Operations and Supply Chain Management 11th edition Russell Solutions Manual

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2 Quality Management

Answers to Questions

2.1. Consumers perceive quality to be how well a product meets its intended use—that is, how well it does what it is supposed to do—whereas from the product's perspective, quality is how well the product conforms to its design during the production process.

Difficulty: Easy
Learning Objective 1: Discuss and define the dimensions of quality.
Section Reference 1: What Is Quality?
Bloomcode: Knowledge

2.2. 1. Performance: operating characteristics of a product
2. Features: extra items added to basic characteristics
3. Reliability: probability that a product will operate properly
4. Conformance: the degree to which a product meets standards
5. Durability: how long the product lasts
6. Serviceability: ease and speed of repair and courtesy of repair person
7. Aesthetics: how a product looks, feels, sounds, smells, or tastes
8. Safety: Assurance that the customer will not suffer harm; especially important for autos.
9. Other: subjective perceptions based on brand name or advertising

Difficulty: Easy
Learning Objective 1: Discuss and define the dimensions of quality.
Section Reference 1: What Is Quality?
Bloomcode: Knowledge

2.3. Quality of design is the degree to which quality characteristics are designed into a product, whereas quality of conformance is how effectively the production process is able to conform to the specifications required by design.

Difficulty: Easy
Learning Objective 1: Discuss and define the dimensions of quality.
Section Reference 1: What Is Quality?
Bloomcode: Knowledge

2.4. The cost of quality assurance is the cost of maintaining an effective quality program and includes prevention and appraisal costs. The cost of nonconformance, or poor quality, is the result of internal and external failures. These two costs react oppositely to each other; as the cost of quality assurance increases, the cost of poor-quality decreases.

Difficulty: Easy
Learning Objective 2: Understand how quality management systems have evolved and be able to assess the stage of quality evolution a particular company exhibits
Section Reference 2: Quality Management System

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Bloomcode: Comprehension

2.5. Internal failure costs are incurred when poor quality is discovered before the product is delivered to the customer, whereas external failure costs are incurred after a customer receives a poor-quality product. Internal failure costs include scrap, rework, process failure, and downtime, whereas external failure costs include customer complaints, product returns, warranty claims, product liability, and lost sales.

Difficulty: Easy
Learning Objective 5: Understand different methodologies companies follow to achieve quality improvement including Six Sigma, productivity improvement, quality awards and ISO 9000.
Section Reference 5: Roadmaps to Quality Improvement: Six Sigma, Productivity, Awards, and ISO
Bloomcode: Comprehension

2.6. The contractor could be experiencing low productivity yields and have extensive internal failure costs, including scrap, rework, process failure, and downtime costs.

Difficulty: Medium
Learning Objective 5: Understand different methodologies companies follow to achieve quality improvement including six sigma, productivity improvement, quality awards and ISO 9000.
Section Reference 5: Roadmaps to Quality Improvement: Six Sigma, Productivity, Awards, and ISO
Bloomcode: Application

2.7. a. From the consumer's (e.g., student or parent) perspective, quality is probably determined by whether the college education provides the job opportunity expected and whether the graduate perceives he or she has acquired an anticipated level of knowledge that will enable the graduate to perform the job effectively. From the producer's (e.g., university) perspective, quality is how effectively it is able to deliver knowledge (i.e., required courses) and provide the quality-of-life experience expected by the student.
b. The education achieved by the student provides the job opportunities expected and a level of knowledge that enables the graduate effectively to perform the job achieved.
c. Quality-assurance costs include the cost of hiring the best faculty, administrators, and support personnel, the cost of designing and redesigning courses and curriculum to meet changing needs, the cost of providing a good physical and mental environment (i.e., housing, food, entertainment, security, etc.), the cost of modern technical teaching equipment, the cost of information systems, and the cost of assessing alumni satisfaction with their education. Costs of poor quality include students who fail or drop out, reduced funding from the state or private donors, and fewer enrollments.
d. Quality circles could be developed within administrative and operational units and academic departments. Circles might include both faculty or administrators and classified employees. The normal quality circle stages of training, problem identification, analysis, solution, and presentation could be followed.

Difficulty: Medium
Learning Objective 1: Discuss and define the dimensions of quality.
Learning Objective 4: Understand the role of customers, employees and services in quality management systems.
Learning Objective 5: Understand different methodologies companies follow to achieve quality improvement including six sigma, productivity improvement, quality awards and ISO 9000.
Section Reference 1: What Is Quality?
Section Reference 4: Customers in Quality Management

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Section Reference 5: Roadmaps to Quality Improvement: Six Sigma, Productivity, Awards, and ISO
Bloomcode: Analysis

2.8. Improving quality will increase product yield—that is, the number of acceptable units—thus increasing productivity.

Difficulty: Easy
Learning Objective 3: Understand different quality tools used to measure and achieve quality improvement.
Section Reference 3: Quality Tools
Bloomcode: Comprehension

2.9. The cost of poor quality could include external failure costs for customer complaints, returned products to be repaired under warranty, lost future sales, and liability costs if someone is hurt because of a problem. Costs of quality improvement might include improved design costs for the product, process costs, and inspection costs for the final product and at various stages of the production process.

Difficulty: Easy
Learning Objective 2: Understand how quality management systems have evolved and be able to assess the stage of quality evolution a particular company exhibits.
Section Reference 2: Quality Management System
Bloomcode: Comprehension

2.10. *cellphones:* Visual attractiveness, size, weight, clarity of sound and picture, and camera features
Pizza: Size, ingredients, taste, smell, service in delivery, and temperature.
Athletic shoes: Size, weight, comfort, visual attractiveness, and durability.

Difficulty: Easy
Learning Objective 1: Discuss and define the dimensions of quality.
Section Reference 1: What Is Quality?
Bloomcode: Comprehension

2.11. The input is customer inquiries, and the final product is responses that result in customer satisfaction. Associated quality costs might include prevention costs, such as designing a telephone system to ensure prompt connections without waiting and a properly designed computer system to provide accurate customer account information, and training costs to make certain service operators are courteous and knowledgeable. Appraisal costs might include the cost of monitoring service calls to ascertain response rates and operator courtesy. Poor quality might result in complaints from customers and lost accounts.
A quality management program could incorporate a system to monitor calls to ensure prompt, courteous, and knowledgeable service. An employee-involvement program, wherein operators might identify problems, would be beneficial.

Difficulty: Medium
Learning Objective 3: Understand different quality tools used to measure and achieve quality improvement.
Section Reference 3: Quality Tools
Bloomcode: Application

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2.12. Prevention costs are directed at preventing poor quality products from reaching the customer, thus avoiding the various internal and external failure costs associated with poor quality.

Difficulty: Easy
Learning Objective 2: Understand how quality management systems have evolved and be able to assess the stage of quality evolution a particular company exhibits.
Section Reference 2: Quality Management System
Bloomcode: Comprehension

2.13. It is important to have a means for assessing the impact of quality improvement programs on the organization's profitability and productivity.

Difficulty: Easy
Learning Objective 2: Understand how quality management systems have evolved and be able to assess the stage of quality evolution a particular company exhibits.
Section Reference 2: Quality Management System
Bloomcode: Comprehension

2.14. *W.E. Deming:* Introduced the Japanese to quality management principles and philosophy, embodied in his 14 points.
Joseph Juran: A major contributor to the Japanese quality movement.
Phillip Crosby: Changed general perceptions of cost of quality and promoted zero defects.
Armand Feigenbaum: Introduced the concept of total quality control, a total company-wide approach to quality management.
Kaoru Ishikawa: Introduced quality circles and cause and effect diagrams.

Difficulty: Easy
Learning Objective 2: Understand how quality management systems have evolved and be able to assess the stage of quality evolution a particular company exhibits.
Section Reference 2: Quality Management System
Bloomcode: Knowledge

2.15. The Baldrige Award has had a pervasive impact on American companies, in general promoting quality improvement. Thousands of companies request award applications each year to use simply to establish quality management programs based on Baldrige Award criteria.

Difficulty: Easy
Learning Objective 5: Understand different methodologies companies follow to achieve quality improvement including Six Sigma, productivity improvement, quality awards and ISO 9000.
Section Reference 5: Roadmaps to Quality Improvement: Six Sigma, Productivity, Awards, and ISO
Bloomcode: Comprehension

2.16. This should be a student project. There are many relevant articles on the internet, and the articles are generally easy to read.

Difficulty: Medium
Learning Objective 2: Understand how quality management systems have evolved and be able to assess the

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stage of quality evolution a particular company exhibits.
Section Reference 2: Quality Management System
Bloomcode: Application

2.17. The student could provide many reasons for failure including lack of total commitment, ineffective planning, goals too easy or too difficult to achieve, improper measurement techniques, ineffective leadership, not enough employee training, etc. See G. Salegra and Farzaneh, "Obstacles to Implementing Quality," *Quality Progress*, 33, no. 7 (July 2000): 53–57.

Difficulty: Medium
Learning Objective 2: Understand how quality management systems have evolved and be able to assess the stage of quality evolution a particular company exhibits.
Section Reference 2: Quality Management System
Bloomcode: Application

2.18. The dimensions of quality for a service company are located in the text. The student should identify these or similar ones for the company they select.

Difficulty: Medium
Learning Objective 1: Discuss and define the dimensions of quality.
Section Reference 1: What Is Quality?
Bloomcode: Application

2.19. The two service companies should be in the community and the quality characteristics the students will tend to focus on will include courtesy and quickness of service.

Difficulty: Medium
Learning Objective 1: Discuss and define the dimensions of quality.
Section Reference 1: What Is Quality?
Bloomcode: Application

2.20. Although students in this class might suggest that grades are a quality measurement a more realistic approach to evaluation are student evaluations of the class or surveys of students. Quality characteristics might include course organization, presentation of lectures, class environment, physical appearance of the classroom, schedule (i.e., are the lectures completed on time), the quality of supplementary material, physical appearance and demeanor of the instructor, including friendliness and courtesy, the accuracy and completeness of assignments, etc.

Difficulty: Medium
Learning Objective 2: Understand how quality management systems have evolved and be able to assess the stage of quality evolution a particular company exhibits.
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Bloomcode: Application

2.21. The answer depends on the company selected by the student. For example, there is a particular hotel that has never gotten a room reservation right for us, and, the instructions for ordering tickets at the web

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site for the 1996 Olympics in Atlanta were littered with pitfalls. Airlines are a favorite example of a poor-quality service for students who travel.

Difficulty: Medium
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Learning Objective 3: Understand different quality tools used to measure and achieve quality improvement
Section Reference 1: What Is Quality?
Section Reference 2: Quality Management System
Section Reference 3: Quality Tools
Bloomcode: Application

2.22. Retail stores and grocery stores are examples of local businesses that, in our experience, tend to vary in quality. We have never had a bad ordering experience with L.L. Bean although that's not true of some other mail order operations we have dealt with. In most cases, if a service has been identified by the student it will be because of courteous, helpful employees, while if a manufacturing product has been identified, it will be because of superior physical traits, such as durability.

Difficulty: Medium
Learning Objective 1: Discuss and define the dimensions of quality.
Section Reference 1: What Is Quality?
Bloomcode: Application

2.23. A QMS tends to give some focus and structure to strategic planning. A QMS provides identifiable goals, and many well-documented initiatives for quality improvement such as quality circles, employee training, empowerment, etc. A QMS also provides a means for measuring success which is essential in a strategic planning process.

Difficulty: Medium
Learning Objective 2: Understand how quality management systems have evolved and be able to assess the stage of quality evolution a particular company exhibits.
Section Reference 2: Quality Management System
Bloomcode: Application

2.24. Many U.S. suppliers cannot do business with companies overseas unless they have ISO certification. In addition, many U.S. companies also desire or request their suppliers to comply with ISO 9000 standards.

Difficulty: Easy
Learning Objective 5: Understand different methodologies companies follow to achieve quality improvement including Six Sigma, productivity improvement, quality awards and ISO. 9000.
Section Reference 5: Roadmaps to Quality Improvement: Six Sigma, Productivity, Awards, and ISO.
Bloomcode: Knowledge

2.25. Common characteristics that the students will discover include strong leadership at the top, total company commitment, employee training, involvement and empowerment, challenging goals for quality achievement, focus on customer satisfaction, and extensive use of statistical quality control techniques,

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among other things.

Difficulty: Easy
Learning Objective 5: Understand different methodologies companies follow to achieve quality improvement including Six Sigma, productivity improvement, quality awards and ISO 9000.
Section Reference 5: Roadmaps to Quality Improvement: Six Sigma, Productivity, Awards, and ISO
Bloomcode: Comprehension

2.26. Some companies believe their quality is "good enough." However, primary reasons for not implementing a QMS program are lack of time and the cost involved; some companies do not have the resources available to undertake a QMS program.

Difficulty: Easy
Learning Objective 2: Understand how quality management systems have evolved and be able to assess the stage of quality evolution a particular company exhibits.
Section Reference 2: Quality Management System
Bloomcode: Comprehension

2.27. This will depend on the web site the student accesses. In general, they should adapt the attributes described for services.

Difficulty: Medium
Learning Objective 1: Discuss and define the dimensions of quality.
Section Reference 1: What Is Quality?
Bloomcode: Application

2.28. This depends on the airline the student selects. Example defects they might mention are flight delays or cancellations, lost luggage or luggage mishandling, discourteous employees, wrong or misleading flight information, uncomfortable seats, etc.

Difficulty: Medium
Learning Objective 1: Discuss and define the dimensions of quality.
Section Reference 1: What Is Quality?
Bloomcode: Application

2.29. This will depend on which websites the student selects.

Difficulty: Medium
Learning Objective 1: Discuss and define the dimensions of quality.
Section Reference 1: What Is Quality?
Bloomcode: Application

2.30. Categories of possible quality problems might be related to the ordering process, pizza construction, pizza ingredients, packaging/boxing, time to receive order, order accuracy/correctness, and pricing.

Difficulty: Medium

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Learning Objective 3: Understand different quality tools used to measure and achieve quality improvement.
Section Reference 3: Quality Tools
Bloomcode: Application

2.31. If someone purchases a residence, then the dwelling is more of a product. However, renting a dormitory room or an apartment tends to fall into the service category because it is part of an ongoing process or interaction between the owner and renter. In other words, the owner retains responsibility for the product, i.e., the dwelling. As such, the quality of the living accommodation should be assessed according to the dimensions of quality for a service.

Difficulty: Medium
Learning Objective 1: Discuss and define the dimensions of quality.
Section Reference 1: What Is Quality?
Bloomcode: Application

2.32. Unfulfilled, late and erroneous orders, and defective items, would obviously have a negative effect on Amazon's reputation. Amazon asks customers to rate sellers on its "open market" according to a number of criteria, and it's assumed that sellers would be banned if they had continued poor performance. In their answer, students could reference the Amazon seller rating system.

Difficulty: Medium
Learning Objective 1: Discuss and define the dimensions of quality.
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Bloomcode: Application

2.33. The calculation of the quality and reliability ratings can be found on the J.D. Power Website. To calculate the ratings, J.D. Power begins with the syndicated study index scores or a specific standard of measurement which can be found, in most cases, in the associated press release. An example of an index score is found in the J.D. Power U.S. Retail Banking Satisfaction Study, where companies are ranked according to overall index scores based upon weighted responses to several survey factors. An example of a specific standard of measurement is found in the J.D. Power Initial Quality Study, where vehicles are ranked according to reported Problems per 100 vehicles (PP100). Using these measurements, ratings are calculated based on the range between the product or service with the highest score and the product or service with the lowest score. J.D. Power generates a rating of five, four, three, or two.

Difficulty: Medium
Learning Objective 4: Understand the role of customers, employees and services in quality management systems.
Section Reference 4: Customers, Employees, and Services in Quality Management
Bloomcode: Application

2.34. The answer will depend on the product and service the student selects.

Difficulty: Medium

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Learning Objective 4: Understand the role of customers, employees and services in quality management systems.
Section Reference 4: Customers, Employees, and Services in Quality Management
Bloomcode: Application

2.35. The Baldrige Award website for K&N, https://www.nist.gov/baldrige/kn-management , has extensive information about the company.

Difficulty: Medium
Learning Objective 5: Understand different methodologies companies follow to achieve quality improvement including Six Sigma, productivity improvement, quality awards and ISO 9000.
Section Reference 5: Roadmaps to Quality Improvement: Six Sigma, Productivity, Awards, and ISO
Bloomcode: Application

2.36. The answer will depend on the service provider the student selects.

Difficulty: Medium
Learning Objective 1: Discuss and define the dimensions of quality.
Learning Objective 2: Understand how quality management systems have evolved and be able to assess the stage of quality evolution a particular company exhibits.
Section Reference 1: What Is Quality?
Section Reference 2: Quality Management System
Bloomcode: Application

2.37. They all focus on all aspects of the dining experience including the overall customer experience, including waiting time, service, food and price. As such, in many ways they are clones of each other, and must compete on all quality attributes. The student might want to reference the Darden Restaurant Group (Red Lobster, Olive Garden) and Bloomin' Brands (Outback, Bonefish Grill, Carrabba's).

Difficulty: Medium
Learning Objective 2: Understand how quality management systems have evolved and be able to assess the stage of quality evolution a particular company exhibits.
Section Reference 2: Quality Management System
Bloomcode: Application

2.38. According to the Baldrige website, there is increasing pressure in the U.S. to overhaul our health care system, and health care organizations around the country are looking for ways to improve safety and outcomes, while reducing cost. The history of the Baldrige Program shows that health care organizations of any size and type and in any location can benefit from using their health care criteria. It is likely that healthcare organizations have made more applications for the Baldrige Award, in part to effectively compete in an industry under close public scrutiny, and partly because health care organizations have the resources to prepare the extensive Baldrige application materials.

Difficulty: Medium
Learning Objective 5: Understand different methodologies companies follow to achieve quality improvement including Six Sigma, productivity improvement, quality awards and ISO. 9000.
Section Reference 5: Roadmaps to Quality Improvement: Six Sigma, Productivity, Awards, and ISO.

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Bloomcode: Application

2.39. Sustainability, in its broadest sense, focuses on improving the "quality" of the workplace (i.e., human resources), which is one of the seven major categories of criteria for the Baldrige Award criteria.

Difficulty: Easy
Learning Objective 5: Understand different methodologies companies follow to achieve quality improvement including six sigma, productivity improvement, quality awards and ISO 9000.
Section Reference 5: Roadmaps to Quality Improvement: Six Sigma, Productivity, Awards, and ISO
Bloomcode: Comprehension

2.40. The quality management systems used by Amazon and Target can be applied to any number of "different" industries, including airlines; the fact that they have not are due more to the commitment of the company. In the case of airlines, their lack of competition and near monopolies in certain markets contributes to their unwillingness to adopt quality management principles. Further airlines seem to have concluded that they must compete on the basis of price and not quality, especially in the customer service areas.

Difficulty: Medium
Learning Objective 1: Discuss and define the dimensions of quality.
Section Reference 1: What Is Quality?
Bloomcode: Application

2.41. The obvious reason that companies outsource their customer service activities is labor cost; it's cheaper. This is the same reason that manufacturing, and retail companies have outsourced their supply to places like China and Mexico. Many quality-conscious companies like P&G and Wal-Mart seek to incorporate their overseas suppliers into their own quality management systems, whereas some companies have not.

Difficulty: Medium
Learning Objective 1: Discuss and define the dimensions of quality.
Learning Objective 2: Understand how quality management systems have evolved and be able to assess the stage of quality evolution a particular company exhibits.
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Bloomcode: Application

2.42. Apple's overall product quality, customer service and technical innovations create demand that overcomes potential "glitches" in its initial product designs.

Difficulty: Medium
Learning Objective 2: Understand how quality management systems have evolved and be able to assess the stage of quality evolution a particular company exhibits.
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Bloomcode: Application

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2.43. Answer depends on the service provider the student selects.

Difficulty: Medium
Learning Objective 4: Understand the role of customers, employees and services in quality management systems.
Section Reference 4: Customers, Employees, and Services in Quality Management
Bloomcode: Application

2.44. Companies can insure quality across its supply chain by requiring its suppliers to adopt its own quality management system, and by closely monitoring its effectiveness. Companies that have failed in their attempts to insure quality among their overseas suppliers in countries like China, have allowed quality to be monitored locally or by a third-party firm, while successful companies have used their own offices and employees to monitor quality overseas, i.e., a physical presence is generally required combined with the willingness to change suppliers if quality is not forthcoming.

Difficulty: Easy
Learning Objective 2: Understand how quality management systems have evolved and be able to assess the stage of quality evolution a particular company exhibits.
Section Reference 2: Quality Management System
Bloomcode: Comprehension

2.45. In the workplace, labor, materials, manufacturing processes, sourcing and transportation.

Difficulty: Easy
Learning Objective 2: Understand how quality management systems have evolved and be able to assess the stage of quality evolution a particular company exhibits.
Section Reference 2: Quality Management System
Bloomcode: Comprehension

2.46. Common characteristics include a commitment to product and process innovation, emulating "best practices" of quality leaders, and supply chain efficiency. These companies are typically involved in ISO certification processes, employ six sigma, and often adopt Baldrige Award criteria.

Difficulty: Easy
Learning Objective 2: Understand how quality management systems have evolved and be able to assess the stage of quality evolution a particular company exhibits.
Section Reference 2: Quality Management System
Bloomcode: Comprehension

2.47. There are several companies identified in the chapter that use six sigma, and the student can also search "Six Sigma" on the internet.

Difficulty: Easy
Learning Objective 4: Understand the role of customers, employees and services in quality management systems.
Section Reference 4: Customers, Employees, and Services in Quality Management
Bloomcode: Comprehension

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2.48. Categories of quality problems for flight delays could relate to employees (not enough to check in, problems with the check-in process, deplaning problems, insufficient maintenance personnel to accomplish plane turn-around, etc.), mechanical problems, luggage problems, maintenance problems, weather, flight controller problems, over booking, over scheduling, etc.

Difficulty: Medium
Learning Objective 3: Understand different quality tools used to measure and achieve quality improvement.
Section Reference 3: Quality Tools
Bloomcode: Analysis

2.49. This depends on the business the student selects. If for example, they selected a restaurant they eat at frequently they would need to identify the categories of quality problems which might include employees, food quality, restaurant environment, waiting time, price, service, menu, etc.

Difficulty: Medium
Learning Objective 3: Understand different quality tools used to measure and achieve quality improvement.
Section Reference 3: Quality Tools
Bloomcode: Application

2.50. It should be obvious to the student that the most important defects are the engine problems and faulty brakes. The priority of the quality problems is almost the reverse of the frequencies; faulty brakes are clearly the most significant category of defects. This points out that when applying Pareto analysis, the degree of importance must be the same for all defect categories. If not, then the categories should be weighted according to their importance in order to adjust the chart.

Difficulty: Medium
Learning Objective 3: Understand different quality tools used to measure and achieve quality improvement.
Section Reference 3: Quality Tools
Bloomcode: Application

2.51. *Marketing* has direct contact with the customer. Marketing is typically responsible for the consumer research that determines the quality characteristics that customers want and need, and the price they are willing to pay for it. Marketing also informs the consumer about the quality characteristics of a product through advertising and promotion. Sales provides feedback information through its interaction with the customer, which is a determinant of product design. Research and development will explore new ideas for products and be actively involved in product innovation.

Engineering translates the product quality characteristics determined by marketing and top management into a product design, including technical specifications, material and parts requirements, equipment requirements, workplace and job design, and operator training and skills. Overdesigning the product is a drain on the company's resources and can erode profits, whereas under designed products will generally not meet the customer's quality expectations. Genichi Taguchi, the Japanese quality expert, estimates that poor product design is the cause of as much as 80 percent of all defective items. It is much cheaper and easier to make changes at the design stage than at the production stage, so companies need to focus on quality at all stages of the design process.

Purchasing must make sure that the parts and materials required by the product design are of high quality. Quality of the final product will be only as good as the quality of the materials used to make it.

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Purchasing must select vendors who share the company's commitment to quality and who maintain their own quality management program for providing high-quality service, materials, and parts.

Human resources is responsible for hiring employees that have the required abilities and skills, and training them for specific job tasks. Employees not well trained in their tasks will probably contribute to poor quality or service. Personnel also have responsibility for educating employees about quality and ways to achieve quality in their tasks. TQM requires that all employees throughout the organization be responsible for quality. Employees, collectively and individually, must not only perform their tasks according to design specifications but also be responsible for identifying poor quality or problems that may lead to poor quality and taking action to correct these problems. Performance appraisal under TQM focuses more on quality improvement and group and company achievement than on individual job performance.

Management at all levels must implement the product design according to quality specifications, controlling labor, materials, equipment, and processes. Failure to manage effectively can result in employee errors, equipment breakdown, bottlenecks, interrupted service, and the like, which contribute to poor quality.

Distribution makes sure that high-quality products are delivered on-time and undamaged to the customer. Packaging methods and materials, storage facilities and procedures, and shipping modes must ensure that final products are protected and that customers receive them on time.

Difficulty: Medium
Learning Objective 2: Understand how quality management systems have evolved and be able to assess the stage of quality evolution a particular company exhibits.
Section Reference 2: Quality Management System
Bloomcode: Analysis

2.52. This answer depends on the award the student selects.

Difficulty: Medium
Learning Objective 5: Understand different methodologies companies follow to achieve quality improvement including Six Sigma, productivity improvement, quality awards and ISO 9000.
Section Reference 5: Roadmaps to Quality Improvement: Six Sigma, Productivity, Awards, and ISO
Bloomcode: Application

2.53. This answer depends on the company the student selects.

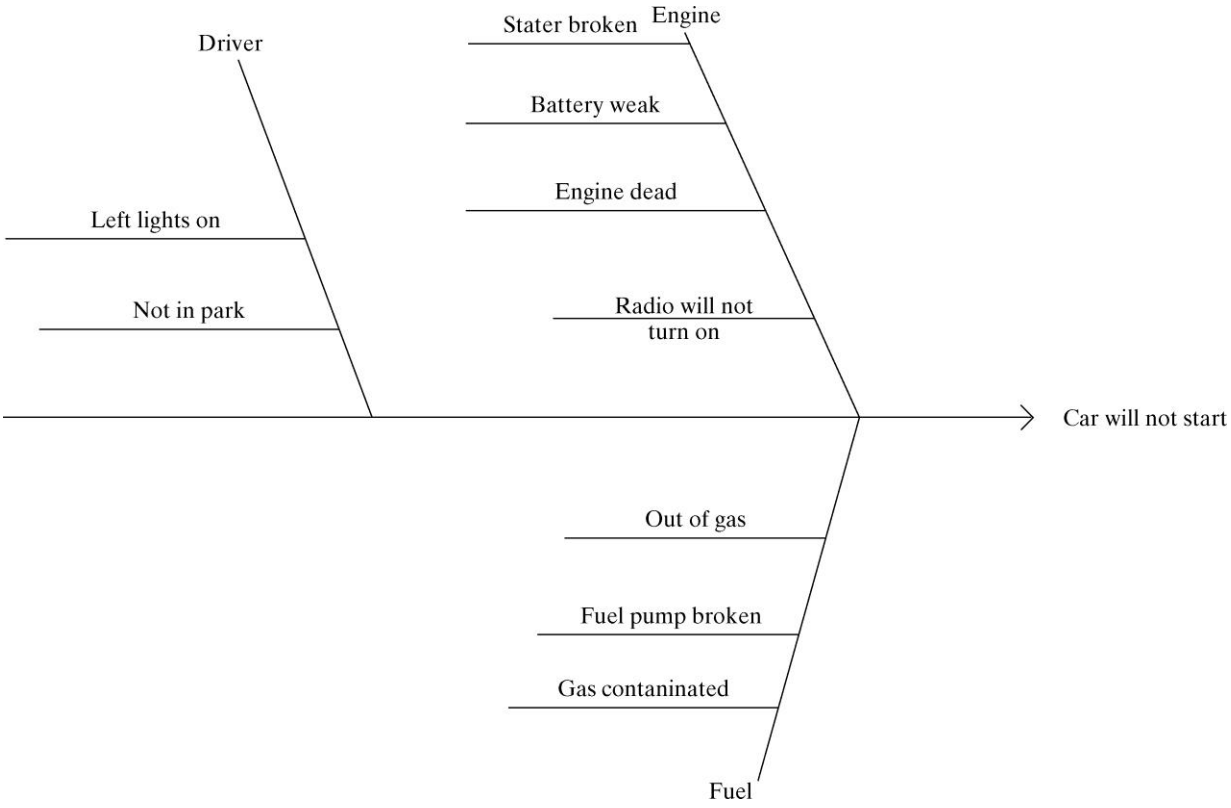
Difficulty: Medium
Learning Objective 5: Understand different methodologies companies follow to achieve quality improvement including Six Sigma, productivity improvement, quality awards and ISO 9000.
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Bloomcode: Application

2.54. This answer depends on the article and company the student selects.

Difficulty: Medium
Learning Objective 5: Understand different methodologies companies follow to achieve quality improvement including Six Sigma, productivity improvement, quality awards and ISO 9000.
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Bloomcode: Analysis

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2.55. This question was adapted from: L. Fredendall, J. Patterson, C. Lenhartz and B. Mitchell," What Should Be Changed?," *Quality Progress* 35 (1; January 2002): p. 50–59. This is an excellent article about the use of cause-and-effect diagrams students can be referred to.



Difficulty: Medium
Learning Objective 3: Understand different quality tools used to measure and achieve quality improvement.
Section Reference 3: Quality Tools
Bloomcode: Analysis

2.56. *Black Belt*—the leader of a quality improvement project, which is a full-time position
Green Belt—a project team member, which is a part-time position
Master Black Belt—a teacher and mentor for Black Belts which, is also a full-time position. A Black Belt would have to have led several successful projects before being certified as a Master Black belt.

Difficulty: Easy
Learning Objective 5: Understand different methodologies companies follow to achieve quality improvement including Six Sigma, productivity improvement, quality awards and ISO 9000.
Section Reference 5: Roadmaps to Quality Improvement: Six Sigma, Productivity, Awards, and ISO
Bloomcode: Knowledge

2.57. Breakthrough Strategy:
1. *Define* the process including who the customers are and what their problems are.
2. *Measure* the process and collect data.

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3. *Analyze* the data in order to develop information that provides insight into the process, including causes of defects.
4. *Improve* the process by making changes and measuring the results.
5. *Control* the improved process by monitoring it and making sure the desired performance level is sustained.

Difficulty: Easy
Learning Objective 5: Understand different methodologies companies follow to achieve quality improvement including Six Sigma, productivity improvement, quality awards and ISO 9000.
Section Reference 5: Roadmaps to Quality Improvement: Six Sigma, Productivity, Awards, and ISO
Bloomcode: Knowledge

2.58. This answer depends on the project the student selects.

Difficulty: Medium
Learning Objective 5: Understand different methodologies companies follow to achieve quality improvement including Six Sigma, productivity improvement, quality awards and ISO 9000.
Section Reference 5: Roadmaps to Quality Improvement: Six Sigma, Productivity, Awards, and ISO
Bloomcode: Application

2.59. In general, the ACSI model is a set of causal equations that link customer expectations, perceived quality, and perceived value to customer satisfaction (ACSI). In turn, satisfaction is linked to consequences as defined by customer complaints and customer loyalty—measured by price tolerance and customer retention. There are two menu items on the ACSI website that describe, in general terms, how the ACSI is determined—"What it measures," and "Methodology." The student should refer to these descriptions. As an example, the student could select two fast food restaurant chains in the fast-food industry and compare the company with the highest score with the lowest scoring company and explain the reasons for the difference in scores.

Difficulty: Medium
Learning Objective 4: Understand the role of customers, employees and services in quality management systems.
Section Reference 4: Customers, Employees, and Services in Quality Management
Bloomcode: Analysis

2.60. Answer depends on the personal health improvement project the student selects.

Difficulty: Medium
Learning Objective 2: Understand how quality management systems have evolved and be able to assess the stage of quality evolution a particular company exhibits.
Section Reference 2: Quality Management System
Bloomcode: Application

2.61. Answer depends on the personal improvement project the student selects.

Difficulty: Medium
Learning Objective 5: Understand different methodologies companies follow to achieve quality

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improvement including Six Sigma, productivity improvement, quality awards and ISO 9000.
Section Reference 5: Roadmaps to Quality Improvement: Six Sigma, Productivity, Awards, and ISO
Bloomcode: Analysis

2.62. Answer depends on the infirmary process the student selects.

Difficulty: Medium
Learning Objective 3: Understand different quality tools used to measure and achieve quality improvement.
Section Reference 3: Quality Tools
Bloomcode: Application

2.63. Answer depends on the registration process at the student's university.

Difficulty: Medium
Learning Objective 3: Understand different quality tools used to measure and achieve quality improvement.
Section Reference 3: Quality Tools
Bloomcode: Application

2.64. In general, the Japanese recognized that even though high quality might cost more in the "short run," in the long run it would help them gain market share, which would increase long term profits. This is something American companies did not recognize. The Japanese economic climate and business and management culture was also more conducive to quality management programs than American companies.

Difficulty: Medium
Learning Objective 3: Understand different quality tools used to measure and achieve quality improvement.
Section Reference 3: Quality Tools
Bloomcode: Analysis

2.65. The student should go to the ISO website at www.iso.org to determine these steps.

Difficulty: Medium
Learning Objective 5: Understand different methodologies companies follow to achieve quality improvement including six sigma, productivity improvement, quality awards and ISO 9000.
Section Reference 5: Roadmaps to Quality Improvement: Six Sigma, Productivity, Awards, and ISO
Bloomcode: Application

2.66. Answer depends on the store the student selects.

Difficulty: Medium
Learning Objective 5: Understand different methodologies companies follow to achieve quality improvement including Six Sigma, productivity improvement, quality awards and ISO. 9000.
Section Reference 5: Roadmaps to Quality Improvement: Six Sigma, Productivity, Awards, and ISO.
Bloomcode: Application

2.67. 5S described in Table 16.1 is a process for identifying defects, establishing goals for improvement,

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and then eliminating or correcting defects to achieve the goals, must like Deming's PDCA cycle, or the Six Sigma Breakthrough Strategy DMAIC 5 step improvement process.

Difficulty: Medium
Learning Objective 1: Discuss and define the dimensions of quality.
Learning Objective 2: Understand how quality management systems have evolved and be able to assess the stage of quality evolution a particular company exhibits.
Learning Objective 5: Understand different methodologies companies follow to achieve quality improvement including six sigma, productivity improvement, quality awards and ISO 9000.
Section Reference 1: What Is Quality?
Section Reference 2: Quality Management System
Section Reference 5: Roadmaps to Quality Improvement: Six Sigma, Productivity, Awards, and ISO
Bloomcode: Application

2.68. The student should refer to the ISO website and the Baldrige Award website at to answer this question.

Difficulty: Medium
Learning Objective 5: Understand different methodologies companies follow to achieve quality improvement including Six Sigma, productivity improvement, quality awards and ISO 9000.
Section Reference 5: Roadmaps to Quality Improvement: Six Sigma, Productivity, Awards, and ISO
Bloomcode: Application

2.69. The answer should include references to some form of customer feedback, such as a "voice of the customer (VOC)" process and surveys. Since assessing customer satisfaction is a critical part of the Baldrige Award criteria, the summaries of Baldrige Award winning companies are a good source for students to learn how companies and organizations assess customer satisfaction.

Difficulty: Medium
Learning Objective 2: Understand how quality management systems have evolved and be able to assess the stage of quality evolution a particular company exhibits.
Section Reference 2: Quality Management System
Bloomcode: Application

2.70. In general, this will be a subjective answer on the part of the student.

Difficulty: Hard
Learning Objective 2: Understand how quality management systems have evolved and be able to assess the stage of quality evolution a particular company exhibits.
Section Reference 2: Quality Management System
Bloomcode: Synthesis

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Solutions to Problems

2.1. a. Failure costs as percentage of quality costs:
Year 1: 157.7 / 187.2 = 0.8424, or 84.24%

Year 2: $\frac{161.8}{201.7} = 0.8022,$ or 80.22%

Year 3: $\frac{153.6}{212.5} = 0.7288,$ or 72.88%

Year 4: $\frac{127.2}{193.9} = 0.6560,$ or 65.6%

Year 5: $\frac{97.3}{166.9} = 0.5830,$ or 58.3%

The failure costs decrease as a percentage of total quality costs. This may be attributed to an increase in product monitoring and inspection. Fewer defective products are reaching the consumer, as evidenced by the sharp decline in external failure costs.

Difficulty: Medium
Learning Objective 5: Understand different methodologies companies follow to achieve quality improvement including six sigma, productivity improvement, quality awards and ISO 9000.
Section Reference 5: Roadmaps to Quality Improvement: Six Sigma, Productivity, Awards, and ISO
Bloomcode: Application

b.

Prevention costs as % of quality costs:	Appraisal costs as % of quality costs:
Year 1: $\frac{3.2}{187.2} = 0.0171,$ or 1.71%;	$\frac{26.3}{187.2} = 0.1404,$ or 14.04%
Year 2: $\frac{10.7}{201.7} = 0.0530,$ or 5.3%;	$\frac{29.2}{201.7} = 0.1448,$ or 14.48%
Year 3: $\frac{28.3}{212.5} = 0.1332,$ or 13.32%;	$\frac{30.6}{212.5} = 0.144,$ or 14.4%
Year 4: $\frac{42.6}{193.9} = 0.2197,$ or 21.97%;	$\frac{24.1}{193.9} = 0.1243,$ or 12.43%
Year 5: $\frac{50}{166.9} = 0.2996,$ or 29.96%;	$\frac{19.6}{166.9} = 0.1174,$ or 11.74%

The increase in prevention costs as a percentage of total quality costs indicates that Backwoods American is placing more emphasis on prevention of defects rather than correction of them. Perhaps they are spending more in the areas of quality planning, product design, process, training, and information. This is contributing to a decline in the need for inspection and testing, equipment testing, and operators to test quality; thus, appraisal costs decline, both absolutely and as a percentage of total costs. Prevention also contributes to the decline in external and internal failures because fewer defective products are produced to begin with. Increases in prevention expenditures will result in a decrease in all other quality costs.

c.

Year	Quality Sales Index	Quality-Cost Index
1	6.93	44.48

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2	7.50	47.64
3	7.85	50.04
4	8.39	44.46
5	5.79	38.32

These index values do not provide much information regarding the effectiveness of the quality assurance program. They are, however, useful in making comparisons from one period to the next and in showing trends in product quality over time.

d. Examples of quality-related costs:

- *Prevention:* Market research, that is, producing what consumers want; purchasing only high-quality down and other materials, designing an efficient and effective manufacturing process; training employees in making quality products.
- *Appraisal:* Inspection of raw materials, work-in-process, and finished product; equipment testing (pattern cutter, sewing machines, etc.), inspection.
- *Internal failure:* Wasted materials and labor, defective products discovered during inspection, use of inefficient processes, equipment downtime, poorly trained employees.
- *External failure:* Defective products, customer complaints, warranty costs, lost sales, loss of good will.

Difficulty: Medium
Learning Objective 3: Understand different methodologies companies follow to achieve quality improvement including six sigma, productivity improvement, quality awards and ISO 9000.
Section Reference 5: Roadmaps to Quality Improvement: Six Sigma, Productivity, Awards, and ISO
Bloomcode: Application

2.2. a. Product yield
Year 1: 20,000 (0.83) + 20,000 (1-0.83) (0.20) = 16,600 + 680 = 17,280 parkas
Year 2: 20,000 (0.85) + 20,000 (0.15) (0.20) = 17,000 + 600 = 17,600 parkas
Year 3: 20,000 (0.87) + 20,000 (0.13) (0.20) = 17,400 + 520 = 17,920 parkas
Year 4: 20,000 (0.89) + 20,000 (0.11) (0.20) = 17,800 + 440 = 18,240 parkas
Year 5: 20,000 (0.91) + 20,000 (0.09) (0.20) = 18,200 + 360 = 18,560 parkas

b. Manufacturing cost per good parka:

$$\text{Year 1:}\ \frac{420{,}900+12(680)}{17{,}280}=\frac{429{,}600}{17{,}280}=\$24.83$$

$$\text{Year 2:}\ \frac{423{,}400+12(600)}{17{,}600}=\frac{430{,}600}{17{,}600}=\$24.47$$

$$\text{Year 3:}\ \frac{424{,}700+12(520)}{17{,}920}=\frac{430{,}940}{17{,}920}=\$24.05$$

$$\text{Year 4:}\ \frac{436{,}100+12(440)}{18{,}240}=\frac{441{,}380}{18{,}240}=\$24.20$$

$$\text{Year 5:}\ \frac{435{,}500+12(360)}{18{,}560}=\frac{439{,}820}{18{,}560}=\$23.70$$

Improving the quality assurance program has resulted in fewer defective parkas, lower rework costs, and

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greater productivity. This has lowered the per-unit manufacturing costs without additional capital investment.

Difficulty: Medium
Learning Objective 5: Understand different methodologies companies follow to achieve quality improvement including six sigma, productivity improvement, quality awards and ISO 9000.
Section Reference 5: Roadmaps to Quality Improvement: Six Sigma, Productivity, Awards, and ISO
Bloomcode: Application

2.3. a. $y = (I)(\%G) + (I)(1-\%G)(\%R)$
$= (150)(0.83) + (150)(1-0.83)(.60) = 139.8$ file cabinets

b. $145 = (150)\ (\%G) + (150)(1-\%G)(0.60)$
$145 = 150G + (150-150G)(0.60)$
$145 = 150G + 90 - 90G$
$55 = 60\ G$
$G = 55 / 60 = 0.9167 = 91.67\%$

Difficulty: Medium
Learning Objective 5: Understand different methodologies companies follow to achieve quality improvement including six sigma, productivity improvement, quality awards and ISO 9000.
Section Reference 5: Roadmaps to Quality Improvement: Six Sigma, Productivity, Awards, and ISO
Bloomcode: Application

2.4. Cost with 83% quality = [27(150) + 8(150)(1-0.83)(0.60)] / 139.8 = $29.85 per cabinet
Cost with 90% quality = [27(150) + 8(9)] / 144 = $28.63 per cabinet

Difficulty: Medium
Learning Objective 5: Understand different methodologies companies follow to achieve quality improvement including six sigma, productivity improvement, quality awards and ISO 9000.
Section Reference 5: Roadmaps to Quality Improvement: Six Sigma, Productivity, Awards, and ISO
Bloomcode: Application

2.5. Manufacturing cost per good product:
Year 1: Yield = 32,000 (0.78) + 32,000 (0.22) (0.25) = 26,720
Product Cost = (278,000 + 3520) ÷ 26,720 = $10.54
In this case, total direct manufacturing cost = $278,000
and total direct rework = 32,000(0.22) (0.25) = $3250
Year 2: Yield = 34,600 (0.83) + 34,600 (0.17) (0.25) = 30,188.50
Product Cost = (291,000 + 2,941) ÷ 30,188.50 = $9.74
Year 3: Yield = 35,500 (0.9) + 35,500 (0.1) (0.25) = 32,837.50
Product Cost = (305,000 + 1,775) ÷ 32,837.50 = $9.34

Percentage change: 2008 - 2009: (9.74 – 10.54) / 10.54 = -7.59%
2009 - 2010: (9.34 – 9.74) / 9.74 = - 4.11%

Difficulty: Medium,
Learning Objective 5: Understand different methodologies companies follow to achieve quality

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improvement including six sigma, productivity improvement, quality awards and ISO 9000.
Section Reference 5: Roadmaps to Quality Improvement: Six Sigma, Productivity, Awards, and ISO
Bloomcode: Application

2.6. a.

$$\text{Product yield} = 300(0.87)(0.91)(0.94)(0.93)(0.93)(0.96)$$
$$= 185 \text{ cabinets}$$

b. For a yield of 300, input would have to be

$$I(0.87)(0.91)(0.94)(0.93)(0.93)(0.96) = 300$$
$$I(0.6179) = 300$$
$$I = 486 \text{ cabinets}$$

Difficulty: Medium
Learning Objective 5: Understand different methodologies companies follow to achieve quality improvement including six sigma, productivity improvement, quality awards and ISO 9000.
Section Reference 5: Roadmaps to Quality Improvement: Six Sigma, Productivity, Awards, and ISO
Bloomcode: Application

2.7. a.

Alt. 1: $300(0.93)(0.91)(0.94)(0.93)(0.93)(0.96) = 198$

Alt. 2: $300(0.87)(0.96)(0.94)(0.97)(0.93)(0.96) = 204$ **Greatest yield**

Alt. 3: $300(0.87)(0.91)(0.94)(0.93)(0.97)(0.98) = 197$

Alt. 4: $300(0.87)(0.97)(0.94)(0.93)(0.93)(0.96) = 198$

b. Alternative 2 will result in the highest yield and will be the most effective.

Difficulty: Medium
Learning Objective 5: Understand different methodologies companies follow to achieve quality improvement including six sigma, productivity improvement, quality awards and ISO 9000.
Section Reference 5: Roadmaps to Quality Improvement: Six Sigma, Productivity, Awards, and ISO
Bloomcode: Application

2.8. $320(1-0.12)(1-0.08)(1-0.04) = 320(0.88)(0.92)(0.96) = 248.71$ errorless orders

Difficulty: Medium
Learning Objective 5: Understand different methodologies companies follow to achieve quality improvement including six sigma, productivity improvement, quality awards and ISO 9000.
Section Reference 5: Roadmaps to Quality Improvement: Six Sigma, Productivity, Awards, and ISO
Bloomcode: Application

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2.9. a. $\text{QPR} = \dfrac{(585+16)(100)}{650(18)+16(3.75)} = 5.11$

b. $\text{QPR} = \dfrac{(720+20)(100)}{800(18)+20(3.75)} = 5.11$

c. $\text{QPR} = \dfrac{(585+16)(100)}{650(16.50)+16(3.20)} = 5.58$

d. $\text{QPR} = \dfrac{(604+11)(100)}{650(18)+11(3.75)} = 5.24$

Difficulty: Medium
Learning Objective 5: Understand different methodologies companies follow to achieve quality improvement including six sigma, productivity improvement, quality awards and ISO 9000.
Section Reference 5: Roadmaps to Quality Improvement: Six Sigma, Productivity, Awards, and ISO
Bloomcode: Application

2.10. a. $\text{QPR} = \dfrac{250(100)}{250(47)+32.5(16)} = 2.34$

b. $\text{QPR} = \dfrac{320(100)}{320(42)+19.2(12)} = 2.34$

Difficulty: Medium
Learning Objective 5: Understand different methodologies companies follow to achieve quality improvement including six sigma, productivity improvement, quality awards and ISO 9000.
Section Reference 5: Roadmaps to Quality Improvement: Six Sigma, Productivity, Awards, and ISO
Bloomcode: Application

2.11. a. $\text{Product cost} = \dfrac{(K_d)(I)+(K_r)(R)}{Y}$

$$= \frac{(\$6.15)(680)+(1.75)(2.72)}{655.52}$$

$$= \frac{4186.76}{655.52} = \$6.39$$

b. $\text{Product cost} = \dfrac{(\$6.20)(680)+(1.75)(0.68)}{673.88}$

$$= \frac{4217.19}{673.88} = \$6.26$$

$\text{Cost savings} = \$0.13 / \text{ good order}$

$\text{Annual savings} = \$0.13/\text{ good order} \times \text{rde orders/day} \times \text{ayd days/year} = \$32{,}266$

c. It is likely that some customers who receive defective orders will not return, thus, fewer defective orders

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will retain more customers and also increase the number of orders.

Difficulty: Medium
Learning Objective 5: Understand different methodologies companies follow to achieve quality improvement including six sigma, productivity improvement, quality awards and ISO 9000.
Section Reference 5: Roadmaps to Quality Improvement: Six Sigma, Productivity, Awards, and ISO
Bloomcode: Application

2.12. a. $\text{QPR} = \dfrac{655.52}{(680)(6.15)+(2.72)(1.75)}\ (100) = 15.66$

b. $\text{QPR} = \dfrac{673.88}{(680)(6.20)+(0.68)(1.75)}\ (100) = 15.98$

Difficulty: Medium
Learning Objective 5:Understand different methodologies companies follow to achieve quality improvement including six sigma, productivity improvement, quality awards and ISO 9000.
Section Reference 5: Roadmaps to Quality Improvement: Six Sigma, Productivity, Awards, and ISO
Bloomcode: Application

2.13. With defects:

$$v = \frac{c_f}{p - c_v}$$
$$= \frac{\$350,000}{1,000 - 600}$$
$$= 875 \text{ units or } \$875,000 \text{ in sales}$$

Without defects (six sigma):

$$v = \frac{\$350,000}{1,000 - 540.05}$$
$$= 760.952 \text{ or } \$760,952 \text{ in sales}$$

The slope of the line is steeper with a reduced break-even point; the company can make more money without making additional units.

Difficulty: Hard
Learning Objective 5: Understand different methodologies companies follow to achieve quality improvement including six sigma, productivity improvement, quality awards and ISO 9000. 9000.
Section Reference 5: Roadmaps to Quality Improvement: Six Sigma, Productivity, Awards, and ISO
Bloomcode: Evaluation

2.14. Sales = \$42(3600)=\$151,200
With 8% defect rate:

Sales	**\$151,200**
Variable costs	61,200
Fixed costs	31,000

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Profit	$59,000

The actual served entrees = 3600/(1-8%) = 3913
The real variable cost per unit = $61,200/3913 = $15.64017
Real variable cost without defects = $15.64017(3600) = $56,305
Fixed costs increased per month = $25000/36 = $694.44

With zero defects:

Sales	**$151,200**
Variable costs	56,305
Fixed costs	31,694.44
Profit	63,200.56

Six sigma results in an 8% reduction in variable costs and a corresponding 8% increase in profit. The return on the Six Sigma investment would be:

Return=100(63,200.56-59,000)/25000=16.8%

Difficulty: Hard
Learning Objective 5: Understand different methodologies companies follow to achieve quality improvement including six sigma, productivity improvement, quality awards and ISO 9000.
Section Reference 5: Roadmaps to Quality Improvement: Six Sigma, Productivity, Awards, and ISO
Bloomcode: Synthesis

2.15. A possible version of the cause-and-effect matrix:

			Key Output (Y) Variables *(CTQC's)*							
			1	2	3	4	5	6		
			Clothes clean	Clothes not damaged	Colors fine	Lint free	Stains removed	Smell fresh/ no odors		
	Key Input (X) Variables	**Customer rank**	1	3	2	5	6	4		
		Weight	*10*	*9*	*9*	*7*	*7*	*8*	**Score**	**Rank of X Variables/ Importance to Customer**
1	Sort laundry		5	6	10	8		5	290	1
2	Cycle		7		8				142	8
3	Wash temperature		8		10		7		219	5
4	Rinse temperature		4		9				121	9
5	Stain treatment				5		10		115	10
6	Load size		9	10	6			6	282	2
7	Fabric softener		3	5		4		9	175	7
8	Detergent		10		7		5	10	278	3
9	Bleach		7		9		6	4	225	4
10	Type of washer		8	9		5			196	6

Difficulty: Medium
Learning Objective 3: Understand different quality tools used to measure and achieve quality improvement.
Section Reference 3: Quality Tools
Bloomcode: Application

2.16. Weekly revenue = (18,400 orders) ($47/order)
= $864,800
Weekly variable costs = - 365,000
Weekly fixed costs = - 85,000

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Total profit = $414,800

Orders returned = (18,400)(.12) = 2,208
Cost of refilling orders = (2,208)(.30)($8) = $5,299.20
Cost of lost sales = (2,208)(.70)($47)= $72,643.20
Cost of lost future sales = (2,208)(.70)(.5)(15) = $11,592
Total cost of defects = $5,299.20 + 72, 643.20 + 11,592 = $89,534.40

With quality improvements:

Orders returned = (18,400)(.02) = 368
Cost of refilling orders = (368)(.30)($8) = $883.20
Cost of lost sales = (368)(.70)($47) = $12,107.20
Cost of lost future sales = (368)(.70)(.50)(15) = $1,932
Total cost of defects = $883 + 12,107 + 1,932 = $14,922.40

Savings with quality improvements = $89,534.40 – 14,922.40 = $74,612 per week
Annual savings = ($74,612)(52) = $3,879,824
Since 3,879.824>800,000, the company should invest in the program.

Processes likely to be improved include computer ordering system, suppliers, handling, etc.

Zero defects unlikely because some orders will be returned because customers simply change their minds.

Difficulty: Hard
Learning Objective 2: Understand how quality management systems have evolved and be able to assess the stage of quality evolution a particular company exhibits.
Learning Objective 3: Understand different quality tools used to measure and achieve quality improvement.
Learning Objective 4: Understand the role of customers, employees and services in quality management systems.
Section Reference 2: Quality Management System
Section Reference 3: Quality Tools
Section Reference 4: Customers, Employees, and Services in Quality Management
Bloomcode: Evaluation

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CASE 2.1: Designing a Quality Management Program for the Internet at D4Q

This can be an instructive, hands-on case project. The students should first search the internet for different web sites at which retail items can be ordered. They should next develop a list of quality characteristics or dimensions to focus on. These might include the visual appearance of the web site, the friendliness of the language used, the accuracy of instructions, the availability of e-mail or telephone support, etc. An attractive web site should probably include photos of the catalog items, for example book jackets, CD covers and video jackets, instead of just item titles. Instructions for ordering should be detailed and accurate with help icons located at every step. Customer support should be easy to access with e-mail or by telephone. Responses to requests for support should be quick. Service measurement is difficult in this type of operation. If an order center is used, then the company can count the number of customers who enter the center then abort as the result of poor instructions. Follow up surveys of customers who place orders or request hard copy catalogs is a good way to evaluate service. From the server end, the server responses to customer inquiries can be monitored for accuracy, completeness and timeliness. These are just a few of the possible quality initiatives you might suggest to develop a high-quality web site ordering system.

Difficulty: Hard
Learning Objective 1: Discuss and define the dimensions of quality.
Learning Objective 2: Understand how quality management systems have evolved and be able to assess the stage of quality evolution a particular company exhibits.
Learning Objective 3: Understand different quality tools used to measure and achieve quality improvement.
Learning Objective 4: Understand the role of customers, employees and services in quality management systems.
Section Reference 1: What Is Quality?
Section Reference 2: Quality Management System
Section Reference 3: Quality Tools
Section Reference 4: Customers, Employees, and Services in Quality Management
Bloomcode: Synthesis

CASE 2.2: Quality Management at State University

In general, the student should respond to this case by attempting to go through the chapter and to discuss each major topic in terms of a university environment. This will require that they first identify the product and the process, obviously the student and the educational process. However, in a university environment, is the product also the customer? This is an interesting question to begin with.

An initial step should be to develop a customer definition of quality—that is, what are the dimensions of quality in an education that parents, students, and legislators expect? This step can be accomplished by surveying alumni, potential employers, parents, students, and legislators. It would also be beneficial to see what the competition (other colleges and universities) does.

The various support functions in the university should be identified in terms of a production process. For example, the admissions office is analogous to the purchasing department. A key problem here in a QM approach is that the university has little, if any, control over suppliers (high schools). As a result, admissions must institute inspection and process control procedures to ensure high-quality raw material (i.e., students), is admitted.

The product-design function, or curriculum design, is typically decentralized in a university among various colleges and departments. In some cases, the university administration will design a core curriculum for the

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first two years and college and departments will design the curriculum for the last two.

The production process is the movement of students through the curriculum to graduation. Discussion should focus on how to institute process control in order to avoid final product "defects." This obviously requires a definition as to what a defective item is—a student who enters but fails to graduate, a student who graduates but does not gain employment, or a graduate who indicates disappointment with his or her education five years from now. An area on which to focus is the degree to which quality control tools such as brainstorming, quality circles, histograms, check sheets, and fishbone diagrams can be used to evaluate the process.

Customer service would seem to be an integral part of a QM approach in the university. This service would focus on support services such as dining, recreation, housing, advising, counseling, extracurricular activities, entertainment, placement, alumni services, etc.

Depending on the time designated to spend on this case, students might interview various administrators at their own university to determine where QM can be applied in the university and obstacles to a TQM approach.

Difficulty: Hard
Learning Objective 1: Discuss and define the dimensions of quality.
Learning Objective 3: Understand different quality tools used to measure and achieve quality improvement.
Learning Objective 4: Understand the role of customers, employees and services in quality management systems.
Learning Objective 5: Understand different methodologies companies follow to achieve quality improvement including Six Sigma, productivity improvement, quality awards and ISO 9000.
Section Reference 1: What Is Quality?
Section Reference 3: Quality Tools
Section Reference 4: Customers, Employees, and Services in Quality Management
Section Reference 5: Roadmaps to Quality Improvement: Six Sigma, Productivity, Awards, and ISO
Bloomcode: Synthesis

CASE 2.3: Quality Problems at the Tech Bookstore

a. Mr. Watson's organization of the customer survey categorized the two bookstores and types of customer, i.e., students and non-students. He differentiated between the two stores because they carried different products, and it also was likely that a different population of customers visited the two stores since they were in different locations. Also, the two stores had different managers, staff and employees; in effect they were separate entities. He differentiated between the two customer groups because he knew they likely had different characteristics and different service expectations. Also, it was probable that they shopped for different items. Student would be primarily interested in textbooks, school supplies, computer items and apparel, whereas non-students would have not been as interested in textbooks and school supplies, and they would have had a higher interest in trade books.

A customer survey was probably the best way to start in order to see if there was a quality problem and its extent. He might also analyze different processes in the store, such as employee floor service, checkout, etc. He could have probably gotten the help of an OM class on campus to help him analyze various service processes in the store. He could also benchmark other "successful" college bookstores.

b. It is possible to develop 9 different Pareto charts—a chart each for students and non-students at the

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campus store, and a chart each for students and non-students at the off-campus store; a combined chart for students at both stores and a combined chart for non-students at both stores; a chart for each store combining the two customer groups at each one; and a summary chart combining all the data for both stores and both customer categories. Following is a summary of the survey data.

c. Using a fitness for use definition, quality should be prompt, knowledgeable and courteous customer service; a pleasant shopping environment with prompt and courteous customer checkout; and quality products at a competitive (or lower) price.

d. The most pronounced problem is the discrepancy between the student and non-student groups in their perception of service. This is likely due to the different expectations of the two groups. Non-students are likely to be older and less patient. The student employees' attitude and demeanor are probably more familiar to other students, i.e., what they are used to, and they are probably more patient with the student employees than the non-student group. Also, it is less likely that students will ask questions than the non-student group so the problem of not being helpful or knowledgeable does not come up as much with students as with non-students. It also may be that students visit the bookstores more often and know where to find items, and they may also be more familiar with bookstore policies. Many of the non-student customers could be visitors.

However, this discrepancy does not hide two other potential quality problems—that the off-campus store has poorer quality service across all categories than the on-campus store, and there seems to be a significant problem with employee training at both stores. The relatively low percentage of customers who think employees are knowledgeable and helpful, reinforced by the graduate student evaluators and the complaint incidents to the Board, clearly indicates that the student employees are not adequately prepared to do their job. They are probably in need of more training, however it is likely the bookstore has been hesitant to provide additional training because of the high turnover rate, i.e., the return on training investment might be perceived by management to be low when student employees leave after a semester or two. The off-campus store may have poorer quality service, in general, because of the management staff, and the fact that the Executive Director resides at the on-campus store.

The much lower percentage of students who think that the cost of purchases at the bookstores is reasonable is probably due to the fact that students purchase textbooks, which are expensive. The bookstore probably does not do a very good job of publicizing the fact that it has a very low mark up on textbooks. This is something that could be highlighted on the store web site, which the students access more than non-students.

e. Since this is a service several of the costs of poor quality that relate to manufactured products such as scrap, product rework, returned products, etc., do not apply. Thus, the two primary costs of poor quality are lost sales and customer complaint costs. The costs the bookstore is incurring to conduct the customer survey, hire the graduate student evaluators, and analyze the results are all costs of poor quality. From the limited information provided it is difficult to address the question of lost sales. However, it is noted that that the town and university have been growing while sales have remained steady. Given the ideal location of the on-campus store in particular, and the fact that the football team is very successful should mean much higher sales of licensed apparel. It could be that the quality problems are having a very negative impact on sales.

f. While the bookstores would benefit from a complete QM program, the most immediate need is for a more extensive employee training program. The bookstore needs to establish a plan for improving its quality that includes employee training as a top priority. The plan needs tangible objectives. For example, every customer question should be answered as promptly as possible. Some form of reward system for employees might be beneficial. They likely would benefit from a set of guidelines for employees for addressing customer questions. Having a resource person available that has intimate knowledge of all aspects of store policies, and knows where all items are in the store, that the student employees could contact at any time

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would be a good personnel investment. In addition, management needs to establish a process for monitoring employee performance on a routine, daily basis. Benchmarking other college bookstores could provide insight into ways to solve quality problems. A process for measuring customer *and* employee satisfaction on a regular basis needs to be put into effect, and performance measures could be tied to these surveys.

g. Because the bookstores are quasi non-profit, government-type entities, the revenue pressures that a business might feel are not present. Thus, the motivation for improved quality is primarily the store's reputation. Another factor is the university-invoked policy of hiring students on a part-time basis. This means that to solve the quality problems associated with part time students, bookstore management must look to other solutions besides hiring more-experienced, full-time employees. The fact that students will be serving adults is a situation that cannot be changed.

h. The most probable benefit would be an increase in sales and revenue. However, employee satisfaction would also likely increase as a result of a quality management program. Also, the Board of Directors would likely receive fewer complaints.

	Campus Store				**Off Campus Store**					
	Student		**Non-student**		**Student**		**Non-student**		**Total**	
	Yes	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**
	%	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**
Were employees courteous and friendly?	86	14	67	33	75	25	52	48	73	27
Were employees knowledgeable and helpful?	79	21	52	48	77	23	41	59	65	35
Was the overall service good?	86	14	63	37	71	29	55	45	71	29
Did you have to wait long for service?	11	89	45	55	11	89	46	54	25	75
Did you have to wait long to checkout?	12	88	46	54	16	84	45	55	27	73
Was the item you wanted available?	92	8	84	16	90	10	90	10	89	11
Was the cost of your purchase(s) reasonable?	58	42	90	10	60	40	92	8	72	28
Have you visited the store web site?	50	50	12	88	58	42	5	95	41	59
	42	5	95	41	59					

Difficulty: Hard
Learning Objective 1: Discuss and define the dimensions of quality.
Learning Objective 2: Understand how quality management systems have evolved and be able to assess the stage of quality evolution a particular company exhibits.
Learning Objective 3: Understand different quality tools used to measure and achieve quality improvement.
Learning Objective 4: Understand the role of customers, employees and services in quality management systems.
Section Reference 1: What Is Quality?
Section Reference 2: Quality Management System
Section Reference 3: Quality Tools
Section Reference 4: Customers, Employees, and Services in Quality Management
Bloomcode: Synthesis

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CASE SOLUTION 2.4 - Product Yield at Continental Luggage Company

Average Weekly Yield

Stage 1 yield:

$$Y_1 = (I)(\%G) + I(1-\%G)(\%R)$$
$$= 500(0.94) + 500(0.06)(0.23)$$
$$= 470 + 6.9$$
$$Y_1 = 476.9$$

Stage 2 yield:

$$Y_2 = (476.9)(0.96) + 476.9(0.04)(0.91)$$
$$= 457.82 + 17.36$$
$$Y_2 = 475.18$$

Stage 3 yield:

$$Y_3 = 475.18(0.95) + 475.18(0.05)(0.67)$$
$$= 451.42 + 15.92$$
$$= 467.34$$

Stage 4 yield:

$$Y_4 = 467.34(0.97) + 467.34(0.03)(0.89)$$
$$= 453.32 + 12.48$$
$$= 465.80$$

Stage 5 yield:

$$Y_5 = 465.80(0.98) + 465.80(0.02)(0.72)$$
$$= 456.48 + 6.71$$
$$= 463.19$$

Increasing Good Quality Yield by 1% at Each Stage

Stage 1 yield:

$$Y_1 = 500(0.95) + 500(0.05)(0.23)$$
$$Y_1 = 480.75$$

Stage 2 yield:

$$Y_2 = 480.75(0.97) + 480.75(0.03)(0.91)$$
$$Y_2 = 479.45$$

Stage 3 yield:

$$Y_3 = 479.45(0.96) + 479.45(0.04)(0.67)$$
$$Y_3 = 473.12$$

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Stage 4 yield:

$$Y_4 = 473.12(0.98) + 473.12(0.02)(0.89)$$

$$Y_4 = 472.08$$

Stage 5 yield:

$$Y_5 = 472.08(0.99) + 472.08(0.01)(0.72)$$

$$Y_5 = 470.76$$

Difference in yields = 470.76 – 463.19 = 7.57 units

Difficulty: Hard
Learning Objective 5: Understand different methodologies companies follow to achieve quality improvement including six sigma, productivity improvement, quality awards and ISO 9000.
Section Reference 5: Roadmaps to Quality Improvement: Six Sigma, Productivity, Awards, and ISO
Bloomcode: Evaluation

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