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Quality in Manufacturing and Service



Learning Objectives

By the end of this chapter, you should be able to:

- Outline the history of quality and its role in corporate strategy and national competitiveness.
- State the major definitions of quality and explain their differences.
- Explain the role of quality in manufacturing and service organizations.
- List the key dimensions of quality.
- Describe the impact of quality on profitability.

INTRODUCTION

During the late 1970s and early 1980s the United States received a rude awakening on the importance of quality. Foreign competition, particularly from the Japanese, resulted in the loss of significant market share for many American companies. For example, in 1980, Detroit's share of the U.S. auto market was 71.3 percent; by 1991 it declined to 62.5 percent. Japan now supplies over one-third of the world's demand. The percentage of U.S.-made computers purchased in the United States dropped from 94 percent in 1979 to 66 percent in 1989. Machine tool, electronics, steel, and other industries faced similar fates.

In 1987, Business Week posed a stern warning to American management:

Quality. Remember it? American manufacturing has slumped a long way from the glory days of the 1950s and '60s when "Made in U.S.A." proudly stood for the best that industry could turn out.... While the Japanese were developing remarkably higher standards for a whole host of products, from consumer electronics to cars and machine tools, many U.S. managers were smugly dozing at the switch. Now, aside from aerospace and agriculture, there are few markets

left where the U.S. carries its own weight in international trade. For American industry, the message is simple. Get better or get beat.

That same year, the Malcolm Baldrige National Quality Award was signed into legislation, spawning a remarkable interest in quality among American business. Perhaps more than any other event, the Baldrige has helped American business take action to accomplish a transformation in management. In 1991, Business Week called quality "a global revolution affecting every facet of business.... For the 1990s and far beyond, quality must remain the priority for business." In assessing the achievements of Baldrige Award winners, Dr. Joseph Juran, one of the premier leaders in the quality movement, stated:

I have become optimistic for the first time since the quality crisis descended on the United States. I now believe that, during the 1990s, the number of U.S. companies that have achieved stunning results will increase by orders of magnitude. I also believe that, during the 1990s, the United States will make great strides toward making "Made in the USA" a symbol of world class quality. (Juran, 1991)

The ability to achieve world-class status in manufacturing and service depends on a business strategy driven by total quality management (TQM). In this chapter we introduce the subject of quality through a brief history, evaluate various definitions and perspectives of the concept in manufacturing and service, and discuss the importance of quality from an economic and competitive viewpoint.

A BRIEF HISTORY

Had the Industrial Revolution not occurred, quality would probably be a moot issue. During the Middle Ages, skilled craftspeople served both as manufacturers and inspectors, building quality into their products with considerable pride of workmanship. Craft guilds emerged to ensure that craftspeople were adequately trained. The Industrial Revolution led to quality being viewed as an inspection-based activity. Thomas Jefferson brought Honoree Le Blanc's concept of interchangeable parts to America. When Eli Whitney was awarded a government contract in 1798 to supply 10,000 muskets in two years, he designed special machine tools and trained unskilled workers to make parts according to a standard design that was measured and compared to a model. Unfortunately, Whitney grossly underestimated the effect of variation in the production process and its impact on quality. It took more than 10 years to complete the project, perhaps the first example of cost-overrun in government contracts. This same obstacle-variation-continues to plague American managers to this day.

Worker responsibility for quality was influenced greatly by Frederick W. Taylor's concept of "scientific management." By focusing on production efficiency and decomposing jobs into small work tasks, inspection was relegated to an independent "quality control" department in manufacturing organizations. The separation of good from bad product became the chief means of ensuring quality.

Modern Developments in Quality

Modern approaches to quality control had their origins at Western Electric when the inspection department was transferred to Bell Telephone Laboratories in the 1920s. The early pioneers of modern quality assurance—Walter Shewhart, Harold Dodge, George Edwards, and others—developed new theories, and methods of inspection to improve and maintain quality. Control charts, sampling techniques, and economic analysis tools laid the foundation for modern quality assurance activity and influenced the thinking of two men, W. Edwards Deming and Joseph M. Juran.

Deming and Juran introduced statistical quality control and various management philosophies to Japanese managers after World War II as part of General MacArthur's rebuilding program. Over the next 20 years, while the Japanese were improving quality at an unprecedented rate, quality levels in the West remained stagnant. By the late 1970s, Japanese companies had gained a significant competitive advantage in world markets, primarily due to higher levels of quality.

In 1980, NBC aired a white paper entitled "If Japan Can ... Why Can't We?" This program introduced the 80-year-old Deming, virtually unknown in the United States, to corporate executives across America. Ford Motor Company, in particular, was among the first to invite Deming to help in transforming its operations. Within a few years, Ford's earnings were the highest for any company in automotive history, despite a 7 percent drop in U.S. car and truck industry sales, higher capital spending, and increased marketing costs. Donald Petersen, chief executive officer at Ford, stated:

The work of Dr. Deming has definitely helped change Ford's corporate leadership.... Dr. Deming has influenced my thinking in a variety of ways. What stands out is that he helped me crystallize my ideas concerning the value of teamwork, process improvement and the pervasive power of the concept of continuous improvement. (Katz, 1988)

With a competitive crisis unfolding, coupled with increasing levels of consumer quality awareness, the technological complexity of modern electronics, and a growing recognition of outdated managerial practices, the 1980s became the decade in which America woke up to quality. Most major companies embarked on extensive quality improvement campaigns. In 1984, the U.S. government designated October as National Quality Month. In 1987, the Malcolm Baldrige National Quality Award was established by an act of Congress. (Malcolm Baldrige was a former Secretary of Commerce who died shortly before the legislation was approved. The award was named in his honor.) By the end of the decade, Florida Power and Light became the first overseas company to win Japan's coveted Deming Prize for quality.

A Race Without a Finish Line

Despite all the publicity and hoopla, a recent study by the American Quality Foundation and Ernst & Young (1991) showed some sobering results. Among the findings were that while 55 percent of U.S. firms use quality information to evaluate business performance monthly or more frequently, 70 percent of

Japanese firms do. Eighteen percent of U.S. businesses look at the business consequences of quality performance less than once each year; the comparable figure in Japan is 2 percent, and in Germany, 9 percent. Even though considerable attention is paid to quality in the United States, we may not be closing the gap with foreign competitors. Business schools are only just beginning to incorporate quality principles into their curriculum; in Japan, elementary schools teach statistical process control. While the next generation of managers may be adequately trained in quality principles, we cannot afford to wait. As one Xerox executive noted, quality is a race without a finish line.

DEFINITIONS OF QUALITY

Quality has been an elusive concept in business. Many people think of quality as some level of superiority or innate excellence; others view it as a lack of manufacturing defects. The official definition of quality, standardized by the American National Standards Institute (ANSI) and the American Society for Quality Control (ASQC) in 1978, is "the totality of features and characteristics of a product or service that bears on its ability to satisfy given needs." This definition implies that we must be able to identify the features and characteristics of products and services that determine customer satisfaction and form the basis for measurement and control. The "ability to satisfy given needs" reflects the value of the product or service to the customer, including the economic value, safety, reliability, and maintainability.

A good example of how this definition works in practice comes from the auto industry (Business Week, 1990). In designing the Lexus automobile, Toyota bought several competitors' cars, including Mercedes, Jaguar, and BMW, and put them through grueling test-track runs, then took them apart. The chief engineer decided that he could match Mercedes on performance and reliability, as well as on luxury and status features. He developed 11 performance goals. The final design had a drag coefficient smaller than any other luxury car, a lighter weight, a more fuel-efficient engine, and a lower noise level. Sturdier materials were used for seat edges to maintain their appearance longer. The engine was designed with more torque than German models to give the car the quick start that Americans prefer. The instrument cluster was called "a work of art" by Ford's director of North American interior design.

Fitness for Use

Although the ANSI/ASQC definition of quality is operationally useful, it does not completely describe the various viewpoints of quality that are commonly used: Since customer needs must be the driving force behind quality products and services, a popular definition of quality is fitness for use. This is encompassed in the ANSI/ASQC definition as "the ability to satisfy given needs." This definition means that a quality product or service must meet customer requirements and expectations.

The fitness for use definition based on customer satisfaction has become the principal definition of quality from a managerial perspective. By the end of

the 1980s, a related though fundamentally different definition of quality had emerged: Quality is meeting or exceeding customer expectations.

Conformance to Specifications

A second approach to defining quality, from the perspective of manufacturing or service delivery, is conformance to specifications. Specifications are targets and tolerances determined by designers of products and services: Targets are the ideal values for which production is expected to strive; tolerances are acceptable deviations from these ideal values, recognizing that it is impossible to meet the targets all the time. For example, a computer chip manufacturer might specify that the distance between pins on a computer chip should be $.095 \pm .005$ inches. The value $.095$ is the target, and $\pm .005$ is the tolerance. Thus, the distance may vary between $.090$ and $.100$ and still be acceptable. Likewise in services, "on time arrival" for an airplane might be specified as within 15 minutes of the scheduled arrival time. The target is the scheduled time, and the tolerance is ± 15 minutes.

The traditional manufacturing view of quality as conformance to specifications has come under much scrutiny in recent years because of the work of Japanese engineer Genichi Taguchi. Taguchi defines quality as the avoidance of "the loss a product causes to society after being shipped." This includes losses due to a product's failure to meet customer expectations, failure to meet performance characteristics, and harmful side effects caused by the product, such as pollution or noise. Taguchi measures loss in monetary units and relates it to targets and tolerances. He has shown that the loss increases more rapidly the further one moves from the target value in a critical specification. For example, just think of what would happen if many airline flights consistently varied from scheduled arrival times. The more flights are delayed (that is, deviate from target), the more passengers will miss connecting flights, causing substantial losses to both passengers and the airlines. While we cannot totally eliminate variation in the production of products and services, we can strive to minimize the variation around target values. This minimizes the economic loss and benefits both the producer and the consumer.

Fitness for use (quality of design) and conformance to specifications (quality of conformance) provide the fundamental basis for managing operations to produce quality products. A "customer-driven" quality focus involves every one in an organization. Customer requirements must be determined and understood. They must be translated into detailed product and process specifications. Manufacturing and service delivery must meet these specifications during production to ensure that what the customer gets is what the customer wants (or more). Quality is everyone's responsibility.

QUALITY IN MANUFACTURING AND SERVICE SYSTEMS

Quality assurance refers to the entire system of policies, procedures, and guidelines established by an organization for the purpose of achieving and maintaining quality. Quality assurance consists of three principal functions: quality

engineering, quality control, and quality management. The aim of quality engineering is to incorporate quality into the design of products and processes and to predict potential quality problems prior to delivery of the product. Quality control involves making a series of planned measurements in order to determine if quality standards are being met. If not, then corrective action and future preventive action must be taken to achieve and maintain conformance. Quality management involves the planning, organization, direction, and control of all quality assurance activities. While many manufacturing firms have quality control departments to provide technical support, successful businesses have found that quality must be integrated throughout the firm. This concept of integrating quality throughout all business functions-total quality management-is the theme of this course.

Quality in Manufacturing Systems

In manufacturing, quality is an important component of all functions. For example, effective market research is necessary to determine customer needs and identify functional requirements for product designers. Product designers must take care to neither overengineer (resulting in inefficient use of a firm's resources) nor underengineer products (resulting in poor quality). Purchasing must ensure that suppliers meet quality requirements. Production planning and scheduling should not put undue pressure on manufacturing that will degrade quality. Tool engineering and maintenance are responsible for ensuring that tools, gages, and equipment are properly maintained. Industrial engineering must select the appropriate technology that is capable of meeting design requirements and developing appropriate work methods. Packaging, shipping, and warehousing have the responsibility of ensuring the condition, availability, and timely delivery of products in transit. Ancillary functions such as finance, human resources, and legal services support the quality effort by providing realistic budgets, a well-trained and motivated workforce, and reviews of warranty, safety, and liability issues.

Quality in Services

The importance of quality in services cannot be underestimated. Service is a "social act which takes place in direct contact between the customer and representatives of the service company" (Norman, 1984). Technical Assistance Research Programs, Inc., has conducted studies that reveal the following:

- The average company never hears from 96 percent of its unhappy customers. For every complaint received, the company has 24 customers with problems, 6 of which are serious.
- Of the customers who make a complaint, more than half will do business again with that organization if their complaint is resolved. If the customer feels that the complaint was resolved quickly, this figure jumps to 95 percent.
- The average customer who has had a problem will tell 9 or 10 others about it. Customers who have had complaints resolved satisfactorily will tell only about 5 others. (Albrecht & Zemke, 1985)

In services, the distinguishing features that determine quality differ from manufacturing. The most important dimensions of service quality include:

- Time: How long must a customer wait?
- Timelines: Will a package be delivered by 10:30 the next morning?
- Completeness: Are all items in the order included?
- Courtesy: Do front-line employees greet each customer cheerfully?
- Consistency: Are services delivered in the same fashion for every customer?
- Accessibility and convenience: Is the service easy to obtain?
- Accuracy: Is the service performed right the first time?
- Responsiveness: Can service personnel react quickly and resolve unexpected problems?

Many service organizations such as airlines, banks, and hotels have well-developed quality assurance systems. Most of them, however, are generally based on manufacturing analogies and tend to be more product-oriented than service-oriented. For example, a typical hotel's quality assurance system is focused on technical specifications such as properly made-up rooms. However, service organizations have special requirements that manufacturing systems cannot fulfill. Service organizations must look beyond product orientation and pay significant attention to customer transactions and employee behavior. The Ritz-Carlton Hotel Company, a 1992 winner of the Baldrige Award, pays extraordinary attention to customers and employees.

Service organizations should consider the following points:

The quality characteristics that should be controlled may not be the obvious ones. Customer perceptions are critical, and it may be difficult to define what the customer wants. For example, speed of service is an important quality characteristic, yet perceptions of speed may differ significantly among different service organizations and customers. Marketing and consumer research can play a significant role.

The quality of interaction is a vital factor in every service transaction that involves human contact. For example, banks have found that the friendliness of tellers is a principal factor in retaining depositors.

Image is a major factor in shaping customer expectations of a service and in setting standards by which customers evaluate that service. A breakdown in image can be as harmful as a breakdown in delivery of the service itself. Top management has the responsibility for shaping and guiding the image that the firm projects.

Setting service levels and measuring them may be difficult. Service standards, particularly those relating to human behavior, are often set judgmentally and are difficult to measure. In manufacturing, it is easy to measure output, scrap, and rework. Customer attitudes and employee competence are not as easily measured.

Quality control activity may be required at times or in places where supervision and control personnel are not present. Work must often be performed at the convenience of the customer. Hence, more training of employees and self-management are necessary. (King, 1985)

ECONOMIC ISSUES

Managers have a good reason to improve quality-profitability. Poor designs that do not meet customer needs, scrap and rework, and field failures all impact the bottom line. In 1976, before quality replaced quantity as a business priority, American Motors spent about \$3 million to correct pollution control systems; and Firestone had to replace 7.5 million tires at a cost greater than its annual net income. The impact of quality on corporate performance has been studied extensively. For example, The Conference Board, Inc., a New York business research group, surveyed senior executives at 800 large U.S. corporations about their quality management practices (1989). Of 149 respondents, 62 reported that they had measured the impact of quality on profitability. Of these, 47 reported "noticeably increased" profits due to quality management, while only one firm reported decreased profits due to "increased costs of providing higher quality products and services." PIMS Associates, Inc., a subsidiary of the Strategic Planning Institute, Cambridge, Mass., maintains a proprietary data base of 1,200 companies and studies the impact of product quality on corporate performance (Strategic Planning Institute, 1986). Among their findings, PIMS researchers have concluded that product quality is an important determinant of business profitability, and that quality is positively and significantly related to a higher return on investment for all kinds of products and market situations.

The economic impacts of quality can be easily understood from the fundamental profit equation:

$$\begin{aligned}\text{Profit} &= \text{revenue} - \text{cost} \\ \text{Revenue} &= \text{price} \times \text{units sold}\end{aligned}$$

To increase profit, you need to either increase revenue or decrease cost. To increase revenue, you must increase price without losing units, or increase the units sold (market share) while maintaining the price. Quality affects each of these terms.

Quality and Price

Many believe that higher quality can only be produced at a higher cost; therefore, they assume that higher prices imply higher quality. This is not always the case. Research studies have found that when other factors such as brand name, store image, product features, or country of origin influence consumer perception, quality assessment is not as heavily influenced by price. Also, if managers observe that consumer perceptions of quality and purchasing decisions are positively related to price, they may command higher prices without actually increasing quality. As a result, price often bears a positive relationship to perceived quality rather than actual quality. Higher prices may actually reflect inefficiencies in production, high fixed costs, and poor quality.

The PIMS studies have shown that high product quality can allow a company to command higher prices. One power tool manufacturer discovered that higher quality tools greatly reduced the costs of maintenance and downtime

for industrial users. This information became the means of convincing customers to accept a price increase (Juran, 1988). One must be cautious, however. Price premiums may also leave a firm open to competitive threats. For example, Japanese luxury car divisions such as Lexus and Infiniti claim to have equaled the quality of German counterparts at significantly lower prices and have made a significant penetration into this market.

Quality and Market Share

If a product or service meets or exceeds customer expectations, we would expect quality and market share to be positively related. We saw this in the 1970s as higher quality Japanese products made significant penetration into Western markets. This also has been verified by many research studies. For example, one study found that businesses that improved quality during the 1970s increased their market share five to six times faster than those whose quality declined, and three times as fast as those whose quality remained unchanged. The PIMS studies found that businesses offering premium quality products and services usually have large market shares and were early entrants into their markets, and that a strategy of quality improvement usually leads to increased market share, but at a cost in terms of reduced short-run profitability.

Quality and Cost

From the viewpoint of quality of design, improved quality generally results in higher costs. Improved quality of design requires more costly materials, more highly skilled labor, and more expensive equipment. As argued earlier, however, improved quality of design can lead to increased revenues through higher prices and market share that can far outweigh the additional costs.

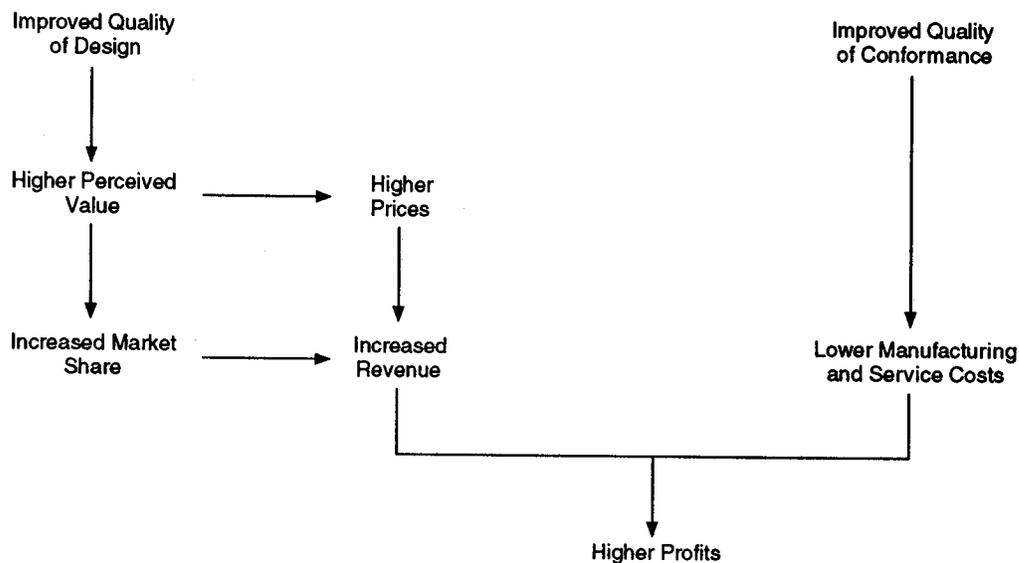
On the other hand, improved quality of conformance usually results in decreased costs through savings in rework, scrap, and warranty expenses. This viewpoint was popularized by Philip Crosby (1979).

Quality is not only free, it is an honest-to-everything profit maker. Every penny you don't spend on doing things wrong, over, or instead of, becomes half a penny right on the bottom line. In these days of "who knows what is going to happen to our business tomorrow," there aren't many ways left to make a profit improvement. If you concentrate on making quality certain, you can probably increase your profit by an amount equal to 5% to 10% of your sales. That is a lot of money for free.

These relationships among quality, price, market share, and cost are summarized in Exhibit 1-1. The value of a product in the marketplace is determined by the quality of design. Improved design will enhance a firm's reputation and the consumer's perception of quality, resulting in the ability to command higher prices and achieve increased market share, leading to increased revenues. Improved quality of conformance leads to lower manufacturing and service costs. The net effect of this two-pronged strategy for quality improvement is increased profits.



Exhibit 1-1 Quality and Profitability



The Taguchi Loss Function

Dr. Genichi Taguchi has proposed a significantly different approach to viewing quality based on the economic implications of poor quality. By measuring loss in monetary units and relating it to quantifiable product characteristics, Taguchi translates from the language of the engineer (product characteristics) to the language of the manager (dollars). In the traditional American production system, acceptable product characteristics are defined in terms of a target specification and a tolerance. Being within tolerance is acceptable; being outside of tolerance is not. We often call this a "goalpost mentality." Taguchi suggests that loss increases (in a rapid fashion) the further away a product characteristic is from its target value (see Exhibit 1-2).

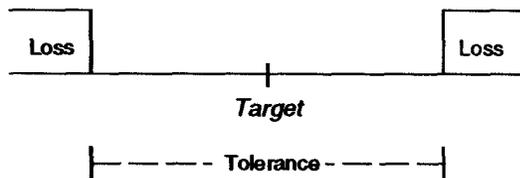
Two well-publicized examples in practice have given credence to this theory. In one case, Ford and Mazda were producing identical transmission components in the United States and Japan using the same blueprints, equipment, and processes. The Ford assemblies were experiencing a higher rate of field failures. Upon examining the critical dimensions produced by the Ford plant, all were found to be within acceptable tolerances. However, upon examining the Mazda-built components, nearly all were precisely on target with almost no variation within the allowable tolerance. The explanation is that in mechanical assemblies, excessive variation from design targets causes premature wear, eventually resulting in early field failure.

A second example was published in the Japanese newspaper *Ashai* comparing the warranty cost differences of Sony televisions at a Japanese and San Diego plant. A critical product characteristic is color density. For this characteristic, all units produced at the San Diego plant were within the design toler-

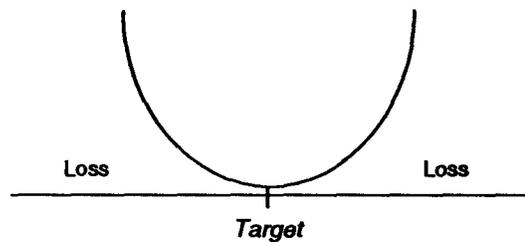


Exhibit 1-2

Traditional vs. Taguchi Loss Functions



Traditional (Goalpost) Loss Function



Taguchi Loss Function

ance, while a small proportion of those shipped from the Japanese plant were not. However, the average loss per unit from the San Diego plant was \$.89 larger than that of the Japanese plant. It was discovered that units out of specification were adjusted at the San Diego plant (adding more cost to the process), but rarely to the target value. In the Japanese plant, the color density of the vast majority of units were produced close to the target value (see Exhibit 1-3). The further the color density was from the target value, the more likely customers will complain and require an adjustment (adding to warranty costs). From Exhibit 1-3 it is clear that the U.S.-made units required significantly more warranty adjustments than the Japanese-made counterparts. The chairman of Sony explained the difference this way (Sullivan, 1984):

When we tell one of our Japanese employees that the measurement of a certain part must be within a tolerance of plus or minus five, for example, he will automatically strive to get that part as close to zero tolerance as possible. When we started our plant in the United States, we found that workers would follow instructions perfectly. But if we said make it between plus or minus five, they would get it somewhere near plus or minus five all right, but rarely as close to zero as the Japanese workers did.

The reduction of variation is the cornerstone of the Deming philosophy. As variation decreases, so will costs, resulting in higher levels of profit and consumer satisfaction.

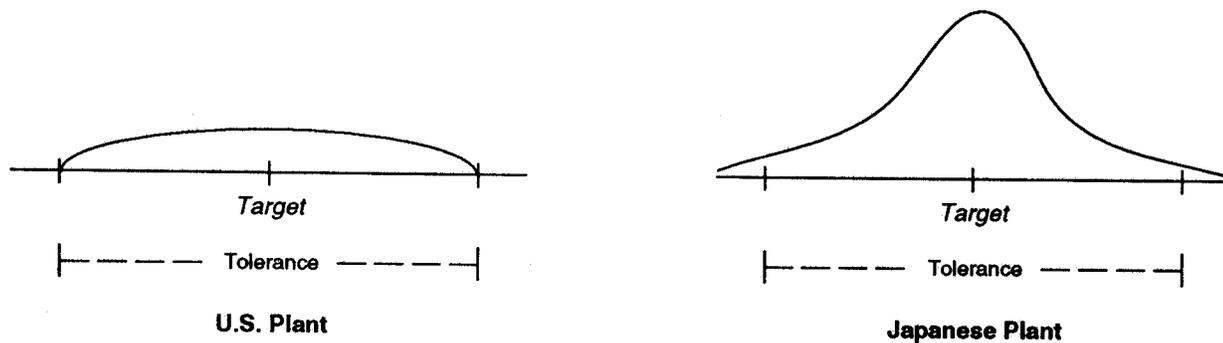
QUALITY, STRATEGIC PLANNING, AND COMPETITIVE ADVANTAGE

A firm has many options in defining its long-term goals and objectives, the customers whom it wants to serve, and the products and services it produces and delivers. Strategy is the approach by which an organization seeks to develop



Exhibit 1-3

Color Density Differences between U.S. and Japanese Plants



its long-term goals, policies, and plans to meet the needs of its stakeholders. In formulating a business strategy, several fundamental questions must be addressed:

- Who is your customer? What are the customer's needs and expectations?
- How can the business best serve its customers?
- What are our strengths and weaknesses? How do we compare to our competitors?
- What risks and threats could subvert future success?

Competitive Advantage

Competitive advantage denotes a firm's ability to achieve market superiority over its competitors. Business strategy should help a business better forecast, plan, and control its future and create a competitive advantage. A strong competitive advantage has six fundamental characteristics:

1. It is externally driven by customer wants and needs.
2. It provides significant leverage in contributing to the success of the business.
3. It provides a unique match of the organization's resources and the opportunities in the environment.
4. It is durable, lasting, and difficult for competitors to copy.
5. It provides a basis for further improvement.
6. It provides direction and motivation to the entire organization. (Wheelwright, 1989)

A business can choose to focus its efforts along several dimensions to achieve competitive advantage. These include low cost or price, outstanding service, high flexibility and variety, continuous innovation, and superior quality.

Quality is now recognized as a powerful strategic weapon. Quality is judged by the customer. All product and service attributes that connote value to the customer and lead to customer satisfaction and preference must be addressed

appropriately. Value, satisfaction, and preference may be influenced by many factors throughout the customer's overall purchase, ownership, and service experiences. This includes the relationship between the company and customers—the trust and confidence in products and services—that leads to loyalty and preference. Customer-driven quality is thus a strategic concept. It is directed toward market share gain and customer retention. It demands constant sensitivity to emerging customer and market requirements, and measurement of the factors that drive customer satisfaction. It also demands awareness of developments in technology, and rapid and flexible response to customer and market requirements.

Multiple Dimensions of Quality

The concept of quality includes not only the product and service attributes that meet basic requirements, but also those that enhance and differentiate them from competing offerings. However, not every firm needs to compete along the same dimensions of quality. David A. Garvin (1984) observes that quality consists of eight basic dimensions:

1. Performance: A product's primary operating characteristics.
2. Features. The "bells and whistles" of the product.
3. Reliability: The probability that a product will operate properly over a specified period of time under stated conditions of use.
4. Conformance: The degree to which physical and performance characteristics of a product match pre-established standards.
5. Durability: The amount of use one gets from a product before it physically deteriorates or until replacement is preferable.
6. Serviceability: The speed, courtesy, and competence of repair.
7. Aesthetics. How a product looks, feels, sounds, tastes, or smells.
8. Perceived quality: Subjective assessment resulting from image, advertising, or brand name.

Garvin has further suggested that a company can create a niche in the marketplace by focusing only on a few of these dimensions that competitors ignore (1987). For example, Japanese automobiles initially emphasized reliability and conformance ("fit and finish"), which were not very well achieved by domestic automobiles at the time.

A word of caution. While quality was a significant source of competitive advantage in the 1970s and 1980s, the recognition of the importance of quality and the rapid rate at which businesses have improved quality has made it a "given" rather than a distinctive source of competitive advantage. In particular, dimensions such as conformance, reliability, and durability are taken for granted by Japanese firms. In one Chrysler television commercial in the late 1980s, Lee Iacocca touted that "Our cars are every bit as good as the Japanese." Mazda's chairman contends that "any manufacturer can produce according to statistics." In a defect-free world, the Japanese argue, it is the fine touches that will impress consumers. (Business Week, October 22, 1990). Companies that do not pay significant attention to all dimensions of quality will simply not be able to compete. Total quality management represents a basic business strategy.



Review Questions

1. Because of the Industrial Revolution, the role of quality was primarily focused on: 1. (b)
 - (a) building quality into the design of products.
 - (b) inspection.
 - (c) reduction of variation.
 - (d) competitive strategy.

2. Which of the following did not influence modern thinking about quality? 2. (c)
 - (a) research at Western Electric during the 1920s.
 - (b) the work of W. Edwards Deming and Joseph Juran in Japan.
 - (c) Frederick Taylor's approach of scientific management.
 - (d) the Malcolm Baldrige National Quality Award.

3. From the point of view of a machinist, the most appropriate definition of quality is: 3. (b)
 - (a) fitness for use.
 - (b) conformance to specifications.
 - (c) customer satisfaction.
 - (d) loss to society.

4. The process of _____ involves measuring the output of a production system to determine if corrective action is necessary. 4. (c)
(a) quality assurance.
(b) quality engineering.
(c) quality control.
(d) quality management.
5. Which of the following is not a true statement? 5. (d)
(a) Quality characteristics are more difficult to define for service organizations than for manufacturing firms.
(b) Employee behavior is an important issue for quality service.
(c) More attention to employee training and self-management must be paid in service organizations.
(d) The measurement of quality is easier for services than for manufactured goods.
6. The major impact of improved quality of design results in the ability of a firm to: 6. (a)
(a) command higher prices and achieve larger market shares.
(b) reduce manufacturing costs.
(c) improve labor productivity.
(d) reduce scrap and rework.
7. The Taguchi loss function is: 7. (c)
(a) a method of categorizing the costs of poor manufacturing practices.
(b) a technique to determine the best target value for a quality characteristic.
(c) a way of expressing the variation from a target in monetary terms.
(d) an economic model of profitability.
8. Which of the following is not a characteristic of a strong competitive advantage? 8. (a)
(a) It establishes targets for profitability.
(b) It is driven by customer needs.
(c) It is difficult for competitors to copy.
(d) It provides direction, motivation, and a basis for improvement.
9. The color, instrument panel design, and placement of hand controls in an automobile are examples of the quality dimension: 9. (c)
(a) performance.
(b) features.
(c) aesthetics.
(d) perceived quality.

10. Which of the following statements best reflects the perspective of quality today? 10. (b)
- (a) Quality is achieved through inspection for conformance to specifications.
 - (b) The emphasis of quality is shifting from a conformance perspective to one of fitness for use through design.
 - (c) Total quality management is another popular program like management by objectives.
 - (d) Firms need only focus on a few key dimensions of quality to be successful.