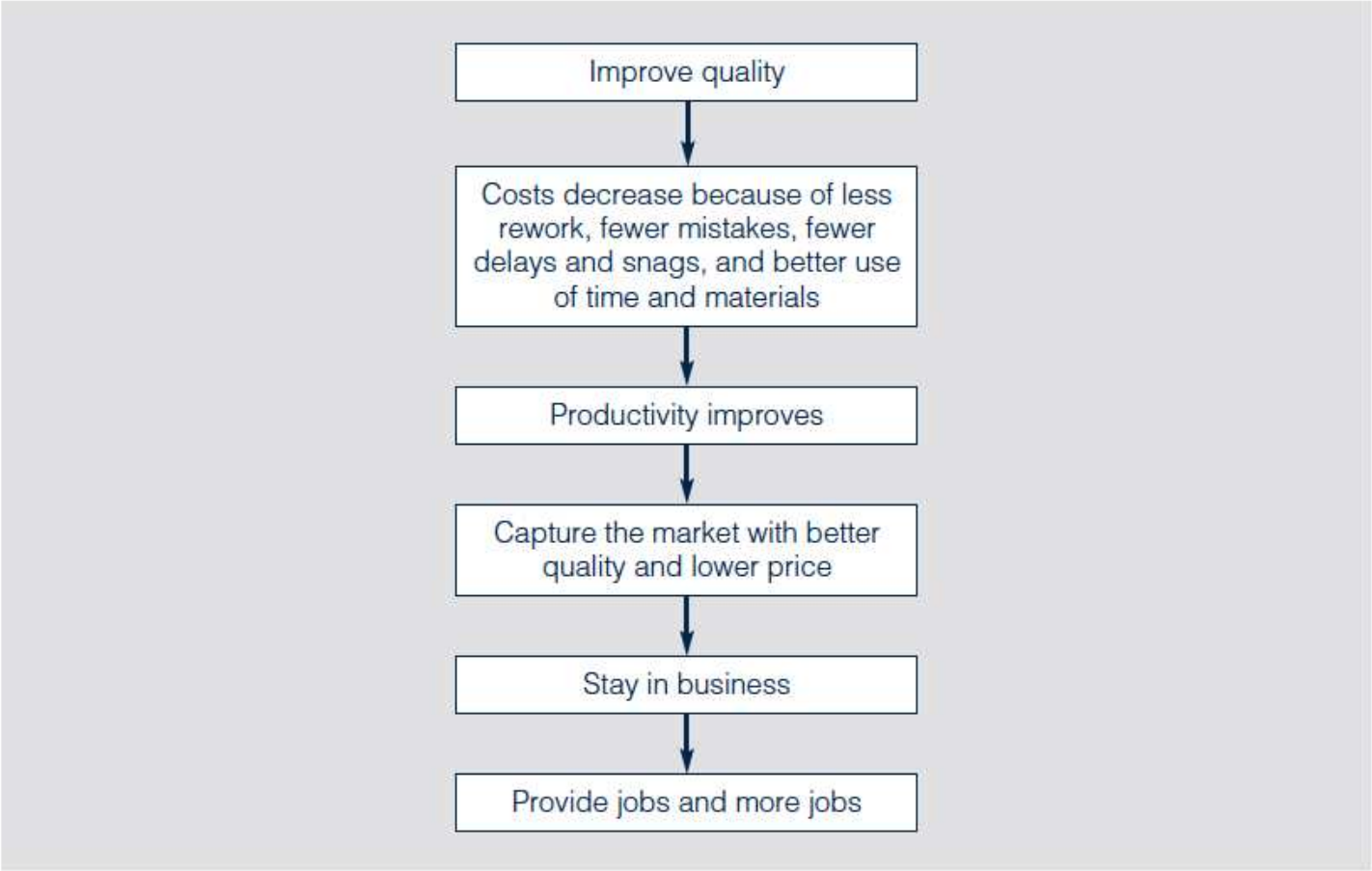
- W. Edwards Deming
- Joseph M. Juran
- Philip B. Crosby

- Armand V. Feigenbaum
- Kaoru Ishikawa

Deming Philosophy

- The Deming philosophy focuses on continual improvements in product and service quality by reducing uncertainty and variability in design, manufacturing, and service processes, driven by the leadership of top management.

FIGURE 2.1
The Deming Chain Reaction



Source: Based on Deming, W. Edwards, Out of the Crisis, figures: Fourteen Points, condensed and expanded versions, pages 23–24, © 2000 Massachusetts Institute of Technology.

Deming's 14 Points (Abridged) *(1 of 2)*

1. Create and publish a company mission statement and commit to it.
2. Learn the new philosophy.
3. Understand the purpose of inspection.
4. End business practices driven by price alone.
5. Constantly improve system of production and service.
6. Institute training.
7. Teach and institute leadership.
8. Drive out fear and create trust.

Deming's 14 Points *(2 of 2)*

9. Optimize team and individual efforts.
10. Eliminate exhortations for work force.
11. Eliminate numerical quotas and M.B.O. Focus on improvement.
12. Remove barriers that rob people of pride of workmanship.
13. Encourage education and self-improvement.
14. Take action to accomplish the transformation.

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WITH AIM TO FOSTER UNDERSTANDING OF
THE DEMING SYSTEM OF PROFOUND KNOWLEDGE™

www.deming.org

Deming's System of Profound Knowledge

- Appreciation for a system
- Understanding variation
- Theory of knowledge
- Psychology

Systems

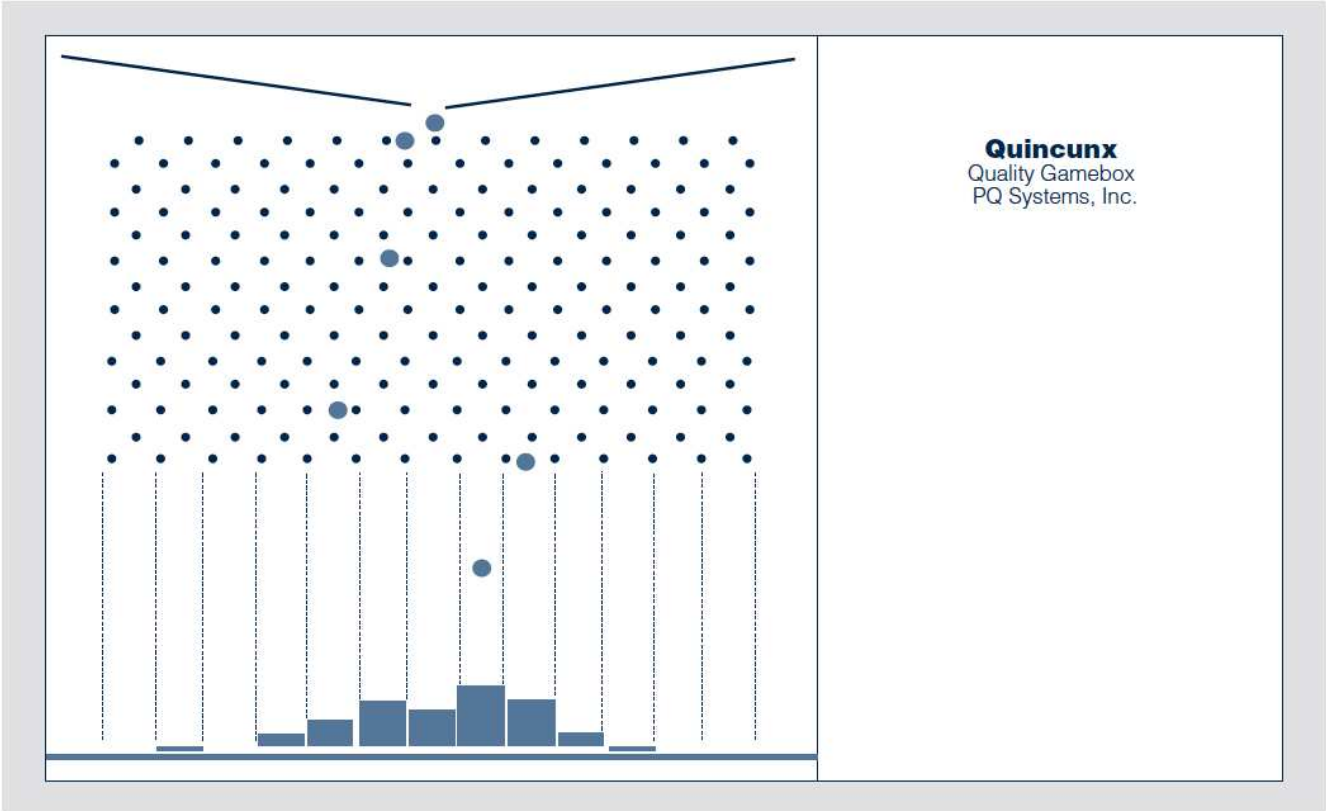
- Most organizational processes are cross-functional
- Parts of a system must work together
- Every system must have a purpose
- Management must optimize the system as a whole

Variation

- Many sources of uncontrollable variation exist in any process
- Excessive variation results in product failures, unhappy customers, and unnecessary costs
- Statistical methods can be used to identify and quantify variation to help understand it and lead to improvements

Quincunx Experiment

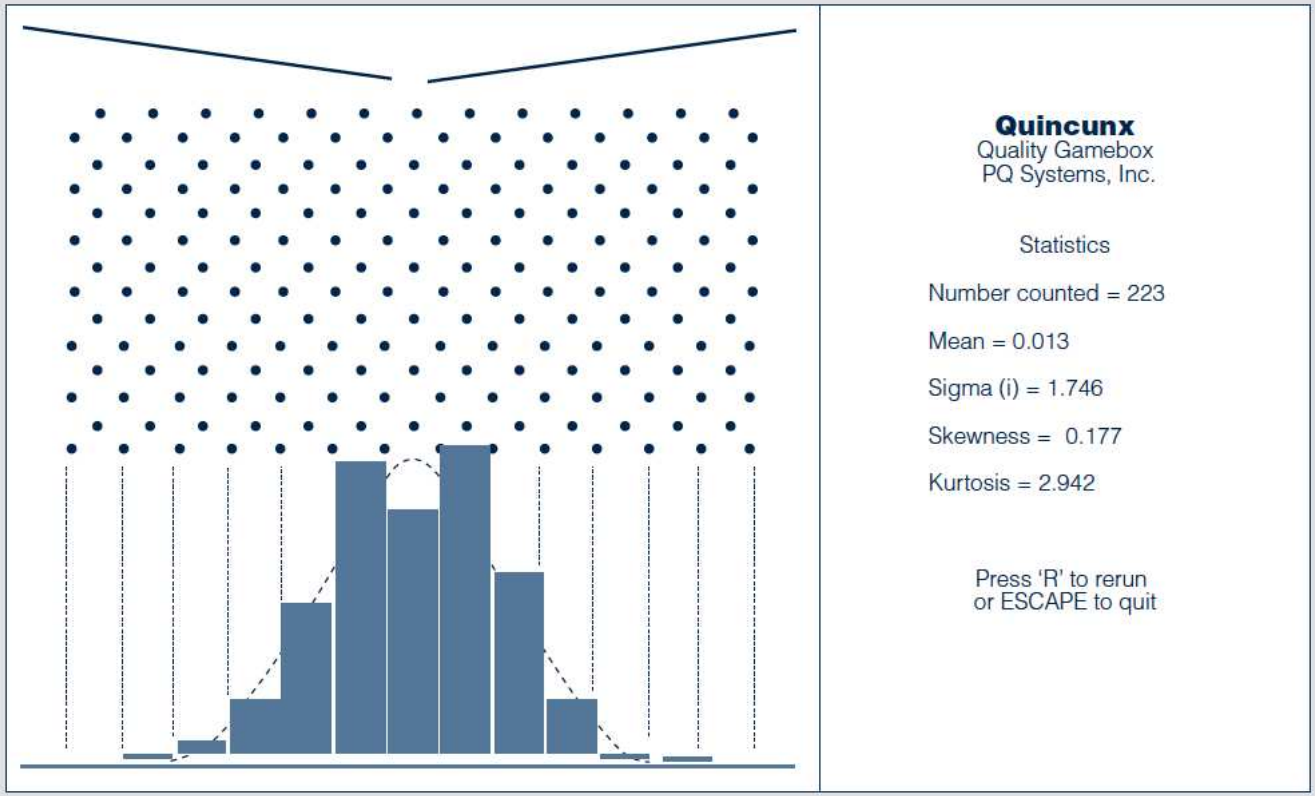
FIGURE 2.2 A Quincunx in Action



Source: From Quality Gamebox, a registered trademark of Productivity–Quality Systems, Inc. Copyright PQ Systems, www.pqsystems.com

Quincunx Experiment Results

FIGURE 2.3 Results from a Quincunx Experiment



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Theory of Knowledge

- Knowledge is not possible without theory
- Experience alone does not establish a theory, it only *describes*
- Theory shows cause-and-effect relationships that can be used for prediction

Psychology

- People are motivated intrinsically and extrinsically; intrinsic motivation is the most powerful
- Fear is demotivating
- Managers should develop pride and joy in work

Juran Philosophy

- Juran proposed a simple definition of quality: “fitness for use.” This definition of quality suggests that it should be viewed from both external and internal perspectives; that is, quality is related to “(1) product performance that results in customer satisfaction; (2) freedom from product deficiencies, which avoids customer dissatisfaction.”

Juran's Quality Trilogy

- Quality planning
- Quality control
- Quality improvement

Juran's Breakthrough Sequence

- Proof of the Need
- Project Identification
- Organization for Breakthrough
- Diagnostic Journey
- Remedial Journey
- Holding the Gains

Crosby Philosophy

"Quality is free . . .

… It's not a gift, but it is free. What costs money are the unquality things -- all the actions that involve not doing jobs right the first time."

Crosby's Absolutes of Quality Management

- Quality means conformance to requirements
- Problems are functional in nature
- There is no optimum level of defects
- Cost of quality is the only useful measurement
- Zero defects is the only performance standard

A.V. Feigenbaum

- Three Steps to Quality
  - Quality Leadership, with a strong focus on planning
  - Modern Quality Technology, involving the entire work force
  - Organizational Commitment, supported by continuous training and motivation

Kaoru Ishikawa

- Instrumental in developing Japanese quality strategy
- Influenced participative approaches involving all workers
- Advocated the use of simple visual tools and statistical techniques

Total Quality

- Principles – foundation of the philosophy
- Practices – activities by which principles are implemented
- Techniques – tools and approaches to make practices effective

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Core Quality Management Principles

- Customer focus
- Teamwork
- Continuous improvement

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ISO 9000:2000 Quality Management Principles

- Customer Focus
- Leadership
- Involvement of People
- Process Approach
- System Approach to Management
- Continual Improvement
- Factual Approach to Decision Making
- Mutually Beneficial Supplier Relationships

Customer Focus Practices

- Researching and understanding customer needs and expectations.
- Ensuring that the objectives of the organization are linked to customer needs and expectations.
- Communicating customer needs and expectations throughout the organization.
- Measuring customer satisfaction and acting on the results.
- Systematically managing customer relationships.
- Ensuring a balanced approach between satisfying customers and other interested parties (such as owners, employees, suppliers, financiers, local communities and society as a whole).

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Leadership Practices

- Considering the needs of all interested parties including customers, owners, employees, suppliers, financiers, local communities and society as a whole.
- Establishing a clear vision of the organization's future.
- Setting challenging goals and targets.
- Creating and sustaining shared values, fairness and ethical role models at all levels of the organization.
- Establishing trust and eliminating fear.
- Providing people with the required resources, training and freedom to act with responsibility and accountability.
- Inspiring, encouraging, and recognizing people's contributions.

Involvement of People Practices

- People understanding the importance of their contribution and role in the organization.
- People identifying constraints to their performance.
- People accepting ownership of problems and their responsibility for solving them.
- People evaluating their performance against their personal goals and objectives.
- People actively seeking opportunities to enhance their competence, knowledge, and experience.
- People freely sharing knowledge and experience.
- People openly discussing problems and issues.

Process Approach Practices

- Systematically defining the activities necessary to obtain a desired result.
- Establishing clear responsibility and accountability for managing key activities.
- Analyzing and measuring of the capability of key activities.
- Identifying the interfaces of key activities within and between the functions of the organization.
- Focusing on the factors such as resources, methods, and materials that will improve key activities of the organization.
- Evaluating risks, consequences, and impacts of activities on customers, suppliers, and other interested parties.

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System Approach to Management Practices

- Structuring a system to achieve the organization's objectives in the most effective and efficient way.
- Understanding the interdependencies between the processes of the system.
- Structured approaches that harmonize and integrate processes.
- Providing a better understanding of the roles and responsibilities necessary for achieving common objectives and thereby reducing cross-functional barriers.
- Understanding organizational capabilities and establishing resource constraints prior to action.
- Targeting and defining how specific activities within a system should operate.
- Continually improving the system through measurement and evaluation.

Continual Improvement Practices

- Employing a consistent organization-wide approach to continual improvement of the organization's performance.
- Providing people with training in the methods and tools of continual improvement.
- Making continual improvement of products, processes, and systems an objective for every individual in the organization.
- Establishing goals to guide, and measures to track, continual improvement.
- Recognizing and acknowledging improvements.

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Factual Approach to Decision Making Practices

- Ensuring that data and information are sufficiently accurate and reliable.
- Making data accessible to those who need it.
- Analyzing data and information using valid methods.
- Making decisions and taking action based on factual analysis, balanced with experience and intuition.

Mutually Beneficial Supplier Relationships Practices

- Establishing relationships that balance short-term gains with long-term considerations.
- Pooling of expertise and resources with partners.
- Identifying and selecting key suppliers.
- Clear and open communication.
- Sharing information and future plans.
- Establishing joint development and improvement activities.
- Inspiring, encouraging, and recognizing improvements and achievements by suppliers.

TQ Techniques

- Statistical methods
- Visual aids for problem solving, such as flowcharts
- Techniques specific to quality assurance activities, such as control charts, measurement systems analysis, reliability models, and so on.

Statistical Thinking

- All work occurs in a system of interconnected processes
- Variation exists in all processes
- Understanding and reducing variation are the keys to success

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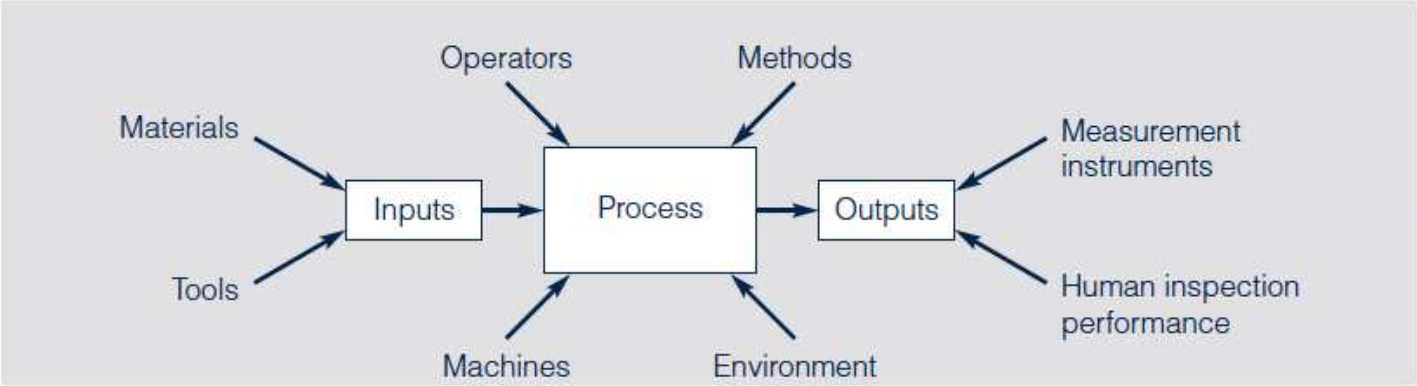
FIGURE 2.4
Sources of Variation in a Production Process



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Problems Created by Variation

- Variation increases unpredictability.
- Variation reduces capacity utilization.
- Variation contributes to a “bullwhip” effect.
- Variation makes it difficult to find root causes.
- Variation makes it difficult to detect potential problems early.

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Types of Variation

- Uncontrollable variation (common causes) are a natural part of a process
- Special (assignable) causes of variation can be recognized and controlled
- Failure to understand these differences can increase variation in a system

Two Fundamental Management Mistakes

1. Treating as a special cause any fault, complaint, mistake, breakdown, accident or shortage when it actually is due to common causes
2. Attributing to common causes any fault, complaint, mistake, breakdown, accident or shortage when it actually is due to a special cause

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Deming's Red Bead Experiment – Round 1

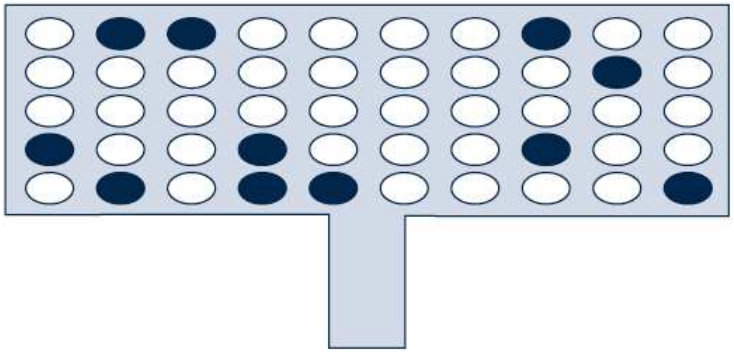
FIGURE 2.5 First Day's Production (The paddle shows the result of the last Willing Worker, Ann)

Bead Box
Quality Gamebox
PQ Systems, Inc.

Percentage of red beads = 20

Player	Rounds	Reds	*p*
Jeff	1	10	0.200
Dave	1	11	0.220
Tom	1	11	0.220
Dennis	1	14	0.280
Marty	1	7	0.140
Ann	1	11	0.220

Statistics
*p*bar = 0.21
UCL = 0.39 LCL = 0.04
p – *p*-chart, <Enter> – continue



Source: Copyright PQ Systems, www.pqsystems.com

Deming's Red Bead Experiment – Round 2

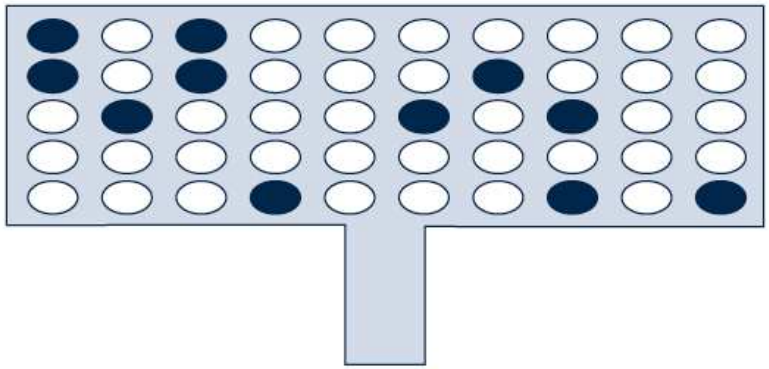
FIGURE 2.6 Second Day's Cumulative Results

Bead Box
Quality Gamebox
PQ Systems, Inc.

Percentage of red beads = 20

Player	Rounds	Reds	*p*
Jeff	2	23	0.230
Dave	2	24	0.240
Tom	2	20	0.200
Dennis	2	21	0.210
Marty	2	17	0.170
Ann	2	23	0.230

Statistics
*p*bar = 0.21
UCL = 0.39 LCL = 0.04
p – *p*-chart, <Enter> – continue



Source: Copyright PQ Systems, www.pqsystems.com

Deming's Red Bead Experiment – Round 3

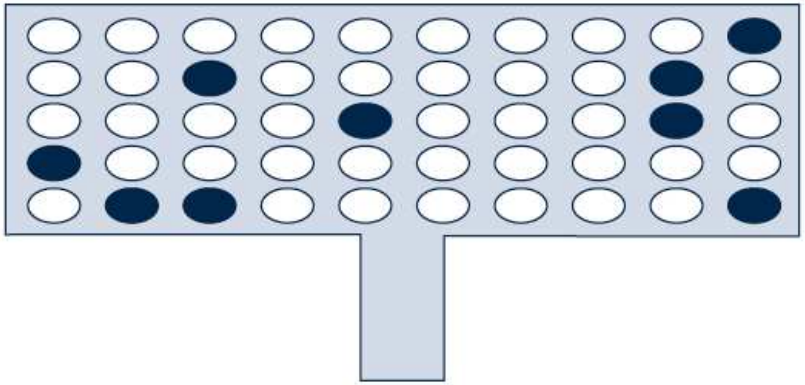
FIGURE 2.7 Third Day's Cumulative Results

Bead Box
Quality Gamebox
PQ Systems, Inc.

Percentage of red beads = 20

Player	Rounds	Reds	*p*
Jeff	3	35	0.233
Dave	3	42	0.280
Tom	3	37	0.247
Dennis	3	30	0.200
Marty	3	23	0.153
Ann	3	32	0.213

Statistics
*p*bar = 0.22
UCL = 0.40 LCL = 0.05
p – *p*-chart, <Enter> – continue



Source: Copyright PQ Systems, www.pqsystems.com

Deming's Red Bead Experiment – Round 4

FIGURE 2.8 Fourth Day's Cumulative Results

Bead Box
Quality Gamebox
PQ Systems, Inc.

Percentage of red beads = 20

Player	Rounds	Reds	*p*
Jeff	4	43	0.215
Dave	4	53	0.265
Tom	4	45	0.225
Dennis	4	39	0.195
Marty	4	31	0.155
Ann	4	41	0.205

Statistics
*p*bar = 0.21
UCL = 0.38 LCL = 0.04
p – *p*-chart, <Enter> – continue

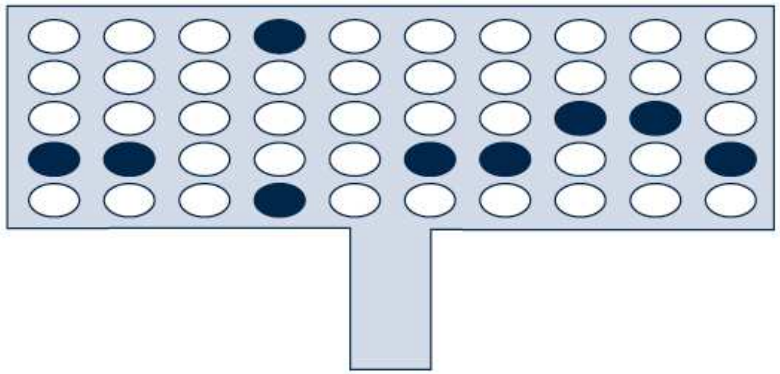


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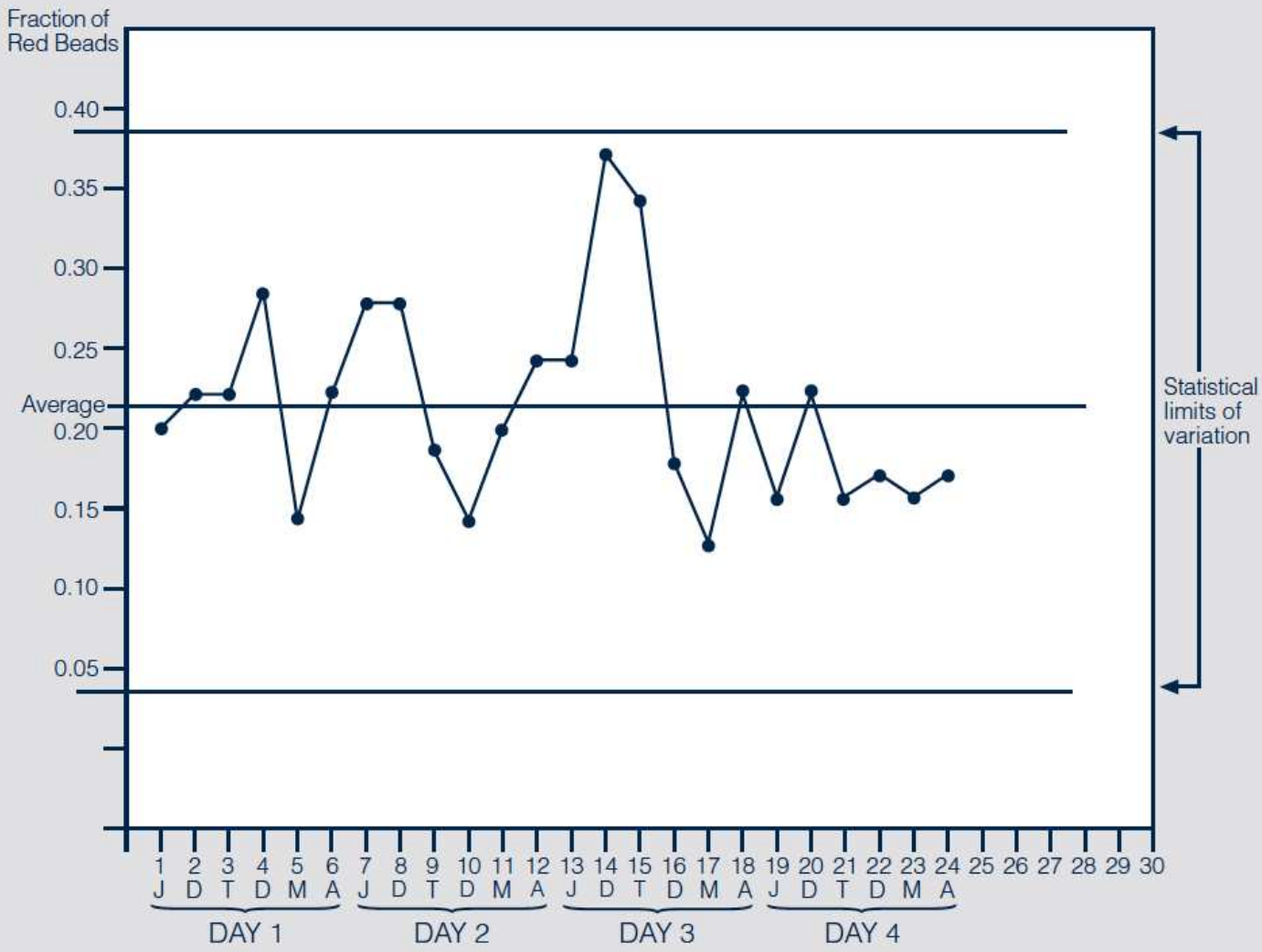
FIGURE 2.9 Run Chart of Fraction of Red Beads Produced



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Lessons Learned

- Quality is made at the top.
- Rigid procedures are not enough.
- People are not always the main source of variability.
- Numerical goals are often meaningless.
- Inspection is expensive and does not improve quality.

Note to Instructors

- The following slides can be used to guide a class demonstration and discussion of the Deming Red Bead experiment using medium size bags of M&Ms, from a suggestion one author found on a TQ newsgroup several years ago. The good output ("red beads") are the blue M&Ms, with the instructor playing the role of Dr. Deming.

We're Going into Business!!!

We have a new global customer and have to start up several factories. So I need teams of 5 to do the work:

1 Production worker
2 Inspectors
1 Chief inspector
1 Recorder

Production Setup

1. Take the bag in your left hand.

2. Tear a 3/4” opening in the right corner. (only large enough for one piece at a time)

Production Process

1. Production worker produces 10 pieces and places them on the napkin.
2. Each inspector, independently, counts the blue ones, and passes to the Chief Inspector to verify.
3. If Chief Inspector agrees, s/he tells the recorder, who reports it to me.

Take Pride in Your Work!

Be a Quality Worker!

Deming's Funnel Experiment

A funnel is suspended above a table with a target drawn on a tablecloth. The goal is to hit the target. Participants drop a marble through the funnel and mark the place where the marble eventually lands.

- *Rule 1:* Leave the funnel alone
- *Rule 2*. Measure the deviation from the point at which the marble comes to rest and the target. Move the funnel an equal distance in the opposite direction from its current position.
- *Rule 3*. Measure the deviation from the point at which the marble comes to rest and the target. Set the funnel an equal distance in the opposite direction of the error from the target.
- *Rule 4*. Place the funnel over the spot where the marble last came to rest.

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FIGURE 2.10
Two Rules for Adjusting the Funnel

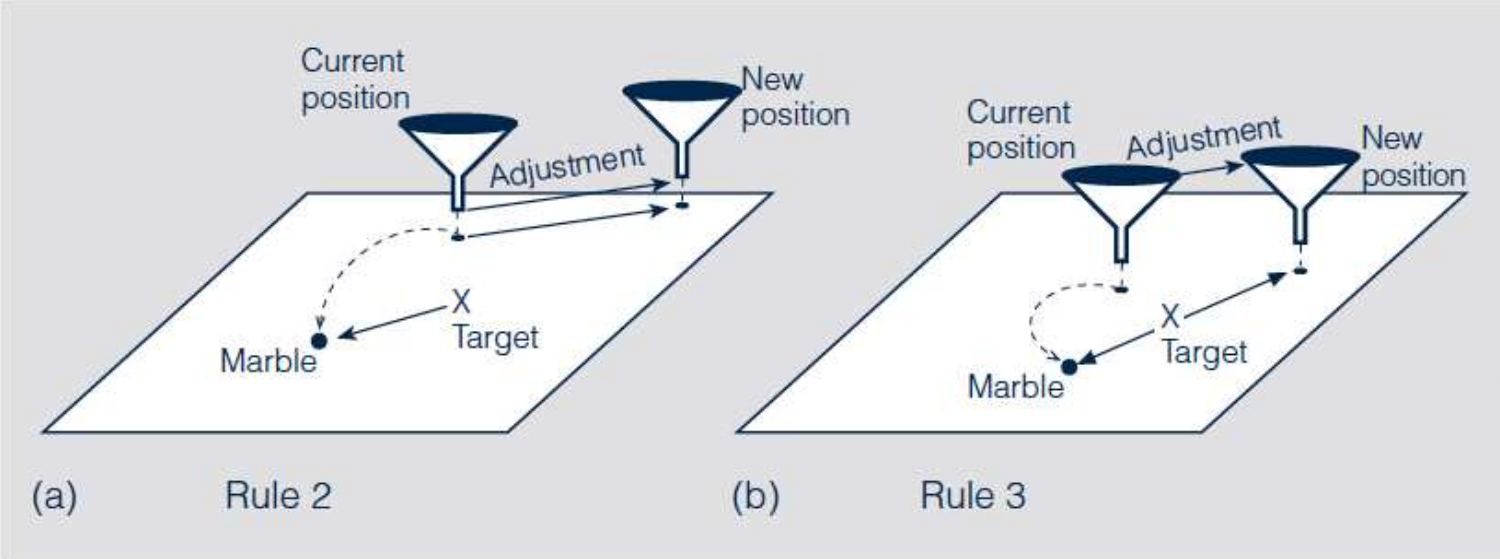

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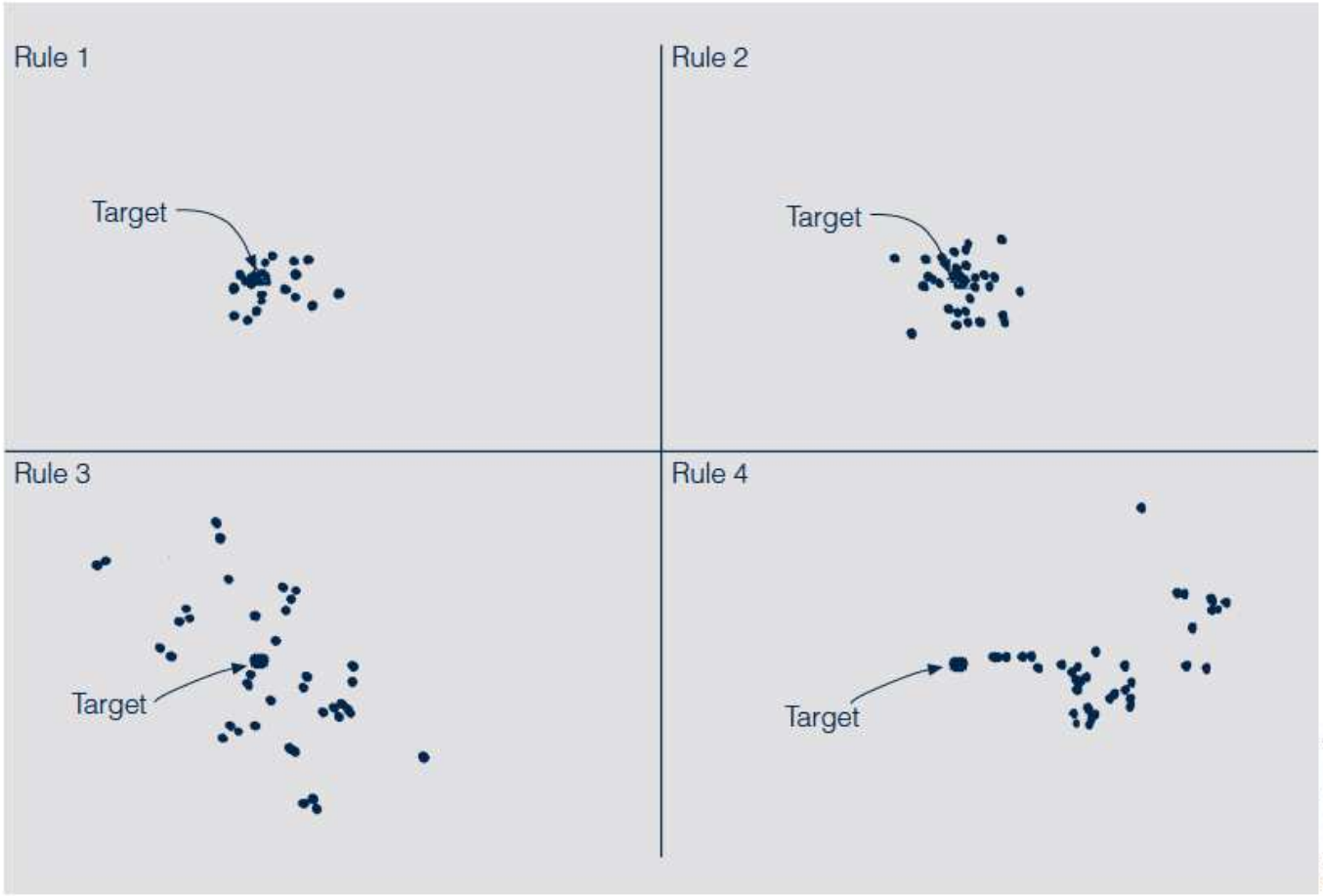
FIGURE 2.11
Results of the Funnel Experiment



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Quality Management Systems

- Quality Management System (QMS) - a mechanism for managing and continuously improving core processes to "achieve maximum customer satisfaction at the lowest overall cost to the organization."
- Objectives
  - Higher product conformity and less variation.
  - Fewer defects, waste, rework, and human error.
  - Improved productivity, efficiency, and effectiveness.

Quality Manual

- A permanent reference for implementing and maintaining the system.
- Typical records
  - inspection reports
  - test data
  - audit reports
  - calibration data

ISO 9000:2000 Objectives

1. Achieve, maintain, and seek to continuously improve product quality (including services) in relationship to requirements.

2. Improve the quality of operations to continually meet customers' and stakeholders' stated and implied needs.

3. Provide confidence to internal management and other employees that quality requirements are being fulfilled and that improvement is taking place.

4. Provide confidence to customers and other stakeholders that quality requirements are being achieved in the delivered product.

5. Provide confidence that quality system requirements are fulfilled.

ISO 9000:2000 Documents

1. ISO 9000:2005—Fundamentals and vocabulary: This document provides fundamental background information and establishes definitions of key terms used in the standards.

2. ISO 9001:2008—Requirements: This is the core document that provides the specific requirements for a quality management system to help organizations consistently provide products that meet customer and other regulatory requirements.

3. ISO 9004:2009—Guidelines for Performance Improvements: This document provides guidelines to assist organizations in improving and sustaining their quality management systems.

ISO 9001:2008

- Management Responsibility addresses what top management must do to ensure an effective quality system.
- Resource Management ensures that an organization provides sufficient people, facilities, and training resources.
- Product Realization refers to controlling the production/service process from receipt of an order or quote through design, materials procurement, manufacturing or service delivery, distribution, and subsequent field service.
- Measurement, Analysis, and Improvement focuses on control procedures for assuring quality in products and processes, analysis of quality-related data, and correction, prevention, and improvement planning activities.

Benefits of ISO 9000

- It provides discipline. The ISO 9001 requirement for audits forces an organization to review its quality system on a routine basis.
- It contains the basics of a good quality system. These include understanding customer requirements, ensuring the ability to meet them, ensuring people resources capable of doing the work that affects quality, ensuring physical resources and support services needed to meet product requirements, and ensuring that problems are identified and corrected.
- It offers a marketing program. ISO certified organizations can use their status to differentiate themselves in the eyes of customers.

Building an Effective QMS

- An effective QMS should
- Be integrated with enterprise systems such as ERP,MES, and SCM, and should focus on actionable decision making, seeking the root causes of problems, and improving processes and systems.
- Drive the principles of quality management throughout the organization by fostering effective practices to implement the principles

Kenneth W. Monfort College of Business[i]

As a college within the University of Northern Colorado (UNC), the Kenneth W. Monfort College of Business (MCB) began in 1968 and quickly grew in step with the explosive growth of business school enrollments nationwide. Located on the university's 236-acre Greeley campus, MCB's 34 full-time faculty, 13 part-time adjunct faculty, and eight administrative staff graduate approximately 300 students a year, drawn from 32 states, primarily Colorado.

In 1984, the College took dramatic steps to make program quality its top priority. At the time, UNC's business program was generally regarded as average and largely overshadowed by a number of key competitors within a fifty-mile radius. With its competitors and most U.S. business programs opting for a growth strategy of degree program assortment and further proliferation of graduate programs, UNC's business administrators and faculty chose an opposite approach. A vision was cast for becoming Colorado's best undergraduate business program—a goal it was agreed would not be possible without making undergraduate business education the College's exclusive mission:

MCB's Mission

> Our mission is to deliver excellent undergraduate business programs and related learning opportunities that prepare students for successful careers and responsible leadership in business.

MCB's Vision

> Our vision is to build a reputation of excellence in Colorado and beyond for preparing future business leaders and professionals.

Within two years, a revolutionary plan commenced for eliminating all graduate programs, including a Ph.D. degree program and Colorado's largest MBA program. Additional changes were made at the undergraduate level, with the elimination of all but one degree program—the Bachelor of Science in business administration. Future business students would declare business as a major and choose from six emphasis areas: accounting, computer information systems, finance, management, marketing, or general business.

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The College adopted two long-term strategies to guide its actions: a positioning strategy of high-quality and low-cost (i.e., exceptional value), and a program delivery framework of *high-touch, wide-tech*, and *professional depth*.

- *High-Touch*. Smaller class sizes are designed to facilitate faculty-student interaction in the classroom. No "mass sections" are permitted to ensure this interaction occurs across the entire curriculum. Smaller class sizes also allow for experiential, hands-on learning techniques to be employed and are designed to increase active learning levels within the student population. Each professor maintains student office hours to increase student access.
- *Wide-Tech*. MCB has invested millions of dollars in its technology infrastructure to support a curriculum that exposes students to a wide array of existing and emerging business technologies, enabling graduates to make a seamless transition into the workplace. The curriculum integrates technology within course content, and MCB prides itself on incorporating the most current versions of industry-standard technologies.
- *Professional depth*. MCB values professional business experience as a selection trait for its instructors. The College also utilizes an innovative executive professor program to strengthen classroom currency and ties with the employment community for graduates. Many of these professors are regionally- or nationally-known executives teaching in-residence, while others are brought to campus as visiting lecturers. The College also has developed partnerships with the business community to provide students with additional opportunities to gain real-world experiences through course components (e.g., business plans, advertising campaigns, market research, and portfolio management).

MCB's value-based approach revolves around three sets of values – instructional, scholarship, and service. Each MCB value statement is held within an overall framework focused on the pursuit of excellence, and a philosophy of continuous improvement guides employee behavior. MCB's commitment to an overall organizational focus on continuous performance improvement and the significant progress made toward development and deployment of this systematic approach, has been driven externally and internally. As a parent organization, UNC requires a regular cycle of program review and evaluation, and MCB's commitment to AACSB accreditation maintenance (which also requires continuous improvement) are both strong external drivers. Internally, drivers include the commitment of

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MCB leadership to performance improvement and a strategic planning system, including Key Performance Indicator (KPI) goal sets, the Educational Testing Service and Educational Benchmarking, Inc. survey feedback which measure achievement, satisfaction, and quality in areas ranging from recruitment, to curriculum, technology, financial resources, program reputation, and faculty and student performance, and the integration of a Malcolm Baldrige-based assessment system. Also included in this framework is the development of a student-centered process, the availability of emerging and existing technologies, the encouragement and support from university leadership, and a series of program accomplishments that have been contagious in creating expectations for continued performance improvement. Although basic processes were already in place during the last five years, MCB has formalized a set of mission-driven key success measures and a budgeting system to facilitate systematic improvement. MCB is proud of its broad set of relationships with key partners and the community and views them as critical to providing a quality education. Within the university, MCB works closely with UNC's admissions, college transition center, and career services offices to ensure that from the time students are enrolled until the time they graduate, they receive the support and guidance they need to be successful.

By most measures of success, MCB is fulfilling its mission of providing a top-quality education that prepares students for successful careers and leadership roles in business, and providing that education at an affordable price. In the results of national standardized tests and the ability of its students to attain jobs in their chosen career fields, MCB ranks among the nation's top undergraduate business programs. The College remains as one of just five undergraduate-only programs nationally to hold AACSB accreditations in business and accounting. MCB ranks in the top 10 percent on 10 of 16 student satisfaction factors measured on the 2004 Business Exit Survey by Educational Benchmarking, Inc. (EBI)—a performance comparison of 171 business schools nationwide. In 2003 and 2004, MCB scored in the top 1 percent for overall student satisfaction. Also, in 2003/04 MCB student scored in the top 10 percent on the major Field Achievement Test, a standardized exam administered by the Educational Testing Service of Princeton, NJ. The ETS exam is give to graduating seniors to measure their knowledge in core business areas. In 2003, nearly 25,000 students in 359 business schools nationwide took the exam. The 2005 numbers went up to 110,000 in 513 programs. As of 2005/06 academic year MCB seniors are scoring in the top 5% . Progress into the top 5

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percent (the highest scoring band possible) reflects a sustained upward trend MCB has experienced over a 12 year span. EBI measures continued to be strong through 2005/2006. MCB received a Baldrige award in 2004.

Key Issues for Discussion

1. How does the mission and vision defined by MCB drive its organizational processes? Why is this important for any business?
2. How important is its continuous improvement philosophy in achieving its mission and vision?
3. Visit the Baldrige website (www.baldrige.nist.gov) and find and read MCB's application summary. Identify several "best practices" that MCB employs that might be useful to your own school for improving quality.

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[i] Source: Malcolm Baldrige National Quality Award 2004 Award Winner Profile, National Institute of Standards and Technology, Department of Commerce, and Kenneth W. Montfort College of Business Baldrige Award Application Summary. A good summary of Monfort's quality journey and approaches can also be found in Valerie Funk, "Narrow Focus Provides Widespread Benefits," Quality Progress, August 2005, 40-47. Information courtesy of Montfort College of Business.