CHAPTER EIGHT

MANAGING QUALITY

- *Managing quality helps build successful strategies of differentiation, low cost, and response.*

Two ways Quality can Improve Profitability

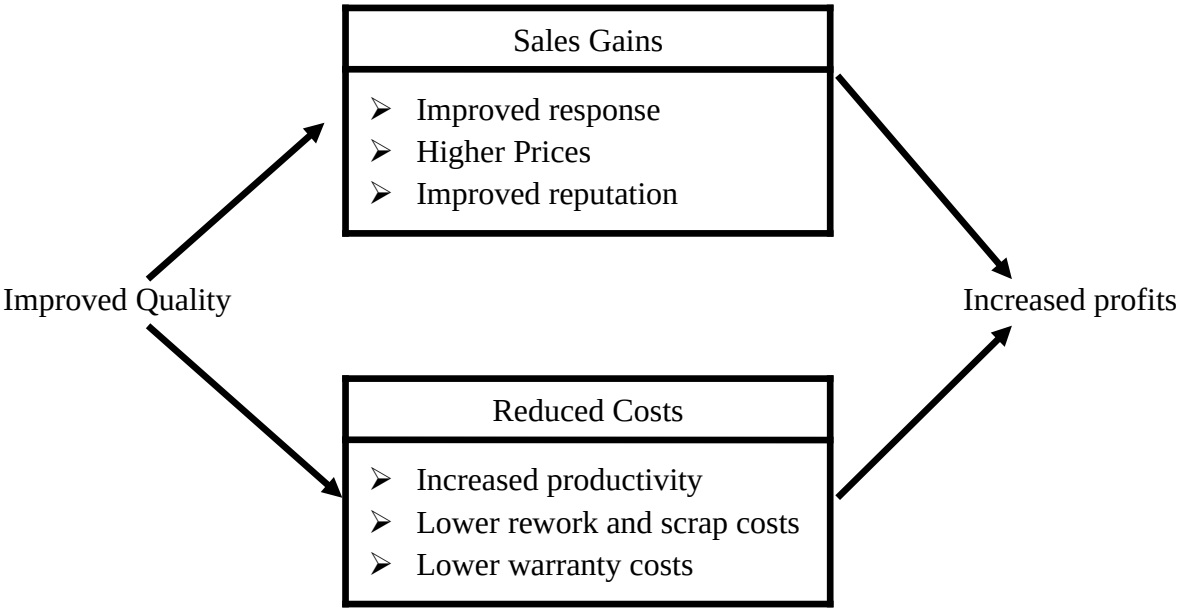


Figure 3.1 Ways Quality Improves Profitability

- As figure 3.1 suggests, improvements in quality help firms increase sales and reduce costs, both of which can increase profitability.
  - Increases in sales often occur as firms speed response, lower selling prices as a result of economies of scale, and improve their reputation for quality products.
  - Similarly, improved quality allows costs to drop as firms increase productivity and lower rework, scarp, and warranty costs.
- Quality or lack of quality, impacts the entire organization from supplier to customer and from product design to maintenance. However, perhaps more importantly, building an organization that can achieve quality also affects the entire organization and it is a demanding task.

- Figure 3.2 below lays out the flow of activities for an organization to use achieve total quality management (TQM).

- A successful set of activities begin with an organizational environment that fosters quality, followed by an understanding of the principles of quality, and then an effort to engage employees in the necessary activities to implement quality.
- When these things are done well, the organization typically satisfied its customers and obtains a competitive advantage. The ultimate goal is to win customers.
- Because quality causes so many other good things to happen it is a great place to start.

Organization practices

Leadership
Mission statement
Effective operating procedures
Staff support
Training
Yields; What is important and what is to be accomplished

Quality principles
Customer focus
Continuous improvement
Employee empowerment
Benchmarking
Just-in-time
Tools of TQM
Yields: How to do what is important and to be accomplished

Employee fulfillment
Empowerment
Organizational commitment
Yields: Employee attitudes that can accomplish what is important

Customer satisfaction
Winning orders
Repeat customers
Yields: An effective organization with a competitive advantage

Figure 3.2. The flows of Activities that are Necessary to Achieve total Quality Management

3.1. *Definining Quality*

- Broadly defined, **quality** refers to the ability of a product or service to consistently meet or exceed customer expectations.

- Total quality management systems are driven by identifying and satisfying customer needs.
- Total quality management takes care of the customer.

The dimensions of quality

- Although they may somewhat from product to product, or between a product and a service, generally speaking, the ***dimensions of quality*** include:

- *Performance,* which refers to the main characteristics of the product or service.
- *Special features*, which refers to extra characteristics.
- ***Conformance,*** which refers to how well a product or service, corresponds to the customer's expectations.
- ***Reliability,*** which refers to consistency of performance.
- ***Durability,*** which refers to the useful life of the product or service.
- ***Service after sale,*** which refers to handling of complaints, or checking on customer satisfaction.

The determinants of quality

- The degree to which a product or a service successfully satisfies its intended purpose has four primary determinants. They are:
  1. The design.
  2. How well it conforms to the design.
  3. Ease of use
  4. Service after delivery.

Quality of Design

Design involves decisions regarding specific characteristics of a product or service such as size, shape, location, and so. On

- **Quality of design** refers to the intention of designers to include or exclude certain features in a product or service.

- For example, there are many different models of automobiles on the market today. They differ in terms of size, appearance, roominess, fuel economy, conform and materials used.
- These differences reflect choices made by designers that determine the quality of design.

- Design decisions must take into account customer wants, production or service capabilities, safety and liability (both during production and after delivery), costs, and other similar considerations.
- Customer wants may be determined from information provided by marketing, perhaps through the use of consumer surveys or other market research, such as the use of focus groups, which consist of consumers brought together to express their views on a product or service (what they like to have).
- Designers must work closely with representatives of operations to ascertain that designs are manufacturable, that is, that production or service has the equipment, capacity, and skills necessary to produce or provide a particular design.
- A poor design can result in difficulties in production or service. For example, materials might be difficult to obtain, specifications difficult to meet, or procedures difficult to follow.

Quality of Conformance

- ***Quality of conformance*** refers to the degree to which goods and services conform to (i.e. *achieve)* the intent of the designers. This is affected by such factors as the capability of equipment used; the skills, training, and motivation of workers; the extent to which the design lends itself to production; the monitoring process to assess conformance; and corrective action-taking (e.g., through problem solving) when necessary.

Ease of Use

- The determination of quality does not stop once the product or service has been sold or delivered. Ease of use and user instructions are important. They increase the chances (but do not guarantee) that a product will be used for its intended purposes and in such a way that it will continue to function properly and safely.

- Much the same reasoning can be applied to services. Customers, patients, clients, or other users must be clearly informed on what whey should or should not do; otherwise, there is the danger that they will take some action that will adversely affect quality.

Service After Delivery

- Quality is also represented by the warranty and repair or replacement of the product after it has been sold.
- Service represents promptness, competence, and integrity. The customer expects that any problems will be corrected quickly, in a satisfactory manner, and with a high degree of honesty and courtesy.

In general failure to conform to the aforementioned quality determinant may affect the organization in terms of loss of business, product liability, loss of productivity, and increased costs,

The Costs of Quality

- Any serious attempt to deal with quality issues must take into account the costs associated with quality. Those costs can be classified into four categories.
  1. **Internal failure costs**- are costs that result from production of defective parts or services before delivery to customers. Examples are reward costs, scrap, and downtime.

- Internal failures occur for a variety of reasons, including defective material from vendors, incorrect machine settings, faulty equipment, carelessness, and faulty or improper material handling procedures.
  2. **External failure costs –** are costs that occur after delivery of defective products or services. Examples are customer warranty replacements, loss of customers or goodwill, handling of complaints, and rework repair costs.
- A common rule of thumb about loss of goodwill is this; A satisfied customer tells three or four others, but a dissatisfied customer tells eight or nine others.
  3. **Appraisal costs –** are costs related to measuring, evaluating, and auditing materials, parts, products, and services to assess conformance with quality standards. Examples

are quality improvement programs, training personnel, redesigning the product or system, and purchasing new equipment.

4. **Prevention costs –** are costs related to reducing the potential for quality problems. Prevention costs relate to attempts to prevent defects from occurring. Examples are quality improvement programs, training personnel, redesigning the product or system, and purchasing new equipment.

3.2. *Total Quality Management*

- ✓ The term **total quality management (TQM)** refers to an organization-wide effort to achieve quality. It can accurately be described as *a philosophy* about quality that is intended to involve everyone in the organization in a quest for quality. It extends to suppliers as well as to customers.

- In fact, in TQM, the *customer* is the focal point, and customer satisfaction is the driving force. And total involvement is important.
- Everyone, from the chief executive officer on down, must be involved and committed.
  - ✓ TQM stresses a commitment by management to have a continuing companywide drive toward excellence in all aspects of products and services that are important to the customer.

TQM approach can be described as follows:

1. Find out what customers want. This might involve the use of surveys, focus groups, interviews, or some other technique that integrates the customer's voice in the decision-making process.
2. Design a product or service that will meet (for exceed) what customers want. Make it easy to use, and easy to produce.
3. Design a production process that facilitates doing the job right the first time. Determine where mistakes are likely to occur and try to prevent them. When mistakes do occur, find out why so that they are less likely to occur again. Strive to "mistake-proof" the process.
4. Keep track of results, and use those to guide improvement in the system. Never stop trying to improve.

5. Extend these concepts to suppliers and to distribution.

- ✓ Successful TQM programs are built through the dedication and combined efforts of everyone in the organization. As noted, top management must be committed and involved. If they aren't, TQM will become just another fad that quickly dies and fades away.

How to Implement TQM

- The following are important concepts for an effective TQM program:
  1. **Continuous Improvement.** Total quality management requires a never-ending process of continuous improvement that covers people, equipment, suppliers, materials and procedures.

- The quest for quality and better service to the customer should be a continual, never-ending one.
- The basis of the philosophy is that every aspect of an operation can be improved. The end goal is perfection, which is never achieved but always sought.
- Competitors will seek to provide better service, and customers will come to expect better service. Hence, to cease improvement efforts will very likely lead to loss of competitive advantage and a decreased level of customer satisfaction.
- The Japanese use the work **Kaizen** to describe this ongoing process of unending improvement the setting and achieving of ever-higher goals. In the U.S., *TQM zero defects,* and *six sigma* are also used to describe continuous improvement efforts. Whatever word or phrase is used, operations managers are key players in building a work culture that endorses continuous improvement.
  2. **Employee empowerment.** Employee empowerment means involving employees in step of the production process.
- Giving workers the responsibility for improvements, and the authority to make changes to accomplish them, provides strong motivation for employees, and puts decision making into the hands of those who are closest to the job and have considerable insight into problems and solutions.

3. **Benchmarking.** Benchmarking involves identifying organizations that are the best at something and then modeling your own organization after them. The organization need not be in the same line of business as yours.

- The steps for developing benchmarks are:
    1. Determine what to benchmark
    2. Form a benchmark team.
    3. Identify benchmarking partners
    4. Collect and analyze benchmarking information
    5. Take action to match or exceed the benchmark.

4. **Team approach.** Teams can be built to address a variety of issues. One popular focus of teams is quality. Such teams are often known as quality circles.

- A **quality circle** is a group of employees who meet regularly to solve work-related problems. The members receive training in group planning, problem solving, and statistical quality control. They generally meet once a week (usually after work, but sometimes on company time). Although the members are not rewarded financially, they do receive recognition from the firm. A specially trained team member, called the facilitator, usually helps train the members and keeps the meetings running smoothly. Teams with a quality focus have proven to be a cost effective way to increase productivity as well as quality.

5. **Knowledge of TQM tools.** To empower employees and implement TQM as a continuing effort, everyone in the organization must be trained in the *techniques of TQM.*

- Everyone in the organization is trained in the use of quality control and improvement tools.
    - ✓ The entire organization must be subject to the search for improved ways of performing; nothing should be regarded as sacred or untouchable. A view that is sometimes helpful is to consider the *internal customers,* and *strive to satisfy them*. That is, every activity in an organization has one or more "*customers"* who receive their output. By thinking in terms of what is needed to satisfy these customers, it is very often possible to improve the system, and in doing so, increase the satisfaction of the ultimate customer.

- ✓ The term **quality at the source.** Refers to the philosophy of making each worker responsible for the quality of his or her work. This incorporates the notion of "Do it right" as well as the notion of "If it isn't right, fix it". Workers are expected to provide goods or services that meet specifications and to find and correct mistakes that occur. In effect, each worker becomes a quality inspector for his or her work. When the work is passed on to the next operation in the process (the internal customers), or, if that step is the last step in the process, to the ultimate customer, the worker is "certifying" that it meets quality standards.
- ✓ This accomplishes a number of things. One is that it places direct responsibility for quality on the person(s) who directly affect it. Another, it removes the adversarial relationship that often exists between quality control inspectors and production workers. And it motivates workers by giving them control over their work as well as pride in their work.
- ✓ *Supplier* are regarded as partners in the process, and long-term relationships are encouraged. This gives suppliers a vital stake in providing quality goods and services. Suppliers, too, are expected to provide quality at the source, thereby reducing or eliminating the need to inspect deliveries from suppliers.
- ✓ ***Quality function deployment*** is a term used to refer to involving customers in the design stage of new or redesigned products. The idea is to try to match customer requirements with engineering characteristics of a product. To facilitate communication and cooperation among departments, teams that include representatives from manufacturing, marketing, and engineering collaborate on the design.

  It would be incorrect to think of TQM as merely a collection of techniques. Rather, TQM reflects a different way of viewing the entre way of life of the people in the organization. It is about the *culture* of an organization. To truly reap the benefits of TQM, the culture of an organization must change.

Table 3-1 illustrates the difference in culture of a TQM organization compared to a more traditional organization.

Table 3-1

Comparing the cultures of TQM and traditional organizations

Aspect	Traditional	TQM
Overall mission	Maximize return on investment	Meet or exceed customer satisfaction
Objectives	Emphasis on short term	Balance of long term and short term
Management	Not always open; Sometimes inconsistent Objectives	Open: encourages employee input; consistent objectives
Role of manager	Issue orders; enforce	Coach, remove barriers, build trust
Customer requirements	Not highest priority; may be unclear	Highest priority; important to identify and understand
Problems	Assign blame' punish	Identify and resolve
Problem solving	Not systematic; individuals	Systematic; teams
Improvement	Erratic	Continual
Suppliers	Adversarial	Partners
Jobs	Narrow, specialized; much individual effort	Broad, more general; much team effort
Focus	Product oriented	Process oriented

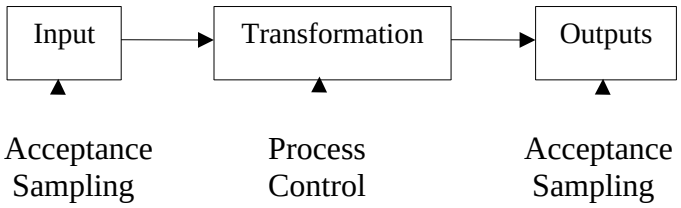
3.3. The Role of Inspection

- To determine if a process is functioning as intended, or to verify that a shipment of raw materials or materials final products does not contain more that a specified percentage of detectives, it is necessary to physically examine at least some of the items in question. The purpose of inspection is to provide information on the degree to which items conform to a standard.
- The basic issues here are;
    1. How much to inspect and how often
    2. At what points in the process inspection should occur
    3. Whether to inspect in a centralized location or on site

- Consider, for example, inspection at an intermediate step in the manufacture of personal computers. Because inspection costs are often significant, the question naturally a rides of whether it is necessary to inspect every computer, or whether a small sample of computers will suffice. Moreover, although there are numerous points in the production process where inspections could be made, it is not generally cost-effective to inspect at every point. Hence, the question comes up of which points to inspect at. Once these have been identified, a decision must be made on whether to remove the computers from the line and take them to a lab, where specialized equipment might be available to run certain tests, or whether to test them where they are being made. We will examine these points in the following sections.

How Much to Inspect and How Often

The amount of inspection can range from no inspection whatsoever to inspecting each item numerous times. Low-cost, high-volume items such as paper clips, roofing nails, and wooden pencils often require little inspection because (1) the cost associated with passing defectives is quite low and (2) the processes that produce these items are usually highly reliable, so that defectives are rate. Conversely, high-cost, low-volume items that have large costs associated with passing defectives often require more extensive inspections. Thus critical components of a manned-flight space vehicle are closely cutinized because of the risk to human safety and the high cost of mission failure. In high-volume systems, one option that may be employed is *automated* inspection.



- The majority of quality control applications lies somewhere between the two extremes. Most require some inspection, but it is neither possible nor economically feasible to critically examine every part of activity for control purposes.
    - The cost of inspection, resulting interruptions of a process or delays caused by inspection, and the manner of testing typically outweigh the benefits of 100

percent inspection. However, the cost of letting undetected defectives slip through is high enough that inspection cannot be completely ignored.

- The amount of inspection needed is governed by the costs of inspection and the expected costs of passing defective items. As illustrated in Figure 3.4, if inspection activities increase, inspection costs increase, but the costs of undetected defectives decrease.
- The goal, of course, is to minimize the sum of these two costs. In other words, it may not pay to attempt to catch every defective, particularly if the cost of inspection exceeds the penalties associated with letting some defectives get through.

- As a rule, operations that have a high proportion of human involvement necessitate more inspection effort than mechanical operations because the letter tends to be more reliable.
- The frequency of inspection depends largely on the rate at which a process may go out of control or the number of lots being inspected. A stable process will necessitate only infrequent checks, whereas an unstable one, or one that has recently given trouble, will require more frequent checks. Likewise, many small lots will require more samples than a few large lots because it is important to obtain sample data from each lot.

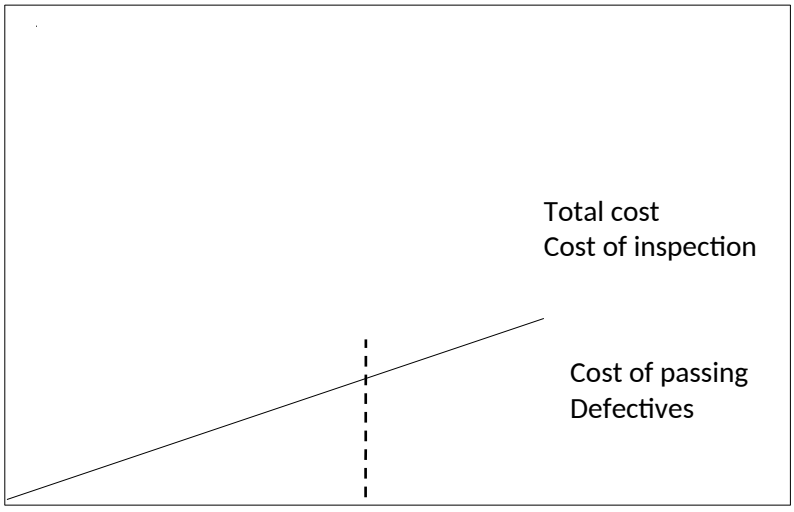


Figure 3.4 The amount of inspection if optimal when the sum of the costs of inspection and passing defective is minimized.

- In many operations, there are many possible inspection points. Because each inspection adds to the cost of the product or service, it is important to restrict inspection efforts to the points where they can do the most good. In manufacturing, some of the typical inspection points are:
    1. *Raw materials and purchased parts.* There is little sense in paying for goods that do not meet quality standards and little sense in expending time and effort on material that is bad to begin with.
    2. *Finished products.* Customer satisfaction and the firm's image are at stake here and repairing or replacing products in the field is usually quite a bit more costly than when it is done at the factory. Likewise, the seller is usually responsible for shipping costs on returns, and payments may be held up pending delivery of satisfactory goods.
    3. *Before a costly operation.* The point is to not waste costly labor or machine time on items that are already defective.
    4. *Before an irreversible process.* In many cases, items can be reworked up to a certain point, but beyond that point they cannot. For example, pottery can be reworked prior to firing. After that, defectives must be discarded or sold as seconds at a lower price.
    5. *Before a covering process.* Painting, plating, and assemblies often mask defects.

In the service area, inspection points are incoming purchased materials and supplies, personnel, service interfaces (*e.g.* service counter), and outgoing completed work (*e.g.*, repaired appliances, automobiles). Table 3.2 illustrates a number of examples.

- Each situation is different. A manager must weigh the costs and benefits of inspections at each potential point in a process when deciding to assign inspections.

Table 3.2

Examples of inspection points in service organizations

Type of business	Inspection points	Characteristics
Fast food	Cashier	Accuracy
	Courter are	Appearance, productivity
	Eating area	Cleanliness, no loitering
	Building and grounds	Appearance, safety hazards
	Kitchen	Cleanliness, purity of food, food storage, health regulations
	Parking lot	Safe, well-lighted
Hotel/motel	Accounting/billing	Accuracy, timeliness
	Building and grounds	Appearance and safety
	Main desk	Appearance, waiting times, accuracy of bills
	Maid service	Completeness, productivity
	Personnel	Appearance manners, productivity
	Reservations/occupancy	Over/under booking, percent occupancy
	Restaurants	Kitchen, menus, meals, bills
	Room service	Waiting time, quality of good
	Supplies	Ordering, receiving, inventories
Supermarket	Cashiers	Accuracy, courtesy, productivity
	Deliveries	Quality, quantity
	Produce	Freshness, well-stocked
	Aisles and stockrooms	Uncluttered
	Inventory control	Stock-outs
	Shelf displays	Ample supply, rotation of perishables
	Checkouts	Appearance
	Shopping carts	Waiting time
		Good working condition, ample supply theft/vandalism
	Parking lot	Safe, well-lighted
	Personal	Appearance

Centralized Versus On-Site Inspection

- Some situations require that inspections be done on *site*. For example, inspecting the hull of a ship for cracks requires inspectors visit the ship.

- At other times, specialized tests can best be performed in a lab. This is the case with many medical tests and it also applies to various tests in business and industry (analyzing ford samples, testing metals for hardness, running viscosity tests on lubricants, and so on).

- The central issue in the decision of whether to inspect on site or in the lab is whether the advantages of specialized lab tests are worth the time and interruption needed to obtain the results.
  - Reasons favoring on site inspection include quicker decisions and avoidance of introduction of extraneous factors (e.g., damage or other alteration of samples during transportation to the lab).
- In unit (one-by-one) production, some companies rely on self-inspections by operators if errors can be traced back to specific operators. This places responsibility for errors at their source.

Source Inspection

- The best inspection can be thought of as no inspection at all; this "inspection" is always done at source-it is just doing the job properly with the operator ensuring that this is so. This may be called **source inspection** (or source control) and is consistent with the concept of employee empowerment, where individual employees self-check their own work.
  - The idea is that each supplier, process, and employee *treats the next step in the process as the customer,* ensuring perfect product to the next "*customer"*.

3.4. TQM in Services

- The personal component of services is more difficult to measure than the quality of the tangible component. Generally, the user of a service, like the user of a good, has features in mind that form a basis for comparison among alternatives.
  - Lack of any one feature may eliminate the service from further consideration. Quality also may be perceived as a bundle of attributes in which many lesser characteristics are superior those of competitors.

- This approach to product comparison differs little between goods and services. However, what is very different about the selection of services is the poor definition of the (1) *intangible differences between products and (2) the intangible expectations customers have of those products.*
- Indeed, the intangible attributes may not be defined at all. They are often unspoken images in the purchaser's mind. This is why all of those marketing issues such as advertising, image, and promotion can make a difference.

- The operations manager plays a significant role in addressing several major aspects of service quality.
  - First, the tangible component of many services is important. How well the service is designed and produced does make a difference. This might be how accurate, clear, and complete your checkout bill at the hotel is how warm the food is, or how well your car runs after you pick it up at the repair shop.
- Secondly, another aspect of service and service quality is the process. Notice in table 3.3 that 9 out of 10 of the Determinations of service quality are related to the *service process.*
  - Such things as reliability and courtesy are part of the process. The operations manager can *design processes (service products) that have these attributes* and can ensure their quality through the TQM techniques discussed in this chapter.
- Third, the operations manager should realize that the customer's expectations are the standard against which the service is judged.
  - Customers' perceptions of service quality result from a comparison of their before-service expectations with their actual service experience. In other words, service quality is judged on the basis of whether it meets expectations.
  - The *manager may be able to influence both the quality of the service and the expectation.* Don't promise more than you can deliver.
- Fourth, the manager must expect exceptions. There is a standard quality level at which the regular service is delivered, such as three bank teller's handling of transaction. However, there are "exceptions" or "problems" initiated by the customer or by less than optimal operating conditions (for example, the computer "crashed").

This implies that quality control system must recognize and *have a set of alternate plant for less than optimal operating conditions.*

Table 3.3. Determinants of Service Quality

Reliability involves consistency of performance and dependability; it means that the firm performs the service right the first time and that the firm honors its promises.

Responsiveness concerns the willingness or readiness of employees to provide service. It involves timelines of service.

Competence means possession of the required skills and knowledge to perform the service.

Access involves approachability and ease of contact.

Courtesy involves politeness, respect, consideration, and friendliness of contact personnel (including receptionists, telephone operators, etc).

Communication means keeping customers informed in language they can understand and listening. It may mean that the company has to adjust its language for different consumers-increasing the level of sophistication with a well-educated customer and speaking simply and plainly with a novice.

Credibility involves trustworthiness, believability, and honesty. It involves having the customer's best interests at heart.

Security is the freedom from danger, risk, or doubt.

Understanding/knowing the customer involves making the effort to understand the customer's needs.

Tangible includes the physical evidence of the service.