Module – 4
Quality and Total Quality Management

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(As per Syllabus of MBA (SCM), MBA(HRM) Semester – II)

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Part – I of II

Quality Management - Definition

The concept and vocabulary of quality is elusive. Different people interpret quality differently. Few can define quality in measurable terms that can be operationalized. When asked what differentiate their product or service, the banker will answer "service," health care worker will answer "quality health care," the hotel restaurant employee will answer "customer satisfaction," and the manufacturer will simply answer "quality product." When pressed to provide a specific definition and measurement, few can do so.

There is an old maxim in management that says, "If you can't measure it, you can't manage it," and so it is with quality. If strategic management systems and the competitive advantage are to be based on quality, every member of the organization should be clear about this concept, definition, and measurement as it applies to his or her job.

Harvard professor David Garvin, in his book *Managing Quality*, summarized five principal approaches to defining quality: Transcendent, Product based, User based, Manufacturing based, and Value based. Let's discuss each one of them:

1. Transcendental View of Quality: Those who hold transcendental view would say, "I can't define it, but I know when I see it."

Advertisers are fond of promoting products in these terms. "Where shoping is a pleasure" (supermarket), "We love to fly and it shows" (airline), and "It means beautiful eyes" (cosmetics) are example.

2. Product-Based View: Product based definitions are different. Quality is viewed as quantifiable and measurable characteristics or attributes. For example durability or reliability can be measured (e.g. mean time between failure, fit and finish), and the engineer can design to that benchmark. Quality is determined objectively. Although this approach has many benefits, it has limitations as well. Where quality is based on individual taste or preference, the benchmark for measurement may be misleading.

3. User-Based View: User based definitions are based on the idea that quality is an individual matter, and products that best satisfy their preferences (i.e. perceived quality) are those with the highest quality. This is a rational approach but leads to two problems. First, consumer preferences vary widely, and it is difficult to aggregate these preferences into products with wide appeal. This leads to the choice between a niche strategy or a market aggregation approach which tries to identify those product attributes that meet the needs of the largest number of consumers.

4. Manufacturing-Based View: Manufacturing-based definitions are concerned primarily with engineering and manufacturing practices and use the universal definition of "conformance to requirements." Requirements, or specifications, are established design, and any deviation implies a reduction in quality. The concept applies to services as well as products. Excellence in quality is not necessarily in the eye of the beholder but rather in the standards set by the organization.

This approach has serious weaknesses. The consumer's perception of quality is equated with conformance and hence is internally focused. Emphasis on reliability in design and manufacturing tends to address cost reduction as the objective, and cost reduction is perceived in a limited way– invest in design and manufacturing improvement until these incremental costs equal the costs of non-quality such as rework or scrap.

5. Value-Based View: Value-based quality is defined in terms of costs and prices as well as a number of other attributes. Thus, the consumer's purchase decision is based on quality (however it is defined) at the acceptable price.

Attributes of Quality

Quality attributes, also known as quality factors, quality characteristics, or non-functional requirements, are a set of system functional and non-functional requirements that are used to evaluate the system performance. There are a large number of system quality attributes identified in the literature (e.g. MSDN 2010, Barbacci et al. 1995). Depending on the type of the system being considered, some of these attributes are more prominent than others. Ideally, a system would be optimized for all the quality attributes that are important to the stakeholders, but this is an impossible task. Therefore, it is important to conduct a trade off analysis to identify the relationship between the attributes and establish whether a change in one attributes would positively or negatively affect any other attributes. An example of such trade off is shown in Table 1 below.

Table 1. Attribute Trade Off

	Flexibility	**Maintainability**	**Reliability**
Flexibility		+	-
Maintainability	+		+
Reliability	-	+	

Finding the right set of quality attributes is the first step in quality control and management. In order to achieve high quality, quality has to be measured, monitored, managed, and improved on. Therefore, in order to increase the overall system quality, it is necessary to

- identify and prioritize the quality attributes
- identify the metrics that can be used for these attributes
- measure and monitor the attributes
- validate the measurements
- analyze the result of those measurements
- establish processes and procedures that result in improved system quality, based on the analysis.

Quality Attributes for Products

Quality attributes for a product focuses on the conformance to the specifications for the product; frequently these are manufacturing specifications. Examples include physical characteristics (length, weight, finish, capacity, etc.) being inside a given tolerance range. The physical characteristics can be related to the function of the product or to aesthetic qualities.

A single product may have a vector of quality attributes of high dimension as wells as an associated region in which the vector is expected to be. Often the quality is summarized by saying the item is "in compliance" (if the vector is in the acceptable region) or "defective" (if the vector is outside the acceptable region).

Quality Attributes for Services

Quality of services plays a major role in the customer satisfaction, which is the measurement of the overall system quality. Services can be divided into two major categories: primary and secondary. The city public transportation system, the U.S. postal service, or the medical services provided by a hospital are all examples of primary services. Services that provide help to a customer are secondary services, which are typically referred to as a *customer service*. Identifying the appropriate quality attributes is critical in the quality management of services. Some examples of service quality attributes include: affordability, availability, dependability, efficiency, predictability, reliability, responsiveness, safety, security, usability, etc. Again, depending on the type of the service, some of these attributes are more prominent than the others.

For example, in the case of services that are provided by the hospital, one may be more interested in the availability, reliability, and responsiveness than potentially the security (typically hospitals

are assumed to be safe) and the affordability (typically insurance covers the majority of the cost). Of course, if the patient does not have a good insurance coverage, then the importance of affordability will increase (de Knoning, 2006).

Quality Attributes for Enterprises

An enterprise typically refers to a large complex set of interconnected entities that includes people, technologies, processes, financial, and physical elements. Clearly, a typical enterprise has a number of internal and external stakeholders, and as a result there are a large number of quality attributes that will define its quality. Identifying the right set of attributes is typically more challenging in such a complex system. An example of an enterprise is the air traffic management system that is mainly responsible for the safe and efficient operation of the civil aviation within a country or collection of countries. There are a large number of stakeholders that are concerned about the overall quality of the system, some example of these stakeholders and some of the primary quality attributes that they are concerned with are identified in Table 2.

Table 2. Enterprise Stakeholders and their Quality Attributes

Stakeholders	**Primary Quality Attributes**
Passengers	Safety, affordability, and reliability
Airlines	adaptability, efficiency, and profitability
Air Traffic Controller	safety, reliability, and usability
Hardware & Software Developers	reliability, fault tolerance, and maintainability
Government/Regulatory Agency	safety, reliability, affordability, etc.

Measuring Quality Attributes

Quality cannot be achieved if it cannot be measured. The Measurement System Analysis (MSA) (Wheeler and Lynday 1989) is a set of measuring instruments that provide an adequate capability for a team to conduct appropriate measurements in order to monitor and control quality. The MSA is a collection of

- **Tools** - measuring instruments, calibration, etc.
- **Processes** - testing and measuring methods, set of specifications, etc.
- **Procedures** - policies and procedures and methodologies that are defined by the company and/or regulatory agency
- **People** - personnel (managers, testers, analysis, etc.) who are involved in the measurement activities
- **Environment** - both environmental setting and physical setting that best simulate the operational environment and/or the best setting to get the most accurate measurements

Once the quality attributes are identified and prioritized, then the MSA supports the monitor and control of overall system quality.

Dimensions of Quality

Eight dimensions of product quality management can be used at a strategic level to analyze quality characteristics. The concept was defined by David Garvin. Some of the dimensions are mutually reinforcing, whereas others are not—improvement in one may be at the expense of others. Understanding the trade-offs desired by customers among these dimensions can help build a competitive advantage. Garvin's eight dimensions can be summarized as follows:

1. **Performance**: Performance refers to a product's primary operating characteristics. This dimension of quality involves measurable attributes; brands can usually be ranked objectively on individual aspects of performance.

2. **Features**: Features are additional characteristics that enhance the appeal of the product or service to the user.
3. **Reliability**: Reliability is the likelihood that a product will not fail within a specific time period. This is a key element for users who need the product to work without fail.
4. **Conformance**: Conformance is the precision with which the product or service meets the specified standards.
5. **Durability**: Durability measures the length of a product's life. When the product can be repaired, estimating durability is more complicated. The item will be used until it is no longer economical to operate it. This happens when the repair rate and the associated costs increase significantly.
6. **Serviceability**: Serviceability is the speed with which the product can be put into service when it breaks down, as well as the competence and the behavior of the serviceperson.
7. **Aesthetics**: Aesthetics is the subjective dimension indicating the kind of response a user has to a product. It represents the individual's personal preference.
8. **Perceived Quality**: Perceived Quality is the quality attributed to a good or service based on indirect measures.

Explanations of the above Dimensions are detailed as follows:

Performance: Performance refers to a product's primary operating characteristics. This dimension of quality involves measurable attributes, so brands can usually be ranked objectively on individual aspects of performance. Overall performance rankings, however, are more difficult to develop, especially when they involve benefits that not every consumer needs. Performance is often a source of contention between customers and suppliers, particularly when deliverables are not adequately defined within specifications. The performance of a product often influences the profitability or reputation of the end-user. As such, many contracts or specifications include damages related to inadequate performance. The question of whether performance differences are quality differences may depend on circumstantial preferences-but preferences based on functional requirements, not taste. Some performance standards are based on subjective preferences, but the preferences are so universal that they have the force of an objective standard.

Features: Features are additional characteristics that enhance the appeal of the product or service to the user. Similar thinking can be applied to features, a second dimensions of quality that is often a secondary aspects of performance. Features are the "bells and whistles" of products and services, those characteristics that supplement their basic functioning. Examples include free drinks on a plane, permanent-press cycles on a washing machine, and automatic tuners on a color television set. The line separating primary performance characteristics from secondary features is often difficult to draw.

Reliability: Reliability is the likelihood that a product will not fail within a specific time period. This is a key element for users who need the product to work without fail.

This dimension reflects the probability of a product malfunctioning or failing within a specified time period. Among the most common measures of reliability are the mean time to first failure, the mean time between failures, and the failure rate per unit time. Because these measures require a product to be in use for a specified period, they are more relevant to durable goods than to products and services that are consumed instantly.

Reliability normally becomes more important to consumers as downtime and maintenance become more expensive. Farmers, for example, are especially sensitive to downtime during the short harvest season. Reliable equipment can mean the difference between a good year and spoiled crops. But consumers on other markets are more attuned than ever to product reliability too. Computers and copying machines certainly compare on this basis.

Reliability may be closely related to performance. For instance, a product specification may define parameters for up-time, or acceptable failure rates. Reliability is a major contributor to brand or

company image, and is considered a fundamental dimension of quality by most end-users. I.E., recent market research shows that, especially for women, reliability has become an automobile's most desired attribute.

Conformance: The dimension of conformance depicts to what extent a product's design and operating characteristics meet established standards. This dimension owes the most to the traditional approaches to quality pioneered by experts like Juran.

All products and services involve specifications of some sort. When products are developed, these specifications are set and a target is set, for instance the materials used or the dimension of the product. Not only the target but also the tolerance (the range of permitted deviation from the target) is defined. One problem with this approach is that there is little interest in whether the specifications have been met exactly as long as the tolerance limits are met.

On the one hand, this can lead to the so-called "tolerance stack-up". When two or more parts are to be fit together, the size of their tolerances often determine how well they will match. Should one part fall at a lower limit of its specification and a matching part at its upper limit, a tight fit is unlikely. The link is likely to wear more quickly than one made from parts whose dimensions have been centered more exactly.

This problem can be addressed by taking a different approach to measuring quality. Instead of measuring a simple conformance to specifications, the degree to which parts or products diverge from the ideal target is measured. Using this approach, process 1 (see picture) is better even though some items fall beyond specification limits. The traditional approach would have favoured process 2 because it produces more items within the specification limit. It was demonstrated that the problem of "tolerance stack-up" is worse when the dimensions of parts are more distant from the target than when they cluster around it, even if some parts fall outside the tolerance. This approach requires a fresh look at the common process quality factor of 'defect rate', to take into account the fact that two parts may each pass the 'tolerance test' separately but be unusable when the attempt is made to join them together.

In service businesses, measures of conformance normally focus on accuracy and timeliness and include counts of processing errors, unanticipated delays and other frequent mistakes.

Durability: Durability measures the length of a product's life. When the product can be repaired, estimating durability is more complicated. The item will be used until it is no longer economical to operate it. This happens when the repair rate and the associated costs increase significantly. Technically, durability can be defined as the amount of use one gets from a product before it deteriorates. After so many hours of use, the filament of a light bulb burns up and the bulb must be replaced. Repair is impossible. Economists call such products "one-hoss shays".

In other cases, consumers must weigh the expected cost, in both dollars and personal inconvenience, of future repairs against the investment and operating expenses of a newer, more reliable model. Durability, then, may be defined as the amount of use one gets from a product before it breaks down and replacement is preferable to continued repair.

This approach to durability has two important implications. First, it suggests that durability and reliability are closely linked. A product that often fails is likely to be scrapped earlier than one that is more reliable; repair costs will be correspondingly higher and the purchase of a competitive brand will look that much more desirable. Second, this approach implies that durability figures should be interpreted with care. An increase in product life may not be the result of technical improvements or the use of longer-lived materials. Rather, the underlying economic environment simply may have changed.

Servicability: Serviceability involves the consumer's ease of obtaining repair service (example: access to service centers and/or ease of self-service), the responsiveness of service personnel (example: ease of getting an appointment, willingness of repair personnel to listen to the customer), and the reliability of service (example: whether the service is performed right the first time).

Competence and ease of repair is the speed with which the product can be put into service when it breaks down, as well as the competence and the behavior of the service personnel.
Consumers are concerned not only about a product breaking down but also about the time before service is restored, the timeliness with which service appointment are kept, the nature of dealings with service personnel, and the frequency with which service calls or repairs fail to correct outstanding problems. In those cases where problems are not immediately resolved and complaints are filed, a company's complaint handling procedures are also likely to affect customer's ultimate evaluation of product and service quality.
Some of these variables reflect differing personal standards of acceptable service. Others can be measured quite objectively. Customers may remain dissatisfied even after completion of repairs. How these complaints are handled is important to a company's reputation for quality and service. Eventually, profitability is likely to be affected as well. Companies differ widely in their approaches to complaint handling and in the importance they attach to this element of serviceability. Some do their best to resolve complaints; others use legal gimmicks, the silent treatment and similar ploys to rebuff dissatisfied customers.
For example recently, General Electric, Procter & Gamble and other companies have sought to preempt consumer dissatisfaction by installing toll-free telephone hot lines to their customer relations departments.
Important attributes for serviceability dimension are: service warranty, parts warranty, parts availability, number of reasonable distance to dealer service centers, distance to service parts center-dealer, distance to service parts center individual, length of wait for service appointment, schedule of preventive maintenance, employees listen to customers, information regarding repairs, courteous service centers, repaired correctly first time, service time relative to other dealers, warranty claims handled without argument, average repair cost/year, extended warranty, underestimation of service cost and provision of loan car.
Aesthetics or Style: The aesthetic properties of a product contribute to a company's or brand's identity. Faults or defects in a product that diminish its aesthetic properties, even those that do not reduce or alter other dimensions of quality, are often cause for rejection.
Aesthetics refers to how the product looks, feels, sounds, tastes or smells. It is clearly a matter of personal judgment and a reflection of individual preference. Nevertheless, there appear to be some patterns in consumers' rankings of products on the basis of taste.
A recent study of quality in 33 food categories, for example, found that high quality was most often associated with "rich and full flavor, tastes natural, tastes fresh, good aroma and looks appetizing". Aesthetics also refers to the "outside" feel of the product.
The aesthetics dimension differs from subjective criteria pertaining to "performance" in that aesthetic choices are not nearly universal. Not all people prefer "rich and full" flavor or even agree on what that means. Companies therefore have to search for a niche. On this dimension of quality, it is impossible to please everyone.
Perceived Quality: Perception is not always reality. Consumers do not always have complete information about a product's or service's attributes; indirect measures may be their only basis for comparing brands.
A product's durability for example, can seldom be observed directly; it usually must be inferred from various tangible and intangible aspects of the product. In such circumstances, images, advertising and brand names -inferences about quality rather than the reality itself- can be critical. For this reason, both Honda -which makes cars in Marysville, Ohio- and Sony -which builds color televisions in San Diego- have been reluctant to publicize that their products are "made in America".

Reputation is the primary stuff of perceived quality. Its power comes from an unstated analogy: that the quality of products today is similar to the quality of products of yesterday, or the quality of goods in a new product line is similar to the quality of a company's established products.

Quality of design and Quality of Conformance

Quality of design is the quality which the producer or supplier is intending to offer to the customer. When the producer is making the quality of design of the product, he should take into consideration the customer's requirements in order to satisfy them with **fitness for use** of the product.

If the quality of design does not reflect the customer's requirements, the product which the producer offers him would not probably satisfy the customer, even if it does sufficiently conform to the design. Quality of design is usually indicated by completeness and correctness of specifications, drawings, catalogues, etc. and is measured with fitness for use.

Quality of conformance is the level of the quality of product actually produced and delivered through the production or service process of the organization as per the specifications or design. When the quality of a product entirely conforms to the specification (design), the quality of conformance is deemed excellent.

Specifications are targets and tolerances determined by the designer of a product. Targets are the ideal values for which production is expected to strive; tolerances are acceptable deviations from these ideal values recognizing that it is difficult to meet the exact targets all the time due to variability in material, machine, men and process.

For example, if an engineering component manufacturer specifies the diameter of a steel pin as 2.525 ± 0.005 mm, the value 2.525 is the target value and ± 0.005 is the tolerance. In a similar way, in case of an Airline service, if on time arrival of a flight is specified as within 15 minutes of scheduled time, the target is scheduled time and tolerance is $\pm$ 15 minutes.

The measure most commonly used for expressing the quality of conformance is fraction defective. A fraction of defect of 0 % implies that the quality of a product wholly conforms to the quality of design. Even if the quality of a design is very good and quality of conformance is poor, the product cannot give the intended service and is classified as poor quality product.

For example, in case of a service product like maintenance of law and order by governmental agencies, the quality of design is reflected in the relevant acts and rules, whereas quality of conformance depends upon the extent to which these acts and rules are complied by the enforcement agencies. In spite of having excellent rules and regulations, the quality of law and order of society cannot be rated as good, if these rules and regulations are not adhered to properly. Fitness for use (quality of design) and conformance to specification (quality of conformance) provide the fundamental basis for managing the processes to produce quality products. Good quality can be attained only when both, quality of design and quality of conformance are good.

Principles of Quality

A principle is a fundamental truth or law and therefore quality management principles are the fundamental truth or laws that form the basis of quality management.

These principles have been identified to facilitate the achievement of quality objectives and form the foundation for effective quality management. The table below describes each of the principles as they are currently defined in ISO 9000:2005. Use this as a more effective means of conducting a Gap Analysis than simply looking at the requirements. For a condensed version use our unique Self Assessment Tool. Both tools will enable you to establish the gap between where your QMS is today and where it needs to be to meet the intent of ISO 9000:2008. Also among the resources

opposite is a detail list of what you would expect to find happening in an organization that had adopted the 8 QM principles. This is key to understanding.
Any revision of existing quality management systems should be carried out using the 8 QM principles otherwise the resultant system will not satisfy the intent of ISO 9000:2008.

Eight Quality Management Principles		
1	**Customer focused organization**	Organizations depend on their customers and therefore should understand current and future customer needs, should meet customer requirements and strive to exceed customer expectations
2	**Leadership**	Leaders establish unity of purpose and direction. They should create and maintain the internal environment in which people can become fully involved in achieving the organization's objectives
3	**Involvement of people**	People at all levels are the essence of an organization and their full involvement enables their abilities to be used for the organization's benefit.
4	**Process approach**	A desired result is achieved more efficiently when activities and related resources are managed as a process.
5	**System approach to management**	Identifying, understanding and managing a system of interrelated processes as a system contributes to the organization’s effectiveness and efficiency in achieving its objectives.
6	**Continual improvement**	Continual improvement of the organization's overall performance should be a permanent objective of the organization.
7	**Factual approach to decision making**	Effective decisions are based on the analysis of data and information.
8	**Mutually beneficial supplier relationships**	An organization and its suppliers are interdependent and a mutually beneficial relationship enhances the ability of both to create value.

Using the above Eight Quality Management Principles

- The principles can be used in validating the design of processes, in validating decisions, in auditing system and processes. You look at a process and ask:
- Where is the customer focus in this process?
- Where in this process is there leadership, guiding policies, measurable objectives and the environment that motivates the workforce to achieve these objectives?
- Where in this process is the involvement of people in the design of the process, the making of decisions, the monitoring and measurement of performance and the improvement of performance?
- Where in this process has the process approach been applied to the accomplishment of these objectives?
- Where in this process is the systems approach to the management of the interfacing processes, the optimization of performance, the elimination of bottlenecks?

- Where in this process are the facts collected and transmitted to the decision makers?
- Where in this process is there continual improvement in performance, efficiency and effectiveness?
- Where in this process is there a mutually beneficial relationship with suppliers?

Philosophies of Quality

(A) W. Edwards Deming "14 Points"

The need for a working understanding of basic quality management system statistical principles is at the heart of Deming's teaching. While accepting the ASQ's Shewhart Medal in 1955, he commented that "Statistical theory has changed practice in almost everything. Statistical techniques, in their ability to aid the discovery of causes, are creating a science of management and a science of administration." His quality process message, directed primarily at management, is stated succinctly in his famous **14 Points for Management**:

1) Create constancy of purpose for improvement of product and service. Inspire the workers to stay competitive in the market and remind about the importance of stability in jobs and new opportunities which may come up in later stages, as inducing a sense of purpose in producing quality products will work as the inspiration to work efficiently.

2) Adopt the new philosophy. The customer demands and taste change very fast and the competition in the market grow at a rapid rate today, and we have to accept new philosophies according to the market trends and technology revolutions.

3) Cease dependence on mass inspection. Instead of inspecting the product for quality after production, infuse quality at the beginning itself with production quality control, as this will ensure no raw materials are wasted for the sake of quality.

4) End the practice of awarding business on price tag alone. Instead, minimize total cost - move towards a single supplier for any item, on trust.

5) Constantly and forever improve the system of production and service. Enterprise systems and services must keep growing indefinitely in order to catch up with the competitive market.

6) Institute modern methods of training on the job. A trained worker has more productivity and quality than an untrained one, so giving training sessions will drastically improve the quality of the person and directly it helps in better product quality performance.

7) Institute modern methods of supervision. A company can display stunning growth if potential leaders are identified and encouraged.

8) Drive out fear. Creating a fearful impression in the employees does not give more quality and productivity to work. If a person is not working willingly with satisfaction then he can never do a work perfectly even if he has the intention to be perfect in conscious mind, so driving out fear is essential.

9) Break down barriers between staff areas. The workers in design, sales, and production must work together to face problems and resolve them, which takes the company to better quality assurance management and also other profit with better planning.

10) Eliminate numerical goals for the work force. Slogans or exhortations call for more quantity in production than focusing on quality control in manufacturing, which will severely damage the quality management process. Employees should have a calm and quiet quality atmosphere in the company.

11) Eliminate work standards and numerical quotas. This focuses on quantity rather than quality of product.

12) Remove barriers that hinder the hourly worker. Supervisor responsibility must be focused on quality, not numbers. Abolish annual or merit rating and MBO completely.

13) Institute a vigorous program of education and training. A person must grow after joining a company, and letting them learn new technology and techniques will increase employee longevity.
14) Create a situation in top management that will push every day on the above points. Just like products and services, every employee in a company must work to accomplish the transformation.

(B) Joseph J. Juran's Trilogy of Quality Management
In addition to Deming, Juran was another great Founding Father of quality, and was responsible for the famous Juran Trilogy concept. This quality philosophy consists of three steps: **Quality Planning, Quality Control** and **Quality Improvement.**

1) Quality Planning: The quality planning phase is the activity of developing products and processes to meet customers' needs. It deals with setting goals and establishing the means required to reach the goals. Below are the steps in the quality planning process:

- **Establish** quality goals
- **Identify** the customers: those who will be impacted by the efforts to meet the goals
- **Determine** the customer's needs
- **Develop** processes that are able to produce those product features
- **Establish** process controls, and transfer the resulting plans to the operating forces

2) Quality Control: This process deals with the execution of plans and it includes monitoring operations so as to detect differences between actual performance and goals. It is outlined with three steps:

- **Evaluate** actual quality performance
- **Compare** actual performance to quality goals
- **Act** on the difference

3) Quality Improvement: The is the process is for obtaining breakthrough in quality performance, and it consists of several steps:

- **Establish** the infrastructure needed to secure annual quality improvement
- **Identify** the specific needs for improvement- the improvement projects
- **Establish** project teams with clear responsibility for bringing the project to a successful conclusion
- **Provide** the resources, motivation, and training needed by the teams to- diagnose the cause, stimulate establishment of remedies, and establish controls to hold the gains.

(C) Philip Crosby's Zero Defects
Philip Crosby, the Guru of Quality Management, was a legend in the discipline of quality. A noted quality professional, consultant, and author, he is widely recognized for promoting the concept of "zero defects" and for defining quality as conformance to requirements.
Zero defects is a performance standard and method states that if people commit themselves to watching details and avoiding errors, they can move closer to the goal of zero defects.
Zero defects is a way of thinking and doing that reinforces the compliance management notion that defects are not acceptable, and that everyone should "do things right the first time". The idea here is that you can increase profits both by **eliminating the cost of failure** and **increasing revenues through increased customer satisfaction**. Zero defects is NOT about being perfect, it's about changing your perspective, and it does this by demanding that you:

- Recognize the high cost of quality issues.
- Continuously think of the places where flaws may be introduced.

- Work proactively to address the flaws in your systems and processes, which allow defects to occur.

"Zero defects" is not a program, nor does it have distinct steps to follow or rules to abide by: which is perhaps why zero defects can be so effective, as it's adaptable to any situation, business, profession or industry.

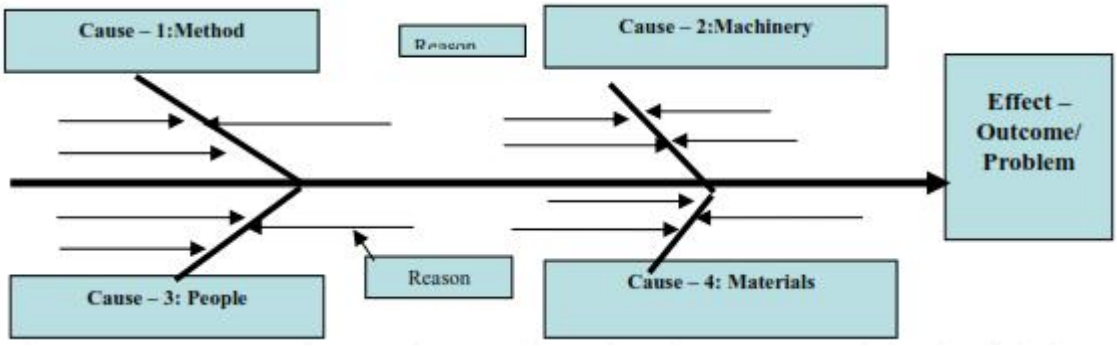
(D) Masaki Imai:

The chairman of the 'Cambridge Corporation' an international management consulting firm, based in Tokyo, brought together the man philosophy theories, and tools as a single concept – **Kaizen.**
'Kaizen' – is a Japanese word means continuous improvement. Three guiding principle he pointed out in Kaizen:

1. Process view of the system
2. Stress comes from people
3. Constant sense of urgency

(E) Kaoru Ishikawa:

Dr. K.Ishikawa was a Japanese quality guru, developed the concept of deployment of quality control circle – small groups of people that meet regularly to plan and carry out process changes to improve quality, productivity and the work environment.
He also developed Ishikawa's cause and effect charts or fish bone diagram.



There are two sets of general categories of main causes used in the fish bone diagrams. **3 Ms and 1P - Method, Machinery, Materials and People**
4Ps – Policies, Procedures, People and Plant
Some key elements of his philosophy are:

1. Quality begins with education and ends with education
2. The first step in quality is to know the requirement of customers
3. The ideal state of Q.C occurs when inspection is no longer necessary.
4. Remove the root causes, not the symptoms
5. Quality control is the responsibility of all workers and all divisions.
6. Do not confuse means with the objectives
7. Put quality first and set your sights long term profits
8. Market is the entrance and exist of quality
9. Top management must not show anger when facts are presented by subordinates
10. 95% problem can solve with problem solving tool.
11. Data without dispersion information (variability) are false data.

(F) Shigeo Shingo:

According to SS, statistical methods detect errors too late in the manufacturing process, what is needed is to identify errors as they happen and to correct or deal with them right away. Shingo

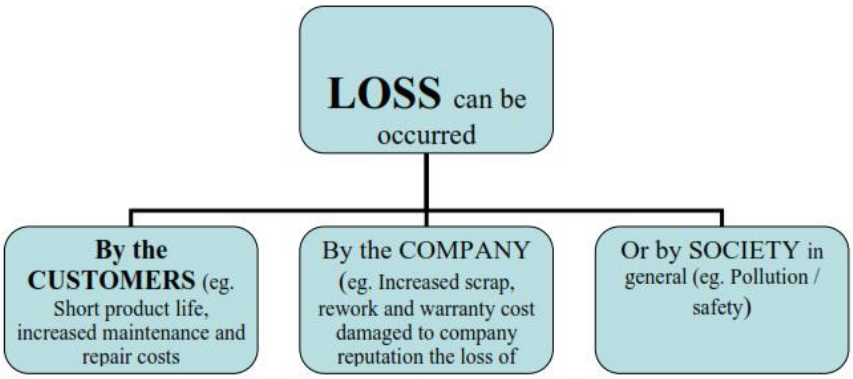
proposed his own version of 'zero – defects'. This is called 'POKA YOKA' in Japanese which means "FOOL PROOFING". The idea is to handle errors as they occur.
Poka Yoka emphases dealing with second logical issues with a relevant technical feedback and control system.
Shingo's ideas have nothing to say about human beings in terms of them as social cultural or political beings.

(G) Genechi Taguchi:
Japanese quality Guru, Genichi Taguchi, Ph.D, believes that:

- To improve quality, one must look up stream at the design stage because that is where quality begins.
- Quality must be designed in, it cannot be inspected later.

Taguchi oriented '**quality engineering**' which is an approach that involves combining engineers and statistical methods to reduce costs and improve quality by optimizing product design and manufacturing processes.
Taguchi methods helps **product designers estimate the true cost of quality** and then cost effectively improve quality.

He developed his **loss function** concept that combines cost, target and variation into one metric. According to him **quality in terms of the social loss, loss to producers and consumers** from the time a product is conceived. The smaller the value of this social loss, the more desirable is the product.



Taguchi quality loss function is a statement that:
'Any deviation from the target value of quality characteristic result in extra costs to some segment of the society'.
Quality loss function is expressed as: L = C (X-T)2 where –
L – Total loss
C – A cost of constant
X – Actual average value of quality characteristics and
T – Target value of quality characteristics

Taguchi's Seven Points: (off line quality control)
Conventionally, quality control activities centre on final inspection sampling or on control charts and process control. This is known as ' on line quality control ' Taguchi pushed the process upstream to focus on product and process design. This is known as **" off line quality control"**
Taguchi's 7 points are as follows:

1. Product quality is measured by the total loss to society created by the product
2. Continuous quality improvement and cost reduction care necessary to survive in world competition.
3. Quality improvement requires continual and repeated reduction of variation.
4. Quality loss is frequently proportional to the square of the deviation of the performance from the nominal value.
5. Product and process design can have an important impact on a product quality and cost.
6. Performance variation can be reduced by suitable adjustment of the products parameters and /or the process parameters.
7. The appropriate parameter settings that reduce variation can be identifying with the appropriate statistically designed experiments.

Philosophical Comparison of Gurus in TQM:

GURU	Definitions of Quality	Emphasis	Dominant factor
Deming	Customer – led	Process	Control of Variation,
Juran	Customer –led	People & Process	Fitness for purpose / use
Crosby	Supply – led	Performance & process	Conformance to requirements
Ishikawa	Value – led	People & process	Company wide quality control
Taguchi	Supply – led	Proceess / Design	Quality loss function

PDCA Cycle

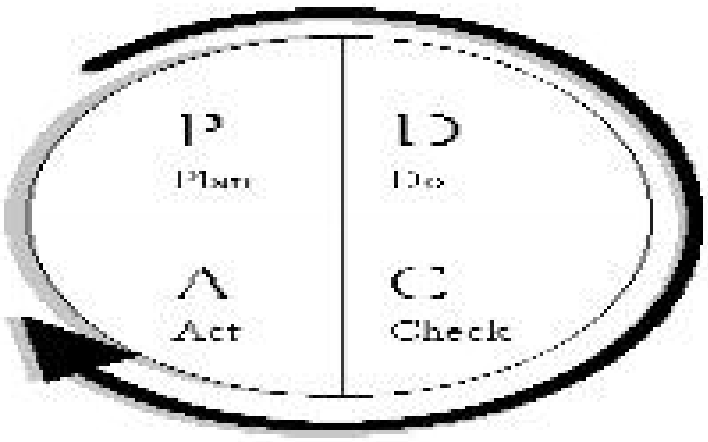
Deming's wheel / PDCA cycle is a problem solving tools adopted by firms engaged in continuous improvements. This cycle consists following steps:

P: Plan- The team select a process that need improvement, documents the selected processes sets qualitative goals. After assessing the benefits and the costs of the alternatives, the team develops a plan with quantifiable measures for improvement.

D: Do – Implement the plan – monitor the progress. Data are collected continuously to measure improvement in the process.

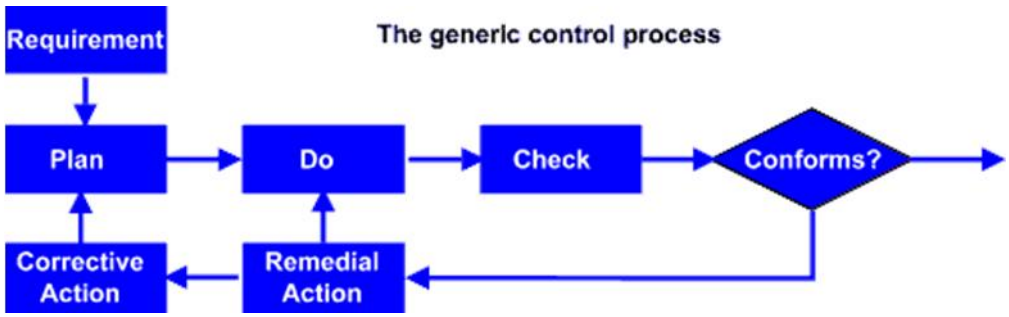
C: Check – Analyze the data collected in do step, find out how closely the results cover ponds to the goals in the plan step.

A: Act – It result is successful, the team documents the revised process for standard.



Quality Control

The ISO definition states that q*uality control* is the operational techniques and activities that are used to fulfil requirements for quality. This definition could imply that any activity whether serving the improvement, control, management or assurance of quality could be a quality control activity. What the definition fails to tell us is that controls regulate performance. They prevent change and when applied to quality regulate quality performance and prevent undesirable changes in the quality standards. Quality control is a process for maintaining standards and not for creating them. Standards are maintained through a process of selection, measurement and correction of work, so that only those products or services which emerge from the process meet the standards. In simple terms quality control prevents undesirable changes being present in the quality of the product or service being supplied. The simplest form of quality control is illustrated in the Figure below. Quality control can be applied to particular products, to processes which produce the products or to the output of the whole organization by measuring the overall quality performance of the organization.



Quality control is often regarded as a post event activity, that is, a means of detecting whether quality has been achieved and taking action to correct any deficiencies. However, one can control results by installing sensors before, during or after the results are created. It all depends on where you install the sensor, what you measure and the consequences of failure. Some failures cannot be allowed to occur and so must be prevented from happening through rigorous planning and design. Other failures are not so critical but must be corrected immediately using automatic controls or fool proofing. Where the consequences are less severe or where other types of sensor are not practical or possible, human inspection and test can be used as a means of detecting failure. Where failure cannot be measured without observing trends over longer periods, one can use information controls. They do not stop immediate operations but may well be used to stop further operations

when limits are exceeded. If you have no controls then quality products are produced by chance and not design. The more controls you install the more certain you are of producing products of consistent quality but there is balance to be achieved. Beware of the law of diminishing returns.
It is often deemed that quality assurance serves prevention and quality control detection, but a control installed to detect failure before it occurs serves prevention such as reducing the tolerance band to well within the specification limits. So quality control can prevent failure. Assurance is the result of an examination whereas control produces the result. Quality Assurance does not change the product, Quality Control does.
Quality Control is also a term used as a name of a department. In most cases Quality Control Departments perform inspection and test activities and the name derives from the authority that such departments have been given. They sort good products from bad products and authorize the release of the good products. It is also common to find that Quality Control Departments perform supplier control activities which are called Supplier Quality Assurance or Vendor Control. In this respect they are authorized to release products from suppliers into the organization either from the supplier's premises or on receipt in the organization.
Since to control anything requires the ability to effect change, the title Quality Control Department is in fact a misuse of the term since such departments do not in fact control quality. They do act as a regulator if given the authority to stop release of product, but this is control of supply and not of quality. Authority to change product usually remains in the hands of the producing departments. It is interesting to note that similar activities within a Design Department are not called quality control but Design Assurance or some similar term. Quality Control has for decades been a term applied primarily in the manufacturing areas of an organization and hence it is difficult to change peoples perceptions after so many years of the terms incorrect use.
In recent times the inspection and test activities have been transferred into the production departments of organizations, sometimes retaining the labels and sometimes reverting to the inspection and test labels.
Control of quality, or anything else for that matter, can be accomplished by the following steps:

- Determine what parameter is to be controlled.
- Establish its criticality and whether you need to control before, during or after results are produced.
- Establish a specification for the parameter to be controlled which provides limits of acceptability and units of measure.
- Produce plans for control which specify the means by which the characteristics will be achieved and variation detected and removed.
- Organize resources to implement the plans for quality control.
- Install a sensor at an appropriate point in the process to sense variance from specification.
- Collect and transmit data to a place for analysis.
- Verify the results and diagnose the cause of variance.
- Propose remedies and decide on the action needed to restore the status quo.
- Take the agreed action and check that the variance has been corrected.

Part – II of II

Total Quality Management – Definition and Concept

Total Quality Management (TQM) is a management approach focusing on the improvement of quality and performance in all functions, departments, and processes across the company to provide quality services which exceed customer expectations.

TQM expands the scope of quality of every department from top management to lower level employees. It enables management to adopt a strategic approach to quality and put more effort on prevention rather than on inspection.

Through TQM, all employees are trained in a professional manner and encouraged to make decisions on their own to improve the overall quality and attain higher standards. This is key to achieving the TQM results desired, because without your employees on board and feeling empowered, you might as well be swimming upstream.

Through TQM, companies increase customer satisfaction, reduce costs, and foster team work. Companies can also gain higher returns on sales and investment. The ability to provide quality services allow for higher prices to be charged. Total quality means better access to global markets, greater customer loyalty, wider recognition as a quality brand, etc.

Principles of Total Quality Management

Total Quality Management is broadly based on the following principles:

1. **Customer Centric Approach** – Consumers are the ultimate judge to determine whether products or services are of superior quality or not. No matter how many resources are pooled in training employees, upgrading machines and computers, incorporating quality design process and standards, bringing new technology, etc.; at the end of the day, it is the customers who have the final say in judging your company. Companies must remember to implement TQM across all fronts keeping in mind the customers.
2. **Employee Involvement** – Ensuring total employee involvement in achieving goals and business objectives will lead to employee empowerment and active participation from the employees in decision making and addressing quality related problems. Employee empowerment and involvement can be increased by making the workspace more open and devoid of fear.
3. **Continual Improvement** – A major component of TQM is continual improvement. Continual improvement will lead to improved and higher quality processes. Continual improvement will ensure companies will find new ways and techniques in producing better quality products, production, be more competitive, as well as exceed customer expectations.
4. **Strategic Approach to Improvement** – Businesses must adopt a strategic approach towards quality improvement to achieve their goals, vision, and mission. A strategic plan is very necessary to ensure quality becomes the core aspect of all business processes.
5. **Integrated System** – Businesses comprise of various departments with different functionality purposes. These functionalities are interconnected with various horizontal processes TQM focuses on. Everyone in the company should have a thorough understanding of the quality policies, standards, objectives, and important processes. It is very important to promote a quality work culture as it helps to achieve excellence and surpass customer expectations. An integrated system ensures continual improvement and helps companies achieve a competitive edge.

6. **Decision Making** – Data from the performance measurement of processes indicates the current health of the company. For efficient TQM, companies must collect and analyze data to improve quality, decision making accuracy, and forecasts. The decision making must be statistically and situational based in order to avoid any room for emotional based decisions.
7. **Communications** – Communication plays a crucial role in TQM as it helps to motivate employees and improve their morale during routine daily operations. Employees need to be involved as much as possible in the day to day operations and decision making process to really give them a sense of empowerment. This creates the environment of success and unity and helps drive the results the TQM process can achieve.

It requires immense efforts, time, courage, and patience to successfully implement TQM. Businesses successfully implementing TQM can witness improved quality across all major processes and departments, higher customer retention, higher revenue due to improved sales, and global brand recognition.

Assumptions of Total Quality Management

When you implement total quality management, you implement a concept. It is not a system that can be implemented but a line of reasoning that must be incorporated into the organization and its culture.

Practice has proved that there are a number of basic assumptions that contribute to a successful roll-out of total quality management within an organization.

The basic assumptions are:

- Train senior management on total quality management principles and ask for their commitment with respect to its roll-out.
- Assess the current culture, customer satisfaction and the quality system.;
- Senior management determines the desired core values and principles and communicates this within the organization.
- Develop a basic total quality management plan using the basic starting principles mentioned above.
- Identify and prioritize customer needs and the market and determine the organization's products and services to meet those needs.
- Determine the critical processes that can make a substantial contribution to the products and services.
- Create teams that can work on process improvement for example quality circles.
- Managers support these teams using planning, resources, and by providing time training.
- Management integrates the desired changes for improvement in daily processes. After the implementation of improved processes, standardization takes place.;
- Evaluate progress continuously and adjust the planning or other issues if necessary.
- Stimulate employee involvement. Awareness and feedback lead to an overall improvement of the entire process. Support this for example by means of a reward model, i.e. Management by Objectives, and recognition.

Customer Satisfaction

Business always starts and closes with customers and hence the customers must be treated as the King of the market. All the business enhancements, profit, status, image etc. of the organization depends on customers. Hence it is important for all the organizations to meet all the customers' expectations and identify that they are satisfied customer.

Customer satisfaction is the measure of how the needs and responses are collaborated and delivered to excel customer expectation. It can only be attained if the customer has an overall good relationship with the supplier. In today's competitive business marketplace, customer satisfaction is an important performance exponent and basic differentiator of business strategies. Hence, the more is customer satisfaction; more is the business and the bonding with customer.

Customer satisfaction is a part of customer's experience that exposes a supplier's behavior on customer's expectation. It also depends on how efficiently it is managed and how promptly services are provided. This satisfaction could be related to various business aspects like marketing, product manufacturing, engineering, quality of products and services, responses customer's problems and queries, completion of project, post delivery services, complaint management etc.
Customer satisfaction is the overall essence of the impression about the supplier by the customers. This impression which a customer makes regarding supplier is the sum total of all the process he goes through, right from communicating supplier before doing any marketing to post delivery options and services and managing queries or complaints post delivery. During this process the customer comes across working environment of various departments and the type of strategies involved in the organization. This helps the customer to make strong opinion about the supplier which finally results in satisfaction or dissatisfaction.
Customer's perception on supplier helps the customer choose among the supplier on basis of money value and how well the delivered products suit all the requirements. The supplier's services never diminishes after the delivery as customer seeks high values post marketing services which could help them use and customize the delivered product more efficiently. If he is satisfied with the post marketing services then there are good chances for supplier to retain the customers to enhance repeated purchases and make good business profits.

It is necessarily required for an organization to interact and communicate with customers on a regular basis to increase customer satisfaction. In these interactions and communications it is required to learn and determine all individual customer needs and respond accordingly. Even if the products are identical in competing markets, satisfaction provides high retention rates. For example, shoppers and retailers are engaged with frequent shopping and credit cards to gain customer satisfaction, many high end retailers also provide membership cards and discount benefits on those cards so that the customer remain loyal to them.
Higher the satisfaction level, higher is the sentimental attachment of customers with the specific brand of product and also with the supplier. This helps in making a strong and healthy customer-supplier bonding. This bonding forces the customer to be tied up with that particular supplier and chances of defection very less. Hence customer satisfaction is very important panorama that every supplier should focus on to establish a renounced position in the global market and enhance business and profit.

Measuring Customer Satisfaction
For improving customer satisfaction it is essential for the supplier to measure it. It is purely believed that if anything is not measurable then it is not authentic. Customers are the most important asset for any organization as they are only responsible to drives the business. Measuring customer satisfaction helps in identifying specific customer information which is needed to run business smoothly.
Following are the information and details that could be generated after measuring customers' satisfaction:

1. **Business Related:** Measuring customer satisfaction helps an organization to identify the efficiency of its business strategies and marketing tactics and encompasses if the

organization is customer focused or not. It also provides analyzed details on how many numbers of customers have defected, how much loss the business has incurred and up to what extent the profit is decayed due to customer defect. A customer is usually dissatisfied when his expectations are not met or the commitments from supplier are not fulfilled reasonably and within the given time span. This becomes a serious issue for the customers as the delay will obvious affect their image too. The customer usually shares these problems and issues with other customers which hiders the business of the supplier. Some of these unsatisfied customers launch complaints but most of the other customers simply defect to other suppliers without even informing which creates a big void in the business processes of supplier because they did not get chance to analyze the reasons of customer defection. Loss of customers is directly proportionate to loss of business and profitability. If an organization is able to measure business related aspects of customer satisfaction then they become capable to bridge the gaps between them and customers to enhance more customer satisfaction among their peer customers.

2. **Customer Related:** By measuring customer related aspects of customer satisfaction following details can be entailed:
    a. How many total numbers of customers have defected?
    b. Specifically which customers have been defected?
    c. Reason why they have defected and where exactly they have defected?
    d. Measurement of customer satisfaction always helps a supplier to analyze appropriate reasons of lost of customers and take measures to avoid this. It also provides analyzed information about the business loss in the coming future. This actually helps the supplier to be profitable because cost involved in acquiring a customer is comparatively higher then the cost involved in retaining an existing customer.
    e. It also helps the supplier to identify the value of their products and services according to the customers' perception. If customer is dissatisfied with products and services then there is a need for supplier to check the performance and quality of the product and services so that other customers could not complaint regarding the same.
    f. It can also analyze the exact need and requirement of customer so that measures are taken accordingly to satisfy each and every customer.
3. **Suppliers Related:** Following are the supplier's specific information that could be generated while measuring customer satisfaction:
    a. It helps the supplier to conclude about his own image, strength and weak points.
    b. It helps the supplier to identify his area of perfection and competency so that they flourish in monopoly of specific products and services.
    c. It helps in encompassing the organization's position according to the benchmark possessed in the market by competitors.

The best way to improve customer satisfaction is to first measure it and then apply methods to enhance it. It helps the supplier to always keep a check on allover business processes by identifying strong and weak aspects and creating strong bond with all their customers to enhance business.

Methods of Measuring Customer Satisfaction

Managing customers' satisfaction efficiently is one the biggest challenge an organization face. The tools or methods to measure customer satisfaction needs to be defined sophisticatedly to fulfill the desired norms.

Following **methods to measure customer satisfaction:**

1. **Direct Methods:** Directly contacting customers and getting their valuable feedback is very important. Following are some of the ways by which customers could be directly tabbed:
    a. Getting customer feedback through third party agencies.
    b. Direct marketing, in-house call centers, complaint handling department could be treated as first point of contact for getting customer feedback. These feedbacks are compiled to analyze customers' perception.
    c. Getting customer feedback through face to face conversation or meeting.
    d. Feedback through complaint or appreciation letter.
    e. Direct customer feedback through surveys and questionnaires.

    Organizations mostly employ external agencies to listen to their customers and provide dedicated feedback to them. These feedbacks needs to be sophisticated and in structured format so that conclusive results could be fetched out. Face to face meetings and complaint or appreciation letter engages immediate issues. The feedback received in this is not uniformed as different types of customers are addressed with different domains of questions. This hiders the analysis process to be performed accurately and consistently. Hence the best way is to implement a proper survey which consists of uniformed questionnaire to get customer feedback from well segmented customers. The design of the prepared questionnaire is an important aspect and should enclose all the essential factors of business. The questions asked should be in a way that the customer is encouraged to respond in a obvious way/. These feedback could received by the organizations can be treated as one of the best way to measure customer satisfaction.

    Apart from the above methods there is another very popular direct method which is surprise market visit. By this, information regarding different segment of products and services provided to the customers could be obtained in an efficient manner. It becomes easy for the supplier to know the weak and strong aspects of products and services.
2. **Indirect Method:** The major drawback of direct methods is that it turns out to be very costly and requires a lot of pre compiled preparations to implement. For getting the valuable feedbacks the supplier totally depends on the customer due to which they looses options and chances to take corrective measure at correct time. Hence there are other following indirect methods of getting feedback regarding customer satisfaction:
    a. **Customer Complaints:** Customer's complaints are the issues and problems reported by the customer to supplier with regards to any specific product or related service. These complaints can be classified under different segments according to the severity and department. If the complaints under a particular segment go high in a specific period of time then the performance of the organization is degrading in that specific area or segment. But if the complaints diminish in a specific period of time then that means the organization is performing well and customer satisfaction level is also higher.
    b. **Customer Loyalty:** It is necessarily required for an organization to interact and communicate with customers on a regular basis to increase customer loyalty. In these interactions and communications it is required to learn and determine all individual customer needs and respond accordingly. A customer is said to be loyal if he revisits supplier on regular basis for purchases. These loyal customers are the satisfied ones and hence they are bounded with a relationship with the supplier. Hence by obtaining the customer loyalty index, suppliers can indirectly measure customer satisfaction.

Factors Affecting Customer Satisfaction

Customer satisfaction is the overall impression of customer about the supplier and the products and services delivered by the supplier. **Following are the important factors that could affect customer satisfaction:**

- Departmentwise capability of the supplier.
- Technological and engineering or re-engineering aspects of products and services.
- Type and quality of response provided by the supplier.
- Supplier's capability to commit on deadlines and how efficiently they are met.
- Customer service provided by the supplier.
- Complaint management.
- Cost, quality, performance and efficiency of the product.
- Supplier's personal facets like etiquettes and friendliness.
- Supplier's ability to manage whole customer life cycle.
- Compatible and hassle free functions and operations.

The above factors could be widely classified under two categories i.e. suppliers behavior and performance of product and services. The supplier's behavior mostly depends on the behavior of its senior subordinates, managers and internal employees. All the functional activities like customer response, direct product and maintenance services, complaint management etc. are the factors that rely on how skillful and trained the internal and human resources of the supplier are. The second category is regarding all the products and services. This depends on the capability of supplier to how to nurture the products and service efficiently and how skilled the employees are. It's all about how the skills are implemented to demonstrate engineering, re-engineering and technological aspects of the products and services. The quality and efficaciousness of the products is also an important factor that enables compatible and hassle free functions and operations. This bears to lower maintenance and higher life of the product which is highly admired by the customers.

If the product is having some problem or compatibility issues and requires frequent maintenance and support than the customers could get irritated and possibilities of sudden divert is there which lead to supplier's financial loss. In the same way if the product is expecting huge amount of financial and manual resources then customers could get a feeling of dissatisfaction and worry. However, if these aspects are handled efficiently by giving class services and dealing with complaints effectively then dissatisfied customers could be converted into long time satisfied customers and retaining them becomes easy.

It is practically impossible for the supplier to provide all the above explained features. There are always some positive as well as negative features in products and services which could lead to delight or irritate customers. The final opinion is the sum of overall experiences which a customer percept. But it is also true that more the positive aspects, the more the customer is satisfied. Hence the aim of the supplier should be always to enhance these positive feelings among all the customers to increase customer satisfaction. The supplier must identify how to enhance these positive aspects to maximum level by analyzing the customer's data and information using CRM system. The individual liking and disliking of customers differ from customer to customer. It is hence required to target a customer and identify individual requirement to make them satisfied.

Having discussed the above factors that affect customer satisfaction we can say that higher the satisfaction level, higher is the sentimental attachment of customers with the specific brand of product and also with the supplier. This helps in making a strong and healthy customer-supplier bonding. This bonding forces the customer to be tied up with that particular supplier and chances of defection are very less. Hence customer satisfaction is very important panorama that every supplier should focus on to establish a renounced position in the global market and enhance business and profit.

House of Quality

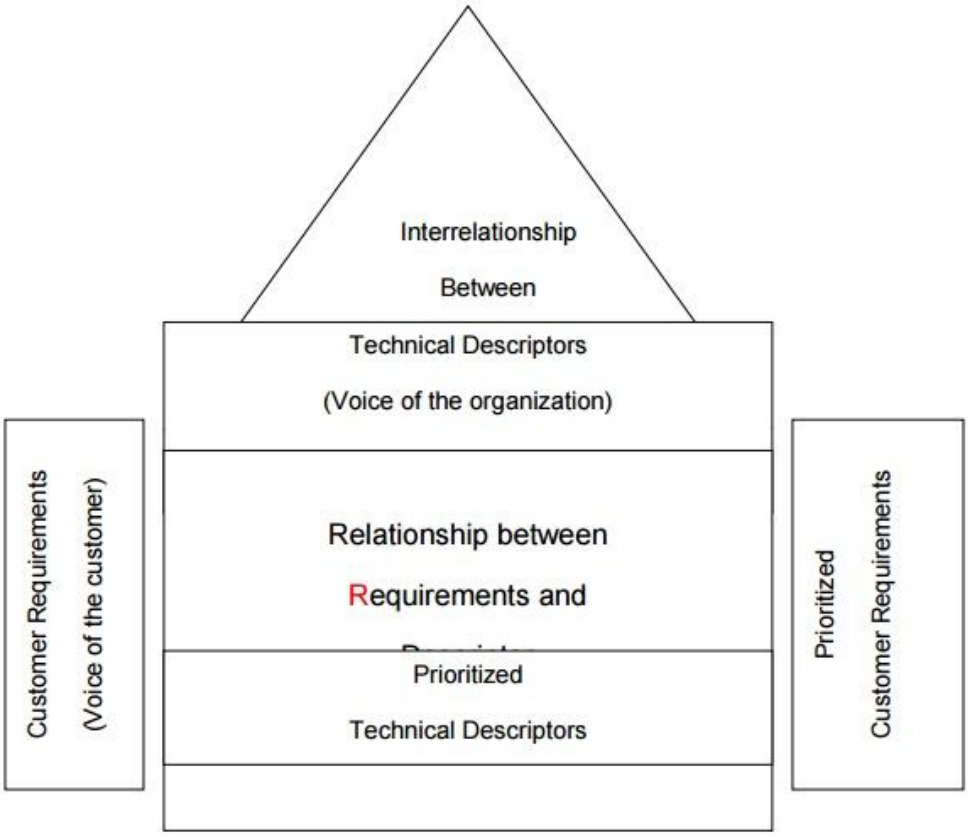
The primary planning tool used in QFD is the house of quality. The house of quality converts the voice of the customer into product design characteristics. QFD uses a series of matrix diagrams, also called "quality tables", resembles connected houses.

Basic structure of House of Quality:

1. Customer requirements
2. Prioritized customer requirements
3. Technical descriptors
4. Relationship matrix
5. Prioritized technical descriptors
6. Competitive assessments
7. Develop a relationship matrix between WHATS AND HOWS

Constructing the House of Quality:

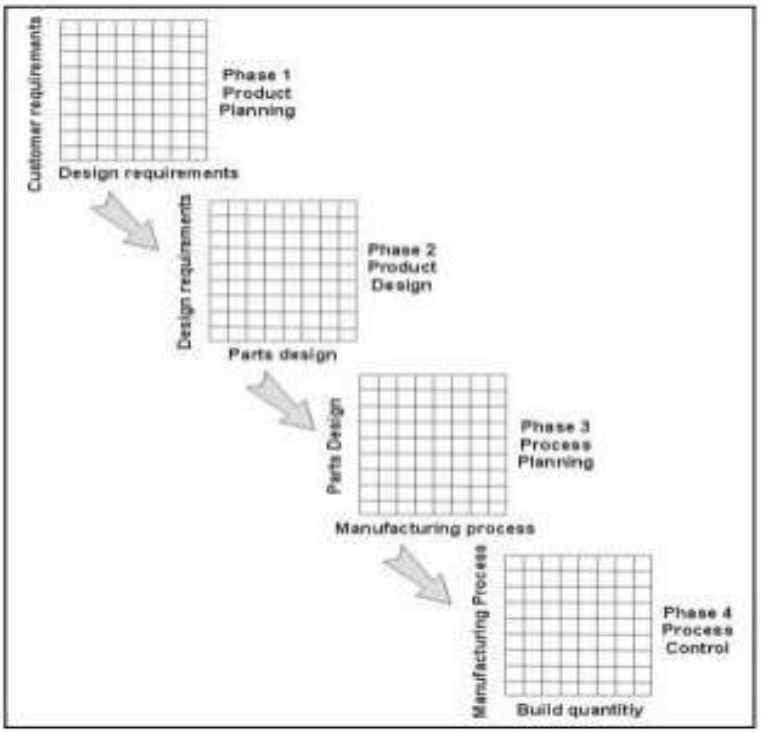
Step1: List customer requirements
Step2: List technical descriptors
Step3: Develop a relationship matrix between HOWS
Step4: competitive assessments
Step5: Develop prioritized customer requirements
Step6: Develop prioritized technical descriptors



Steps in Building House of Quality

1. List Customer Requirements (WHATs)

2. List Technical Descriptors (HOWs)
3. Develop a Relationship Matrix Between WHATs and HOWs
4. Develop an Inter-relationship Matrix between HOWs
5. Competitive Assessments
   a. Customer Competitive Assessments
   b. Technical Competitive Assessments
6. Develop Prioritized Customer Requirements
7. Develop Prioritized Technical Descriptors



Phase 1, *Product Planning:* Building the House of Quality. Led by the marketing department, Phase 1, or product planning, is also called The House of Quality.
Phase 1 documents customer requirements, warranty data, competitive opportunities, product measurements, competing product measures, and the technical ability of the organization to meet each customer requirement.
Getting good data from the customer in Phase 1 is critical to the success of the entire QFD process.

Phase 2, ***Product Design:*** This phase 2 is led by the engineering department. Product design requires creativity and innovative team ideas. Product concepts are created during this phase and part specifications are documented. Parts that are determined to be most important to meeting customer needs are then deployed into process planning, or Phase 3.

Phase 3, *Process Planning:* Process planning comes next and is led by manufacturing engineering. During process planning, manufacturing processes are flowcharted and process parameters (or target values) are documented.

Phase 4, *Process Control*: And finally, in production planning, performance indicators are created to monitor the production process, maintenance schedules, and skills training for operators. Also,

in this phase decisions are made as to which process poses the most risk and controls are put in place to prevent failures.

Quality Function Deployment

A key to improving quality through TQM is linking the design of products or services to the processes that produce them. Quality Function Deployment (QFD) is a means of translating customer requirements into appropriate technical requirements for each stage of product or service development and production. Bridgestone Tire and Mitsubishi Heavy Industries originated QFD in late 1960s adn early 1970s when they used quality charts that take customer requirements into account in the product design process.

In 1978 Yoji Akao and Shigeru Mizuno published the first work on this subject, showing how design considerations could be "deployed" to every element of competition. The core of this approach is a chart called **House of quality**, which is a conceptual map for inter-functional planning and communications. See the following chart that shows a house of quality chart for improving the quality of a car door.

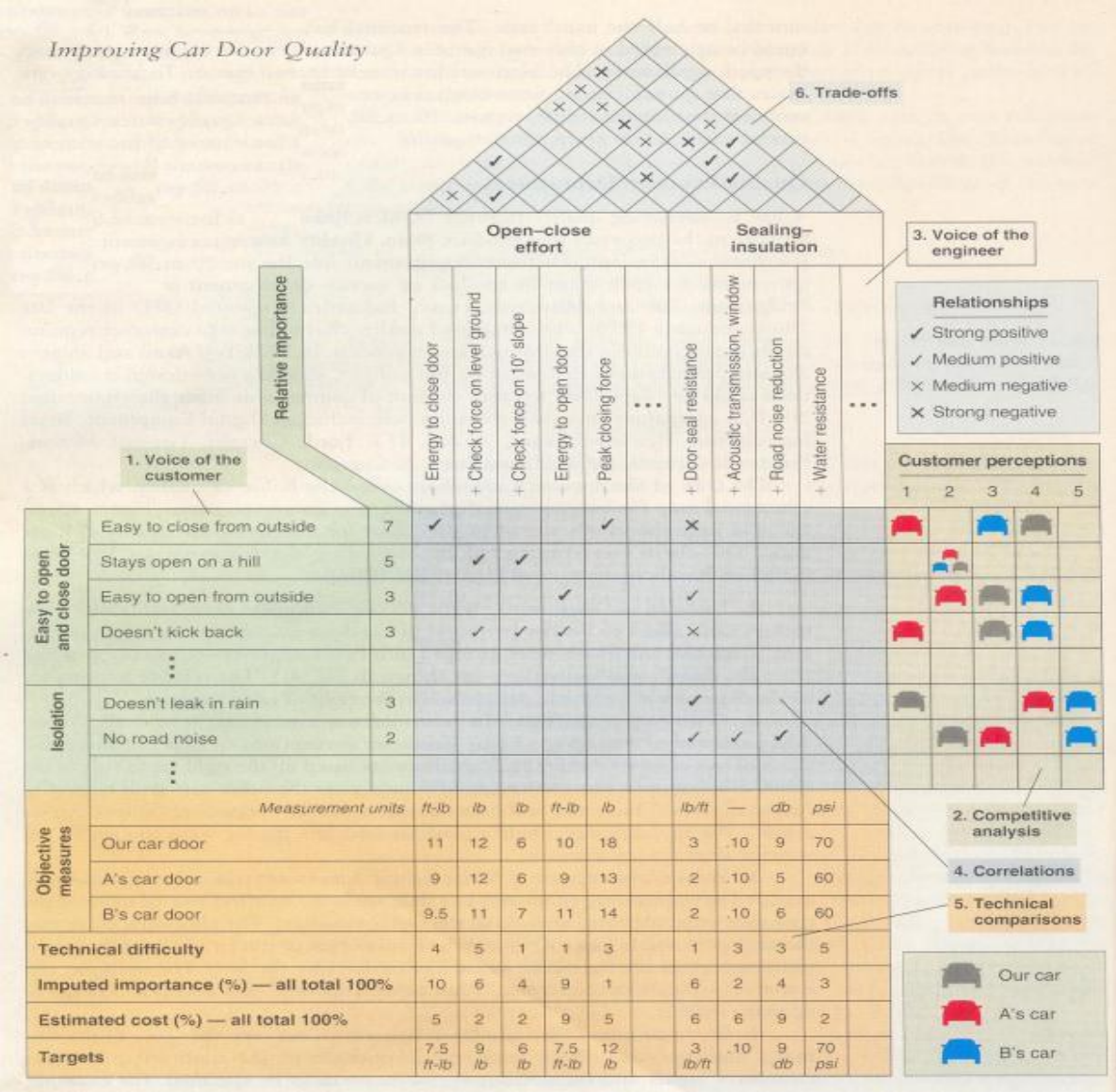
The below given chart was constructed by answering the following six questions:

1. ***Voice of customer:*** What do our customer need and want? Customers were asked to list attributes of car-door quality they felt were important. Customer attributes were grouped into two categories-"easy to open and close the door" and "isolation"-as shown in the above chart. The relative importance to the customer is listed as a percentage to the right of each attribute.
2. ***Competitive analysis:*** In terms of our customer, who well we are doing relative to our competitors? Customer perceptions of our car doors and those of our competitors for each attribute are listed on the right-hand side of the chart. For example, our car has an advantage over the other cars with respect to "no road noise," but nine of the cars has advantage regarding "stay open on a hill." The evaluations provide a place to start looking for ways to gain an advantage over the competition.
3. ***Voice of the engineer:*** What technical measures relate to our customers' needs? The engineering characteristics that are likely to affect one or more of the customer attributes are listed along the top of the chart. The plus sign means that the engineers would like to increase the level that characteristic, and the minus sign mean that engineers would like to decrease the level. For example, our engineers would like to decrease the level. For example, our engineers would like to increase "road noise reduction" and decrease "energy to open the door."
4. ***Correlation:*** What are the relationships between the voice of the customer and the voice of the engineer? The nature of the relationship between customers' needs ad engineering attributes needs to be specified. For example, reducing the amount of energy required to close the door will make closing the door easier, but increasing the door seal resistance will make closing the door more difficult.
5. ***Technical Comparison:*** How does our product or service performance compare to that of our competition? Comparing our door with those of the competition for each engineering characteristics allows the technical difficulty of working on each one to be assessed. For example, our door requires the greatest energy to close (11 ft-lb) and the greatest peak closing force (18 lb). A scale of 1 to 5 (where a rating of 5 means most difficult) conveys the relative technical difficult of improving each dimension. In addition, the importance of each characteristic in responding to customer concern can be assessed. For example, "easy to close the door from outside" has high relative importance to customers and has a strong positive relationship with "reducing the energy to close the door" receives the highest

imputed importance (10 % points) of all the engineering characteristics. Estimated costs, again expressed as percentages, indicate relative importance. Finally, in this step targets are assigned for the various engineering characteristics. Note that reducing the "energy to close the door" from 11 ft-lb to 7.5 ft-lb makes our car very competitive with the other cars. Other targets for the "open-close effort" category also were changed to improve the door.

6. ***Trade-offs:*** What are the potential technical trade-offs? Note that no changes were targeted in the current measures of engineering characteristics relating to the category "sealing insulation." The reason is that those engineering characteristics and the ones included in the "open-close effort" category have some strongly negative relationships. These relationships are depicted at the top of the chart. For example, though "increasing road noise reduction" would have a strong positive impact on "no road noise," it would have strong negative impact on "reducing the peak closing force" and "reducing energy to close the door." Because customers gave a low priority to "no road noise," no adjustment were made to "increasing road noise reduction.

The house of quality method provides a way to set targets and debate their effects on product quality. Engineering uses the data to focus on significant product deisgn features. Marketing uses this input for determining marketing strategies. Operations uses the chart to identify the processes that are crucial to improving product quality in the eyes of the customer. As a result, the house of quality encourages inter-functional communication for the purpose of improving the quality of products and services.



QFD Team

There are two types of teams namely

1. Team for designing a new product
2. Team for improving an existing product

Benefits of QFD

1. Improves Customer satisfaction
   - Creates focus on customer requirements
   - Uses competitive information effectively
   - Prioritizes resources
   - Identifies items that can be acted upon

2. Reduces Implementation Time
   - Decreases midstream design changes
   - Limits post introduction problems

- Avoids future development redundancies

3. Promotes Team Work
   - Based on consensus
   - Creates communication
   - Identifies actions

4. Provides Documentation
   - Documents rationale for design
   - Adds structure to the information
   - Adapts to changes (a living document)

Significance of QFD

- QFD "is a method for developing a design quality aimed at satisfying the consumer and then translating the consumer's demand into design targets and major quality assurance points to be used throughout the production phase. ..."
- QFD is a way to assure the design quality while the product is still in the design stage.
- Quality Function Deployment is a planning tool used to fulfill customer expectations.
- Quality Function Deployment focuses on customer expectations or requirements, often referred to as Voice of the customer.

Quality Circles

Definition: Perhaps the most widely discussed and undertaken intervention of employee involvement is the quality circle (QC). The concept of QC originally began in the United States and was exported to Japan in the 1950s. It is mentioned that it is the concept of QC that enabled Japanese firms to make high quality products at low costs.

What is quality circle? It is a work group of employees who meet regularly to discuss their quality problems, investigate causes, recommend solutions, and take corrective actions. Generally, QC is a small group of employees belonging to the same similar work area.

This is so because the employees doing the similar type of work are well familiar to problems faced by them. The size of the QC should not be too big so as to prevent some members from participating meaningfully in its meetings. Generally, six to eight members are considered the ideal size of the QC.

Objectives of Quality Circles

1. Improvement in quality of product manufactured by the organization.
2. Improvement in methods of production.
3. Development of employees participating in QC.
4. Promoting morale of employees.
5. Respect humanity and create a happy work place worthwhile to work.

Features of Quality Circles

The main features of Quality circles are as discussed below:

1. Voluntary Groups: QC is a voluntary group of employees generally coming from the same work area. There is no pressure from anywhere on employees to join QC.

2. Small Size: The size of the QC is generally small consisting of six to eight members.

3. Regular Meeting: QC meetings are held once a week for about an hour on regular basis. The members meet during working hours usually at the end of the working day in consultation with

the manager. The time of the meetings is usually fixed in advance in consultation with the manager and members.

4. Independent Agenda: Each QC has its own agenda with its own terms of reference. Accordingly, each QC discusses its own problems and takes corrective actions.

5. Quality Focused: As per the very nature and intent of QC, it focuses exclusively on quality issues. This is because the ultimate purpose of QC is improvement in quality of product and working life.

Developing Quality Circles in Organizations

Like any other organizational change, QC being a new concept may be opposed by the employees. Therefore, QC should be developed and introduced with great concern and precaution as discussed below:

1. Publicizing the Idea: Introduction of QC is just like an organizational change programme Hence, like an organizational change programme, the workers need to be convinced about the need for and significance of QC from the points of view of the workers and the organization. Moreover, participation in QC being voluntary, its publicity among the workers is necessary. To begin with, management can also arrange for initial training to those workers who want to form a quality circle.

2. Constitution of QC: Workers doing the same or similar type of work are drawn voluntarily to form quality circle. The membership of a QC is generally restricted to eight to ten. Once a QC is formed, they remain as permanent members of the circle unless they leave that work area.

3. Initial Problem Solving: The members of QC should discuss the problem at threadbare and, then, prepare a list of alternative solutions. Thereafter, each alternative solution should be evaluated and the final solution should be arrived at on the basis of consensus.

4. Presentation and Approval of Suggestions: The final solution arrived at should be presented to the management either in oral or in written form. The management may evaluate the solution by constituting a committee for this purpose. The committee may also meet the members of the quality circle for clarifications, if required. Presentation of solutions to the management helps improve the communication between management and workers and reflects management's interest to the members of QC.

5. Implementation: Once the suggestion or solution is approved by the management, the same is being put into practice in a particular workplace. Quality circles may be organized gradually for other workplaces or departments also. In this way, following above outlined process, the entire organization can have quality circles.