

MODULE – 1

PRINCIPLES AND PRACTICE

Syllabus:

Principles and Practice: Definition, basic approach, gurus of TQM, TQM Framework, awareness, defining Quality, historical review, obstacles, benefits of TQM.

Quality Management Systems: Introduction, benefits of ISO registration, ISO 9000 series of standards, ISO 9001 requirements.

Definition:

Total Quality Management (TQM) is an enhancement to the traditional way of doing business.

Total - Makeup of the whole

Quality - Degree of excellence a product or service provides

Management - Act, art, or manner of handling, controlling, directing etc.

TQM is an art of managing the whole to achieve excellence. TQM is defined as both a philosophy and a set of benchmarks that represent the foundation of a continuously improving organization. It is an application of quantitative methods and human resources to improve all the processes within an organization and exceed customer needs at present and in the future. TQM integrates fundamental management techniques, existing improvement efforts and technical tools under a disciplined approach.

Basic Approach:

1. A committed and involved management should provide long-term top-to-bottom organizational support.
2. An unwavering focus on customers, both internally and externally.
3. Effective involvement and utilization of the entire work force.
4. Continuous improvement of business and production process.
5. Treating suppliers as partners.
6. Establish performance measures for the processes.

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1. All employees should participate in a quality program. A quality council should be established to develop a clear vision, set long-term goals and direct the program. Quality goals are included in the business plan. An annual quality improvement program involves input from the entire workforce. Managers participate in quality improvement teams and also act as coaches to other teams. TQM is a continual activity and should be entrenched in the culture. It means that it is not just a one-shot program. TQM should be communicated to all people.
2. The key to an effective TQM program is its focus on customers. An excellent place to start is by satisfying internal customers. One should always listen to the “voice of the customer” and emphasize on design quality and defect prevention. Do it right the first time and every time because customer satisfaction is the most important consideration.
3. TQM is an organization wide challenge that is everyone’s responsibility. All personnel should be trained in TQM, statistical process control (SPC) and other appropriate quality improvement skills to effectively participate in project teams. Including internal customers and, for that matter, internal suppliers on project teams are an excellent approach. Those affected by the plan should be involved in its development and implementation. They understand the process better than anyone else. Changing behaviour is the goal. People should come to work not only to do their jobs but also to think about how to improve their jobs. People should be empowered at the lowest possible level to perform processes in an optimum manner.
4. There should be a continual striving to improve all business and production processes. Quality improvement projects such as on-time delivery, order entry efficiency, billing error rate, customer satisfaction, cycle time, scrap reduction and supplier management are good areas to begin. Technical techniques such as SPC, benchmarking, quality function development, ISO 9000 and designed experiments are excellent for problem solving.
5. A partnering relationship rather than an adversarial one should be developed. Both parties have as much to gain or lose based on the success or failure of a product or service. The focus should be on quality and life-cycle costs rather than on price. Suppliers should be few in number so that true partnering can occur.
6. Performance measures such as uptime, percentage of nonconforming, absenteeism and customer satisfaction should be determined for each functional area. These measures should be posted for everyone to see. Quantitative data are necessary to measure the continuous quality improvement activity.

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New and Old Cultures Quality Element	Previous State	TQM
Definition	Product-orientated	Customer-oriented
Priorities	Second to service and cost	First among equals of service and cost
Decisions	Short-term	Long-term
Emphasis	Detection	Prevention
Errors	Operations	System
Responsibility	Quality control	Everyone
Problem Solving	Managers	Teams
Procurement	Price	Life-cycle costs, partnership
Manager's Role	Plan, assign, control and mentor	Delegate, coach facilitate and
enforce		

New and old cultures

Gurus of TQM:

Shewhart: Walter A. Shewhart worked as professional in western electric and bell telephone laboratories. He developed control chart theory with control limits. He wrote a book *Economic Control of Quality of Manufactured Product* on basic principles of quality control. He developed PDSA (Plan-Do-Study-Act) cycle for learning improvement.

Ronald fisher: Fisher is not known as a quality guru. However, he created a solid foundation of statistical methods such as, design of experiments (DOE) and analysis of variance (ANOVA) in the 1930s. DOE is one of the most powerful tools used by many organizations in problem solving and process improvement. Analysis is widely known after being included in his book *Statistical Methods for Research Workers*. Fisher also published *The Design of Experiments* in 1935 and *Statistical Tables* in 1947.

Deming: W. Edwards Deming PhD, in 1950 he taught statistical process control and six importance of quality to the leading CEOs of Japanese industry. He is credited with providing the foundation for the Japanese quality miracle and resurgence as an economic power. Deming is the best-known quality expert to the world. His 14 points provide a theory for management to improve quality, productivity and competitive position. He has authored a number of books including *Out of the Crisis and Quality, Productivity and Competitive Position* as well as 161 scholarly studies.

Juran: Joseph M Juran, PhD worked at Western Electric from 1924 to 1941. There he was exposed to the concepts of in Shewhart. Juran travelled to Japan in 1954 to teach quality management. He emphasized the necessity for management at all levels to be committed to the quality effort with hands on involvement. He recommended project improvements based on return on investment to

achieve breakthrough results. The Juran Trilogy for managing quality is carried out by the three interrelated processes of planning, control and improvement. In 1951 the first edition of Juran's Quality Control Handbook was published.

Feigenbaum: Armand V. Feigenbaum PhD argues that total quality control is necessary to achieve productivity, Market penetration and competitive advantage. Quality begins by identifying the customer's requirements and ends with product or service in the hands of a satisfied customer. In addition to customer satisfaction some of Feigenbaum quality principles are genuine management involvement, employee involvement first-line supervision and company-wide quality control. In 1951 he authored Total Qualm Control.

Ishikawa: Kaoru Ishikawa, PhD, studied under Deming, Juan and Feigenbaum. He borrowed the total quality control concept and adapted it for the Japanese. In addition, he authored SPC texts in Japanese and in English. Ishikawa is best known for the development of the *cause and effect diagram*, which is sometimes called an Ishikawa diagram. He developed the quality circle concept in Japan, whereby work groups, including their supervisor, were trained in SPC concepts. The groups then met to identify and solve quality problems in their work environment.

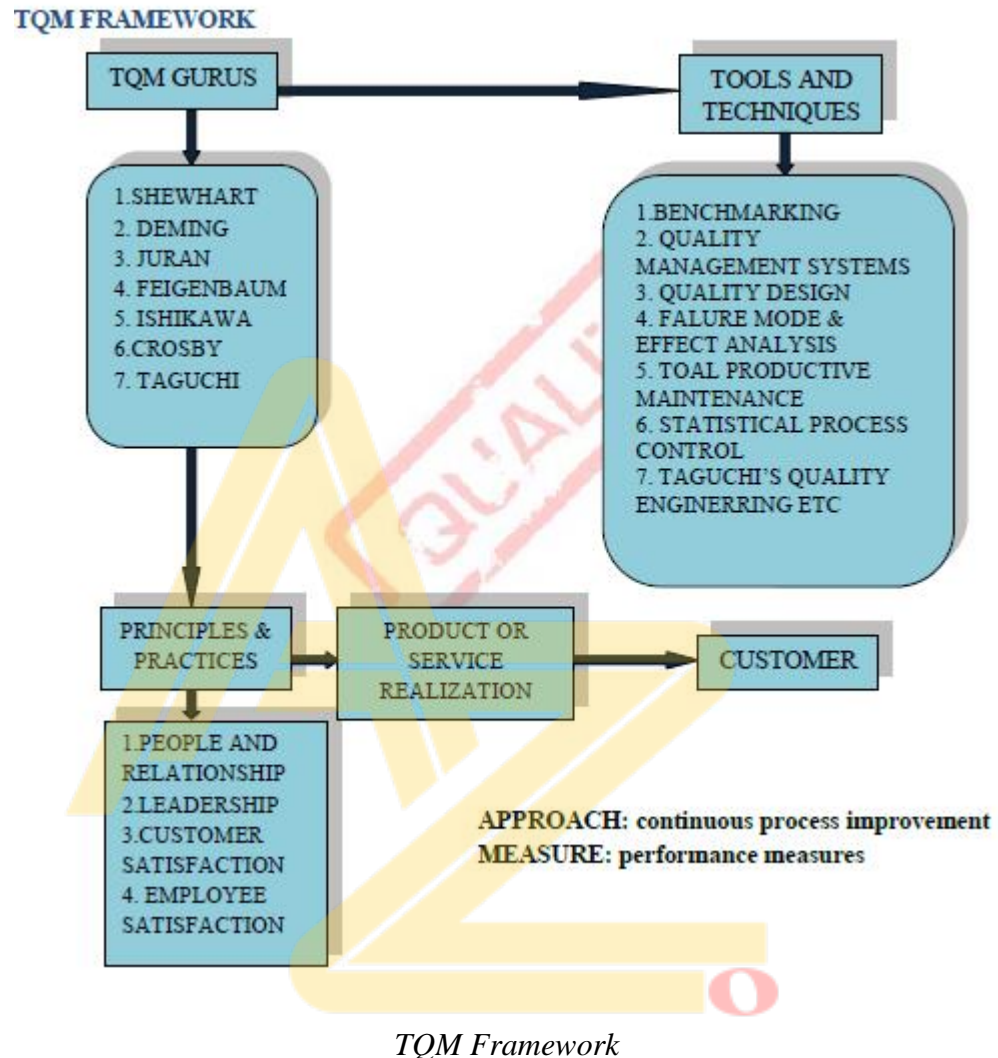
Crosby: Phillip B Crosby authored his first book; *Quality is Free*, in 1979, which was translated into 15 languages. It sold 13 million copies and changed the way management looked at quality. He argued that "doing it right the first time" Is less expensive than the costs of detecting and correcting nonconformities. In 1984, he authored Quality Without Tears, which contained his four absolutes of quality management These absolutes are quality is conformance to requirements, prevention of non-conformance is the objective not appraisal, the performance standard is zero defects not "that's close enough" and the measurement of quality is the cost of non-conformance.

Taguchi: Genichi Taguchi, PhD, developed his loss function concept that combines cost, target and variation into one metric. Because the loss function is reactive, he developed the signal to noise ratio as a proactive equivalent. The cornerstone of Taguchi's philosophy is the robust design of parameters and tolerances. It is built on the simplification and use of traditional design of experiments.

TQM Framework:

Figure shows the framework for a TQM system. It starts with the knowledge provided by quality gurus- Shewhart, Deming, Juran, Feigenbaum, Ishikawa, Crosby and Taguchi. They contributed to the development of principles and practices and the tools and techniques. These tools

and techniques as well as principles and practices are used for improving product service realization. Ultimate aim is satisfy customer needs with continuous process improvement by performance measures of the product or service.



Awareness:

Any organization will not start TQM until it is aware of the fact that the quality of product or service should be improved. Awareness comes when an organization loses market share or realizes that quality and productivity go hand-in-hand. It also occurs if TQM is mandated by a customer or if management realizes that TQM is a better way to run a business and compete in domestic and world markets.

Automation and other productivity enhancements might not help a corporation if it is unable to market its products or services because of their poor quality. Until recently, corporations have not

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recognized the importance of quality. However, a new attitude has emerged--quality first among the equals of cost and service. To sum it up, a customer wants value.

Quality and productivity are not mutually exclusive. An improvement in quality can lead directly to increased productivity and other benefits. Table illustrates this concept. In the table, the improved quality results in a 5.6% improvement in productivity, capacity and profit. Many quality improvement projects are achieved with the same workforce, same overhead and no investment in new equipment. The prevention of product, service and process problems is a more desirable objective than taking corrective action after the product is manufactured or a service rendered.

TQM does not occur overnight. There are no quick remedies. It takes a long time to build an appropriate emphasis and technique into culture. Overemphasis on short-term results and profits should be set aside and long-term planning and constancy should be allowed to prevail.

Gain in Productivity with Improved Quality		
Item	Before improvement 10% nonconforming	After improvement 5% non-conforming
Relative total cost for 20 units	1.00	1.00
Conforming units	18	19
Relative cost for nonconforming units	0.10	0.05
Productivity increase		(100) (1/18)=5.6%
Capability increase		(100) (1/18)=5.6%
Profit increase		(100) (1/18)=5.6%

Gain in productivity with improved quality

Defining Quality:

Quality can be quantified as follows most definitions given to quality refer to 'fitness for use' or 'conformance to requirements'.

$$Q = P / E$$

Q= quality P = performance E = expectations

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The Oxford American Dictionary defines quality as “a degree or level of excellence.”

Each approach to defining quality has strengths in terms of generalizability, ease of measurement and utility. Thus, the “quality as conformance to standards” approach is more relevant in a manufacturing environment than in a high-contact personal service industry and is of great value in emphasizing efficiency and productivity. “Quality as excellence” is seen as particularly valuable as a motivational device in the general call to arms in a quality management campaign.

The 9 dimensions of quality:

Performance

The basic operating characteristic of a product is performance. For example, how well a car handles or its gas mileage.

Features

Features are the “extra” items added to the basic features, such as stereo CD or a leather interior in a car.

Reliability

Reliability is the probability that a product will operate properly within an expected time frame, e.g., a TV without repair for about 7 years.

Conformance

Conformance is the degree to which a product meets pre-established standards.

Durability

Durability tells how long a product lasts, i.e. its life span before replacement.

Serviceability

Serviceability is the ease of getting repairs, the speed of repairs, and the courtesy and competence of the repair person.

Aesthetics

Aesthetics tells how a product looks, feels, sounds, smells or tastes.

Response

Human – to – human interface, such as the courtesy of the dealer

Reputation

Past performance and other intangibles, such as being ranked first

Historical Review:

History of quality control is as old as industry itself. The concept of specialization of worker is introduced during industrial revolution which leads to the decline of workmanship. In fact because productivity improved there was a decrease in cost, which resulted in lower customer expectations. As products became more complicated and jobs more specialized, it became necessary to inspect products after manufacture.

In 1924 W.A. Shewhart of bell telephone laboratories developed a statistical chart for the control of product variables. This chart is considered to be the beginning of statistical quality control. Later in the same decade. H. F. Dodge and H. G Romig, both of Bell Telephone Laboratories, developed the area of acceptance sampling as a substitute for 100% inspection. Recognition of the value of statistical quality control became apparent by 1942. Unfortunately U.S. managers failed to recognize its value.

In 1946 the *American Society for Quality Control* was formed. Recently, the name was changed to American Society for Quality (ASQ). This organization, through its publications, conferences, and training sessions, has promoted the use of quality for all types of production and service. In 1950, W. Edwards Deming who learned statistical quality control from Shewhart gave a series of lectures on statistical methods to Japanese engineers and on quality responsibility to the CEOs of the largest organizations in Japan. Joseph M Juran made his first trip to Japan in 1954 and further emphasized management's responsibility to achieve quality. Using these concepts the Japanese set the quality standards for the rest of the world to follow.

In 1960 The first quality control circles were formed for the purpose of quality improvement. Simple statistical techniques were learned and applied by Japanese workers. By the late 1970s and early 1980s, U.S., managers were making frequent trips to Japan to learn about the Japanese miracle. A quality renaissance began to occur in U.S. products and services, and by the middle of 1980 the concepts of TQM were being publicized. In the late 1980s the automotive industry began to emphasize statistical process control (SPC). Other industries and the Department of Defence also

implemented SPC. The Malcolm Baldrige National Quality Award was established and became the means to measure TQM.

Taguchi introduced his concepts of parameter and tolerance design and brought about a resurgence of design of experiments (DOE) as a valuable quality improvement tool. Emphasis on quality continued in the auto industry in the 1990s when the Saturn automobile ranked first in customer satisfaction (1996). In addition, ISO 9000 became the worldwide model for a quality management system; ISO 14000 was approved as the worldwide model for environmental management systems. The new millennium brought about increased emphasis on worldwide quality and the Internet.

OBSTACLES:

Many organizations, especially small ones with a niche, feel comfortable with their current state. They are satisfied with the amount of work being performed, the profits realized and the perception that the customers are satisfied. Organizations with this culture see little need for TQM until they begin to lose market share. Once an organization embarks on TQM, it faces some obstacles to its successful implementation. Some of the obstacles are as follows:

1. Lack of Management Commitment

In order to make an organizational effort successful, there should be substantial management commitment of management time and organizational resources. The purpose should be clearly and continuously communicated to all personnel. Management should consistently apply the principles of TQM. In a survey, out of 188 quality professionals, 66% reported that management's compensation is not linked to quality goals such as failure costs, customer complaints and cycle time reduction.

2. Inability to Change Organizational Culture

Changing an organization's culture is difficult and requires a lot of time. Individuals resist change as they become accustomed to doing a particular process and it becomes the preferred way. Management should understand and utilize the basic concepts of change which are as follows:

- i) People change when they want to and to meet their own needs.
- ii) Never expect anyone to engage in behaviour that serves an organization's values unless adequate reason (way) has been given.
- iii) For change to be accepted, people should be moved from a state of fear to trust.

It is difficult for individuals to change their way of doing things. It is much more difficult for an organization to make cultural changes. Impediments to a cultural change are ineffective communication and emphasis on short-term results. Organizations that spend more time in planning for the cultural aspects of implementing a TQM program will improve their chances of success.

3. Improper Planning

All constituents of an organization should be involved in the development of an implementation plan and any modifications that occur as the plan evolves. Of particular importance is the two-way communication of ideas among all personnel during the development of plan and its implementation. The goal should be to achieve customer satisfaction not to achieve any financial or sales goals.

4. Lack of Continuous Training and Education

Training and education is an on-going process for everyone in an organization. Training and education are the most effective when senior management conducts the training on the principles of TQM. Informal training occurs by communicating the TQM efforts to all personnel on a continual basis. Lack of training in group discussion and communication techniques, quality improvement skills, problem identification and the problem-solving methods was the second most important obstacle.

5. Incompatible Organizational Structure and Isolated Individuals and Departments

Differences between departments and individuals can create implementation problems. The use of multi-functional teams helps to break down long-standing barriers. The process of restructuring in order to make an organization more responsive to customer needs may be desired. Individuals who do not embrace the new philosophy can be required to leave the organization.

6. Ineffective Measurement Techniques and Lack of Access to Data and Results

The key characteristics of an organization should be measured in order to make effective decisions. In order to improve a process, one needs to measure an effect of improvement ideas. Access to data and quick retrieval is necessary to make a process effective.

7. Paying Inadequate Attention to Internal and External Customers

Organizations need to understand the changing needs and expectations of their customers. Effective feedback mechanisms that provide data for decision making are necessary for this understanding. A way to overcome this obstacle is to give the right people a direct access to the customers.

When an organization fails to empower individuals and teams, it cannot hold them responsible for producing results.

8. Inadequate Use of Empowerment and Teamwork

Whenever possible, teams need to have the proper training and, at least in the beginning, a facilitator and the team's recommendations should be followed. Individuals should be empowered to make decisions affecting the efficiency of their process or the satisfaction of their customers.

9. Failure to Improve Continually

However, a lack of continuous improvement of the process, product and/or service will even leave the leader of the pack in the dust. Will Rogers said, "Even if you're on the right track, you'll get run over if you just sit there." Even though Champion Mortgage's 1998 business volume increased to 59%, it continues to address culture, staff and services issues.

Benefits of TOM:

- Improved quality
- Employee participation
- Team work
- Working relationships
- Customer satisfaction
- Employee satisfaction
- Productivity
- Communication
- Profitability
- Market share

Quality Management Systems-I

Introduction

The International Organization for Standardization (ISO) was founded in 1946 in Geneva, Switzerland, where it is still based. Its mandate is to promote the development of international standards to facilitate the exchange

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of goods and services worldwide. ISO is composed of more than 90 member countries. The United States representative is the American National Standards Institute (ANSI).

The ISO Technical Committee (TC) 176 develops a series of international standards for quality systems which were first published in 1987. The standards (ISO 9000, 9001 and 9004) were intended to be advisory and were developed for use in two-party contractual situations and internal auditing. However, with their adoption by the European Community (EC) and a worldwide emphasis on quality and economic competitiveness, the standards have become universally acceptable.

Most of the countries have adopted the ISO 9000 series as their national standards. Likewise, thousands of organizations throughout the world have quality systems registered to the standard. In the United States, the national standards are published by the American National Institute/American Society for Quality (ANSI/ASQ) as the ANSI/ASQ Q9000 series. Government bodies throughout the world, including the United States, are also using the standards. US government agencies using the series are the Department of Defense (DOD) and the Food and Drug Administration (FDA).

In a two-party system, the supplier of a product or service would develop a quality system that conforms to the standards. The customers would then audit the system for acceptability. This two-party system results in both supplier and customer having to participate in multiple audits which can be extremely costly. This practice is replaced by a third-party registration system.

A quality system registration involves the assessment and periodic surveillance audit of the adequacy of a supplier's quality system by a third party, who is a registrar. When a system conforms to the registrar's interpretation of the standard, the registrar issues a certificate of registration to the supplier. This registration ensures customers or potential customers that a supplier has a quality system in place and it is being monitored.

Benefits of ISO Registration

There are various reasons for implementing a quality system that conforms to an ISO standard. The primary reason is that customers are suggesting, or market is demanding, compliance to a quality system. Other reasons include required improvements in processes or systems and a desire for global deployment of products and services. As more and more organizations become registered, they require their subcontractors or suppliers to be registered, creating a snowball effect. Consequently, in order to maintain or increase market share, many organizations are finding that they should be in conformance with an ISO standard. Internal benefits that can be received from developing and implementing a well-documented quality system can far outweigh the external pressures.

A study of 100 Italian manufacturing firms was undertaken to determine if there was any improvement in performance after registration. Significant improvement was noted in the following areas:

- Internal quality as measured by the percent of scrap, rework and nonconformities at final inspection
- Production reliability as measured by the number of breakdowns per month, percent of time dedicated to emergencies and percent of downtime per shift

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- External quality as measured by product accepted by customers without inspection, claims of nonconforming product and returned product
- Time performance as measured by time to market, on-time delivery and throughput time
- Cost of poor quality as measured by external nonconformities, scrap and rework

On the negative side, prevention and appraisal costs increased. Additional examples of benefits after registration are as follows:

1. The American Institute of Certified Public Accountants (AICPA) now has a quality system that works. Also, there was a 4% improvement in gross margins which was the largest improvement in their history.
2. North town Ford automobile dealership in Toronto, Ontario, raised customer satisfaction and loyalty by 20%. It experienced a 55% increase in customers who would recommend the dealership.
3. United Airlines reduced the average engine overhaul cycle time from 120 days to 60 days.
4. Cleveland Center for Joint Reconstruction has experienced lower costs and more control and consistency in the care it provides.

ISO 9000 Series of Standards

The ISO 9000 series of standards is generic in scope. By design, the series can be tailored to fit any organization's needs, whether it is large or small, a manufacturer or a service organization. It can be applied to construction, engineering, health care, legal and other professional services as well as the manufacturing of anything from nuts and bolts to spacecraft. Its purpose is to unify quality terms and definitions used by industrialized nations and use those terms to demonstrate a supplier's capability of controlling its processes. In simplified terms, the standards require an organization to say what it is doing to ensure quality, then do what it says and finally document or prove that it has done what it said.

The three standards of the series are described briefly below:

1. ISO 9000:2000

Quality Management Systems (QMS) fundamentals and vocabulary discusses the fundamental concepts related to the QMS and provides the terminology used in the other two standards.

2. ISO 9001:2000

QMS requirements is the standard used for registration by demonstrating conformity of the QMS to customers, regulator and the organization's own requirements.

3. ISO 9004:2000

QMS guidelines for performance improvement provide guidelines that an organization can use to establish a QMS focused on improving performance.

ISO 9001 Requirements

The standard has following eight clauses:

1. Scope
2. Normative references

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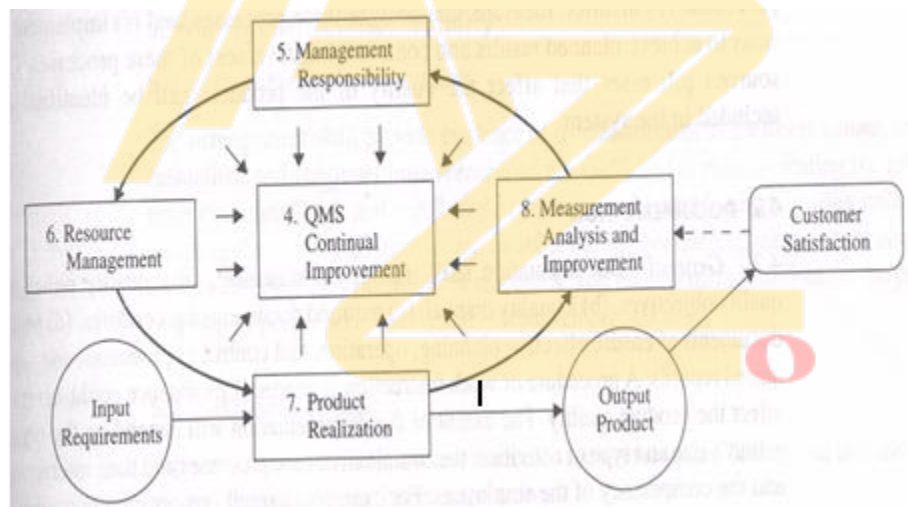
3. Definitions
4. Quality management systems
5. Management responsibility
6. Resource management
7. Product and/or service realization
8. Measurement, analysis and improvement

The first three clauses are for information while the last five are requirements that an organization should meet. The application of a system of process within an organization, together with their identification and interactions and the managing of these processes, is referred to as the process approach. This approach emphasizes the importance of the following:

- Understanding and fulfilling the requirements
- The need to consider processes in terms of value added
- Obtaining results of process performance and effectiveness
- Continual improvement of processes based on objective measure

1. Scope

The purpose of the standard is for the organization to demonstrate its ability to provide a product that meets customer and regulatory requirements and achieves customer satisfaction.



Model of a process-based quality management system

This purpose is accomplished by evaluating and continually improving the system rather than the product. The requirements of the standard are intended to be applicable to all types and sizes of organization. Requirement in clause 7, product realization which is not appropriate to an organization, can be excluded.

2. Normative Reference

ISO 9000:2000 Quality Management Systems-- Fundamentals and vocabulary are a normative reference that provides applicable concepts and definitions.

3. Terms and Definitions

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For the purposes of this standard, the terms and definitions given in ISO 9000:2000 apply. In addition, the supply chain is defined as follows:

Supplier → Organization → Customer

4. Quality Management System (QMS)

I. General Requirements

The organization should establish, document, implement and maintain a QMS and continually improve its effectiveness. The organization should also do the following

- i) Identify needed processes such as management activities, provision of resources, product realization and measurement.
- ii) Determine their sequence and interaction.
- iii) Determine criteria and methods for effective operation and control of these processes.
- iv) Ensure the availability of resources and information necessary to support and monitor these processes.
- v) Monitor, measure and analyze these processes.
- vi) Implement actions to achieve planned results and continual improvement of these processes.

Outsourced processes that affect the quality of the product should be identified and included in the system.

5. Documentation

a. General Documentation

It should include the following:

- Statements of a quality policy and quality objectives
- A quality manual
- Required documented procedures
- Needed documents to ensure effective planning, operation and control of processes
- Required records

b. Quality Manual

A quality manual should be established and maintained that includes the following:

- All the scope of the QMS with details and justification for any exclusions
- The documented procedures or reference to them
- A description of the interaction among the QMS processes

c. Control of Documents

Documents required by the QMS should be controlled. A documented procedure should be in place to define the control needed to do the following:

- Approve documents prior to use
- Review, update and re-approve as necessary
- Identify the current revision status
- Ensure that current versions are available at the point of use
- Ensure that documents are legible and readily identified
- Identify and distribute documents of external origin

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- Provide for the prompt removal of obsolete documents and suitably identify those that may be retained

Documented procedure means that the procedure is established, documented, implemented and maintained.

d. Control of Records

Records should be established and maintained to provide evidence of conformity to requirements and the effective operation of the QMS. They should be legible, readily identifiable and retrievable. A documented procedure should be established to define the controls needed for the identification, storage, protection, retrieval, retention time and disposition of records. Records can be used to document tractability and to provide evidence of verification, preventive action and corrective action.

6. Management Responsibility

I. Management Commitment

Top management should provide evidence of its commitment to the development, implementation and continual improvement of the QMS by doing the following:

- Communicating the need to meet customer, legal and regulatory expectations
- Establishing a quality policy
- Ensuring that quality objectives are established
- Conducting management reviews
- Ensuring the availability of resources

Top management is defined as the person or group of people who directs and controls an organization.

II. Customer Focus

Top management should ensure that customer requirements are determined and met with the aim of enhancing customer satisfaction.

III. Quality Policy

Top management should ensure the following with regard to the quality policy:

- i) It is appropriate to the organization's purpose or mission.
- ii) It includes a commitment to comply with requirements and continually improve the effectiveness of the QMS.
- iii) It provides a framework for establishing and reviewing the quality objectives.
- iv) It is communicated and understood within the organization.
- v) It is reviewed for continuing stability.

The quality policy gives the overall intention and direction of the organization related to quality.

IV. Planning

a. Quality Objectives

Top management should ensure that quality objectives are established at relevant functions and levels within the organization and include product requirements.

b. Quality Management System Planning

Top management should ensure that the planning of the QMS is accomplished in order to meet the requirements of the QMS as stated in the general requirements as well as the quality objectives.

V. Responsibility, Authority and Communication

a. Responsibility and Authority

Top management should ensure that responsibilities and authorities are defined and communicated within the organization. Responsibilities can be defined in job descriptions, procedures and work instructions.

b. Management Representative

Top management should appoint a member of the management, regardless of his/her other duties, who should have the responsibility and authority including the following:

- Ensuring that processes needed for the QMS system are established, implemented and maintained
- Reporting to top management on the performance of the QMS and any need for improvement
- Ensuring the promotion of awareness of customer requirements throughout the organization.

c. Internal Communication

Top management should ensure that appropriate communication channels are established within the organization and that communication takes place regarding the QMS. Typical communication techniques are management workplace briefing, recognition of achievement, bulletin boards, e-mail and in-house news brochures.

VI. Management Review

a. General

Top management should review the QMS at planned intervals to ensure its continuing suitability, adequacy and effectiveness.

b. Review Input

The input to the review should include information on the following:

- Results of audits
- Customer feedback
- Process performance and product conformity
- Status of corrective and preventative performance
- Follow-up actions from previous management reviews
- Changes that could affect the QMS
- Recommendations for improvement

c. Review Output

The output from the review should include any decisions and actions related to the following:

- Improvement of the effectiveness of the QMS and its processes
- Improvement of the product related to customer requirements
- Resource needs

Top management can use the outputs as inputs to improvement opportunities.

6. Resource Management

I. Provision of Resources

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The organization should determine and provide the resources needed to implement and maintain the QMS and continually improve its effectiveness and to enhance customer satisfaction by meeting customer requirements. Resources may be people, infrastructure, work environment, information, suppliers, natural resources and financial resources. Resources can be aligned with quality objectives.

II. Human Resources

a. General

Personnel performing work that affects product quality should be competent on the basis of appropriate education, training, skills and experience.

b. Competence, Awareness and Training

The organization should do the following:

- Determine the necessary competence for personnel performing work affecting product quality
- Provide training or take other actions to satisfy these needs
- Evaluate the effectiveness of the actions taken
- Ensure that its personnel are aware of the relevance and importance of their activities and how they contribute to the achievement of the quality objectives
- Maintain appropriate records of education, training, skills and experience

III. Infrastructure

The organization should determine, provide and maintain the infrastructure needed to achieve conformity to product requirements. Infrastructure includes, as applicable, the following:

- Buildings, workspace and associated utilities
- Process equipment (both hardware and software)
- Supporting services (such as transport or communication)

IV. Work Environment

The organization should determine and manage the work environment needed to achieve conformity to product requirements. Creation of a suitable work environment can have a positive influence on employee motivation, satisfaction and performance.

7. Product Realization

I. Planning of Product Realization

The organization should plan and develop the processes needed for product realization. In planning product realization, the organization should determine the following, as appropriate:

- Quality objectives and requirements for the product
- The need to establish processes, documents and provide resources specific to the product
- Required verification, validation, monitoring, inspection and test activities specific to the product and the criteria for product acceptance
- Records needed to provide evidence that the realization processes and resulting product or service meet requirements.

The output of this planning should be in a form suitable for the organization's method of operations.

II. Customer-Related Processes

- a. Determination of Requirements Related to the Product
- b. Review of Requirements Related to the Product
- c. Customer Communication

III. Design and Development

- a. Design and Development Planning
- b. Design and Development Inputs
- c. Design and Development Outputs
- d. Design and Development Reviews
- e. Design and Development Verification
- f. Design and Development Validation
- g. Control of Design and Development Changes

IV. Purchasing

- a. Purchasing Process
- h. Purchasing Information
- i. Verification of Purchased Product
- j. Production and Service Provision
- k. VI. Control of Monitoring and Measuring Devices

8. Measurement, Analysis and Improvement

I. General

- l. The organization should plan and implement the monitoring, measurement, analysis and improvement processes needed for the following purposes:
 - m. • To demonstrate conformity of the product
 - n. • To ensure conformity of the QMS
 - o. • To continually improve the effectiveness of the QMS

II. Monitoring and Measurement

- p. Customer Satisfaction
- q. Internal Audit
- r. Monitoring and Measurement of Processes
- s. Monitoring and Measurement of Product and Service

III. Control of Non-conforming Product

- t. The organization should ensure that product which does not conform to product requirements is identified and controlled to prevent its unintended use or delivery. The controls and related

responsibilities and authorities for dealing with nonconforming product should be defined in a document procedure.

IV. Analysis of Data

- u. The organization should determine, collect and analyze appropriate data to demonstrate the suitability and effectiveness of the QMS and to evaluate where continual improvement of the effectiveness of the QMS can be made.

V. Improvement

a. Continual Improvement

- v. The organization should continually improve the effectiveness of the QMS through the use of the following:

w. • Quality policy

- Quality objectives
- Audit results
- Analysis of data
- Corrective and preventive actions
- Management review

b. Corrective Action

The organization should take action to eliminate the cause of nonconformities in order to prevent recurrence .

c. Preventive Action

The organization should determine action to eliminate the causes of potential nonconformities in order to prevent their occurrence.

c. Preventive Action

The organization should determine action to eliminate the causes of potential nonconformities in order to prevent their occurrence.

Module-2

- Leadership: Definition, characteristics of quality leaders,
- Leadership
- concept,
- characteristics of effective people,
- ethics,
- the Deming philosophy,
- role of TQM leaders,
- implementation, core values,
- concepts and framework,
- strategic planning communication,
- decision making

MODULE – 2 Leadership

Definition:

Leadership according to James Mac Gregor Burns describes a leader as one who instills purposes, not one who controls by brute force. A leader strengthens and inspires the followers to accomplish shared goals. Leader shape the organization's values, promote the organization's values, protect the organization's values and exemplify the organization's values.

Characteristics of Quality Leaders:

There are 12 behaviors or characteristics that successful quality leaders demonstrate.

1. *They give priority attention to external and internal customers and their needs.* Leaders place them-selves in the customers' shoes and service their needs from that perspective. They continually evaluate the customers' changing requirements.
2. *They empower, rather than control, subordinates.* Leaders have trust and confidence in the performance of their subordinates. They provide the resources, training, and work environment to help subordinates do their jobs. However, the decision to accept responsibility lies with the individual.
3. *They emphasize improvement rather than maintenance.* Leaders use the phrase "If it isn't perfect, improve it" rather than -If it isn't broke, don't fix it. There is always room for improvement, even if the improvement is small. Major breakthroughs sometimes happen, but it's the little ones that keep the continuous process improvement on a positive track.

4. *They emphasize prevention.* –“An ounce of prevention is worth a pound of cure” is certainly true. It is also true that perfection can be the enemy of creativity. We can't always wait until we have created the perfect process or product. There must be a balance between preventing problems and developing better, but not perfect, processes.

5. *They encourage collaboration rather than competition.* When functional areas, departments, or work groups are in competition, they may find subtle ways of working against each other or withholding information. Instead, there must be collaboration among and within units.

6. *They train and coach, rather than direct and supervise.* Leaders know that the development of the human resource is a necessity. As coaches, they help their subordinates learn to do a better job.

7. *They learn from problems.* When a problem exists, it is treated as an opportunity rather than something to be minimized or covered up. "What caused it?" and "How can we prevent it in the future?" are the questions quality leaders ask.

8. *They continually try to improve communications.* Leaders continually disseminate information about the TQM effort. They make it evident that TQM is not just a slogan. Communication is two way ideas will be generated by people when leaders encourage them and act upon them. Communication is the glue that holds a TQM organization together.

9. *They continually demonstrate their commitment to quality.* Leaders walk their talk their actions, rather than their words, communicate their level of commitment. They let the quality statements be their decision-making guide.

10. *They choose suppliers on the basis of quality, not price.* Suppliers are encouraged to participate on project teams and become involved. Leaders know that quality begins with quality materials and the true measure is the life-cycle cost.

11 *They establish organizational systems to support the quality effort.* At the senior management level a quality council is provided, and at the first-line supervisor level, work groups and project teams are organized to improve the process.

12. *They encourage and recognize team effort.* They encourage, provide recognition, and reward Individuals and teams. Leaders know that people like to know that their contributions are appreciated and important. This action is one of the leader's most powerful tools.

Leadership Concept:

In order to become successful, leadership requires an intuitive understanding of human nature the basic needs, wants and abilities of people. To be effective, a leader understands that:

1. People, paradoxically, need security and independence at the same time.
2. People are sensitive to external rewards and punishments and yet are also strongly self-motivated.
3. People like to hear a kind word of praise. Catch people doing something right.
4. People can process only a few facts at a time; thus, a leader needs to keep things simple.
5. People trust their gut reaction more than statistical data.

6. People distrust a leader's rhetoric if the words are inconsistent with the leader's actions.

Leaders need to give their employees independence and yet provide a secure working environment—one that encourages and rewards successes. A working environment must be provided that fosters employee creativity and risk taking by not penalizing mistakes.

A leader will focus on a few key values and objectives. Focusing on a few values or objectives gives the employee the ability to discern on a daily basis what is important and what is not. Employees, upon understanding the objectives, must be given personal control over the task in order to make the task their own and thereby, something to which they can commit. A leader, by giving the employee a measure of control over an important task, will tap into the employee's inner drive. Employees, led by the manager can become excited participants in the organization.

The 7 Habits of Highly Effective People:

Stephen R. Covey has based his foundation for success on the character ethic things like integrity, humility, fidelity, temperance, courage, justice, patience, industry, simplicity, modesty, and the Golden Rule. The personality ethic—personality growth, communication skill training, and education in the field of influence strategies and positive thinking is secondary to the character ethic. What we are communicates far more eloquently than what we say or do.

A paradigm is the way we perceive, understand, and interpret the world around us. It is a different way of looking at people and things. To be effective we need to make a paradigm shift. Most scientific breakthroughs are the result of paradigm shifts such as Copernicus viewing the sun as the center of the universe rather than earth. Paradigm shifts are quantum changes, whether slow and deliberate or instantaneous. A habit is the intersection of knowledge, skill, and desire. Knowledge is what we to do and the why; skill is the how to do; and desire is the motivation or want to do. In order for something to become a habit you have to have all three.

Habit 1: Be Proactive

Being proactive means taking responsibility for your life the ability to choose the response to a situation. Proactive behavior is a product of conscious choice based on values, rather than reactive behavior, which is based on feelings. Reactive people let circumstances, conditions, or their environment tell them how to respond. Proactive people let carefully thought-about, selected, and internalized values tell them how to respond. It's not what happens to us but our response that differentiates the two behaviors. The language we use is a real indicator of our behavior. Comparisons are given in the table below.

Reactive

There is nothing I can do.
She makes me so mad.
I have to do that.
I cannot.
I must.
Things are getting worse.

Proactive

Let us look at our alternatives.
I control my own feelings.
I will choose an appropriate response.
I choose.
I prefer.
What initiative can we use?

Comparison between reactive and proactive behavior of an individual.

Habit 2: Begin with the end mind first

The most fundamental application of this habit is to begin each day with an image, picture or paradigm of the end of your life as your frame of reference. Each part of your life can be examined in terms of what really matters to you-- a vision of your life as a whole.

All things are created twice-- there is a mental or first creation and a physical or second creation to all things. To build a house you first create a blueprint and then construct the actual house. You create a speech on paper before you give it. If you want to have a successful organization, you begin with a plan that will produce the appropriate end. Thus, leadership is the first creation and management is the second. Leadership means doing the right things and management means doing things right.

In order to begin with the end in mind, develop a personal philosophy or creed. Start by considering the examples mentioned below:

- Never compromise with honesty
- Remember the people involved
- Maintain a positive attitude
- Exercise daily
- Do not fear mistakes
- Facilitate the success of subordinates
- Seek divine help
- Read a leadership book monthly

By centering our lives on correct principles, we create a solid foundation for the development of the life support factors of security, guidance, wisdom and power. Principles are fundamental truths. They are tightly interwoven threads running with exactness, consistency, beauty and strength through the fabric of life.

Habit 3-- Put First Things First

Habit one says, "You're the creator. You are in charge." Habit two is the first creation and is based on imagination-- leadership based on values. Habit three is practicing self-management and requires habits one and two as prerequisites. It is the day-by-day, moment-by-moment management of your time.

	Urgent	Not Urgent
Important	I Crises, firefighting Pressing problems Deadline driven projects	II Prevention, PC Relationship building Recognizing new opportunities Planning, recreation
Not Important	III Interruptions, pressing matters Some mail, calls, report Some meetings, proximate Popular activities	IV Trivia, busy work Time wasters Pleasant activities

Urgent means it requires immediate attention and important has to do with results that contribute to your mission, goals and values. Effective, proactive people spend most of their time in quadrant II, thereby reducing the time spent in quadrant I. Four activities are necessary to be effective. First, write down your key roles for the week (such as research manager, United Way Chairperson and parent). Second, list your objectives for each role using many quadrant II activities. These objectives

should be tied to your personal goals or philosophy developed in habit 2. Third, schedule time to complete the objectives. Fourth, adapt the weekly schedule to your daily activities.

Habit 4-- Think Win-Win

Win-win is a frame of mind and heart that constantly seeks mutual benefit in all human interactions. Both sides come out ahead. In fact, the end result is usually a better way. If win-win is not possible, then the alternative is no deal. It takes great courage as well as consideration to create mutual benefits, especially if the other party is thinking win-lose.

Win-win embraces five interdependent dimensions of life-- character, relationships, agreements, systems and processes. Character involves the following traits:

- Integrity
- Maturity-- a balance between being considerate of others and the courage to express feelings
- Abundance mentality (there is plenty out there for everyone)

Relationship means that the two parties trust each other and are deeply committed to win-win. Agreements require the five elements of desired results, guidelines, resources, accountability and consequences. Win-win agreements can only survive in a system that supports it-- you cannot talk win-win and reward win-lose. In order to obtain win-win, a four-step process is needed. It is as follows:

1. See the problem from the other viewpoint.
2. Identify the key issues and concerns.
3. Determine acceptable results.
4. Seek possible new options to achieve those results.

Habit 5-- Seek First to Understand, then to be Understood

Seek first to understand involves a paradigm shift since we usually try to be understood first.

Empathic listening is the key to effective communication. It focuses on learning how the other person sees the world, how they feel etc. The essence of empathic listening is not that you agree with someone. It is that you fully and deeply understand the person, emotionally as well as intellectually. Next to physical survival is the greatest need of a human being of psychological survival-- to be understood, affirmed, validated and appreciated.

The second part of the habit is to be understood. Covey uses three sequentially arranged Greek words-- ethos, pathos and logos. Ethos is your personal credibility or character, pathos is the empathy you have with the other person's communication and logos is the logic or reasoning part of your presentation.

Habit 6-- Synergy

Synergy means that the whole is greater than the parts. Together, we can accomplish more than any of us can accomplish alone. This can best be exemplified by the musical group "The Beatles." They as a group created more music than each individual created after the group broke up. The first five habits build toward habit six. It focuses the concept of win-win and the skills of empathic communication on tough challenges that bring about new alternatives which did not exist before. Synergy occurs when people abandon their humdrum presentations and win-lose mentality and open themselves up to creative cooperation. When there is a genuine understanding, people reach solutions that are better than they could have achieved acting alone.

Habit 7-- Sharpen the Saw (Renewal)

Habit seven is taking time to sharpen the saw so that it will cut faster. It is personal PC-- preserving and enhancing the greatest asset you have, which is you. It is renewing the four dimensions of your nature-- physical, spiritual, mental and social/emotional. All four dimensions of your nature should

be used regularly in wise and balanced ways. Renewing the physical dimension means following good nutrition, rest and relaxation, and regular exercise. The spiritual dimension is your commitment to your value system. Renewal comes from prayer, meditation and spiritual reading. The mental dimension is continuing to develop your intellect through reading, seminars and writing. These three dimensions require that time be set aside-- they are quadrant II activities. The social and emotional dimensions of our lives are tied together because our emotional life is primarily, but not exclusively, developed out of and manifested in our relationship with others. While this activity does not require time, it does require exercise.

Ethics

Ethics is not a precept that is mutually exclusive from quality. Indeed, quality and ethics have a common care premise, which is to do the right things right.

Definition

Ethics is the body of principles or standards of human conduct that govern the behavior of individuals and organizations. It governs the actions and helps one to decide what the right thing to do is. Some people learn it while growing up and some do it during an organization's ethics training program. Ethics can mean differently to different people, especially when given an organization's international workforce and the varying cultural norms. Because individuals have different concepts of what is right, the organization will need to develop the standards or code of ethics for the organization.

The Root Causes of Unethical Behavior

Much of the unethical behavior in organizations occurs in the following cases:

1. Organizations favor their own interests above the well-being of their customers, employees or the public.
2. Organizations reward behavior that violates ethical standards, such as increasing sales through false advertising.
3. Organizations encourage separate standards of behavior at work than at home, such as secrecy and deceit versus honesty.
4. Individuals are willing to abuse their position and power to enhance their interests, such as taking excessive compensation for themselves off the top before other stakeholders receive their fair share.
5. Managerial values exist that undermine integrity, such as the pressure managers exert on employees to cover up mistakes or to do whatever it takes to get the job done, including cutting corners.
6. Organizations and individuals overemphasize the short-term results at the expense of themselves and others in the long run. For example, behavior is good based on the degree of utility, pleasure or good received, regardless of the effect on others.
7. Organizations and managers believe their knowledge is infallible and miscalculate the true risks, such as when financial managers invest organizational funds in high-risk options trading.

The Deming Philosophy

Deming's philosophy is given in the 14 points. Most of these points were given in a seminar for 21 presidents of leading Japanese industry in 1950. The rest were developed and the original ones were modified over a period of three decades.

1. Create and Publish the Aims and Purposes of Organization

Management should demonstrate constantly their commitment to this statement. It should include investors, customers, suppliers, employees, community and a quality philosophy. The statement is a

forever-changing document requiring input from everyone. Organizations should develop a long-term view of at least ten years and plan to stay in business by setting long-range goals. Resources should be allocated for research, training and continuing education to achieve the goals. Innovation is promoted to ensure that a product or service does not become obsolete. A family organizational philosophy is developed to send the message that everyone is the part of organization.

2. Learn the New Philosophy

Top management and everyone should learn the new philosophy. The organizations should seek never-ending improvement and refuse to accept non-conformance. Customer satisfaction should always be the number one priority because dissatisfied customers will not continue to purchase non-conforming products and services. An organization should concentrate on defect prevention rather than on defect detection. By improving the process, quality and productivity will also improve. Everyone in an organization including union should be involved in quality journey and change his or her attitude regarding quality. A supplier should be helped to improve quality by providing statistical evidence of conformance and shared information relative to customer expectations.

3. Understand the Purpose of Inspection

Management should understand that the purpose of inspection is to improve the process and reduce its cost. For most of the part, mass inspection is costly and unreliable. Where appropriate, it should be replaced by never-ending improvement using statistical techniques. Statistical evidence is required of self and supplier. Every effort should be made to reduce and then eliminate acceptance sampling. Mass inspection is managing for failure and defect prevention is managing for success.

4. Stop Awarding Business based on Price Alone

An organization should stop awarding business based on the low bid because price has no value without quality. The goal is to have a single supplier for each item to develop a long-term relationship between loyalty and trust, thereby providing improved products and services. Purchasing agents should be trained in statistical process control and require it from suppliers. They should follow the materials throughout the entire life cycle in order to examine how customer expectations are affected and provide feedback to the suppliers regarding the quality.

5. Improve Constantly and Forever the System

Management should take more responsibility for problems by actively finding and correcting problems so that quality and productivity could be continually and permanently improved and costs could be reduced. The focus is on preventing problems before their occurrence. Variation is expected but there should be a continual striving for its reduction using control charts. Responsibilities are assigned to teams to remove the causes of problems and continually improve the process.

6. Institute Training

Each employee should be oriented toward the organization's philosophy of commitment to never-ending improvements. Management should allocate resources to train employees to perform their jobs in the best possible manner. Everyone should be trained in statistical methods and these methods should be used to monitor the need for further training.

7. Teach and Institute Leadership

A responsibility of management is to improve supervision. It should provide supervisors with training in statistical methods and these 14 points so the new philosophy can be implemented. Instead of focusing on a negative and fault-finding atmosphere, supervisors should create a positive and supportive one where pride in workmanship can flourish. All communication should be clear from top management to supervisors to operators.

8. Drive Out Fear, Create Trust and a Climate for Innovation

Management should encourage open and effective communication and teamwork. Fear is caused by a general feeling of being powerless to control important aspects of one's life. It is caused by a lack of job security, possible physical harm, performance appraisals, and ignorance of organization goals, poor supervision and not knowing the job. Driving fear out of the workplace involves managing for success. Management can begin by providing workers with adequate training, good supervision and proper tools to do the job as well as removing physical dangers. When people are treated with dignity, fear can be eliminated.

9. Optimize the Efforts of Teams, Groups and Staff Areas

Management should optimize the efforts of teams, work groups and staff areas to achieve the aims and purposes of the organization. Internally, barriers do not exist not only within departments but also among the following:

- Levels of management
- Departments
- Shifts

Externally, they exist between the organization and its customers and suppliers. These barriers exist because of the following reasons:

- Poor communication
- Ignorance of the mission of organization
- Competition
- Fear
- Personal grudges or jealousies

To break down the barriers, management needs a long-term perspective. It should opt for the following changes in order to break down the barriers:

- All the different areas should work together
- Change in attitude
- Opening of communication channels
- Project teams organized
- Training in teamwork implemented

Multi-functional teams such as used in concurrent engineering are an excellent method.

10. Eliminate Exhortations for the Work Force

Exhortations that ask for increased productivity without providing specific improvement methods can handicap an organization. They do nothing but express desires of management. They do not produce a better product or service because workers get limited by the system. Those goals should be set that are achievable and are committed to the long-term success of the organization. The improvements in a process cannot be made without the availability of tools and methods.

11a. Eliminate Numerical Quotas for the Work Force

Instead of quotas, management should learn and institute methods for improvement. Quotas and work standards focus on quantity rather than quality. They encourage poor workmanship in order to meet their quotas. Quotas should be replaced with statistical methods of process control. Management should provide and implement a strategy for never-ending improvements and work with work force to reflect new policies.

11b. Eliminate Management by Objective

Instead of management by objective, management should learn the capabilities of processes and the procedure to be employed for their improvement. Internal goals set by management without a method are a burlesque. Management by numerical goal is an attempt to manage without knowledge of what to do. An excellent analysis supporting this point is given by Castellano and Roehm.

12. Remove Barriers That Rob People of Pride of Workmanship

Loss of pride in workmanship exists throughout an organization because of the following reasons:

- a. Workers do not know how to relate themselves to the organization's mission.
- b. They are being blamed for system problems.
- c. Poor designs lead to the production of junk.

- d. Inadequate training is provided.
- e. Punitive supervision exists.
- f. Inadequate or ineffective equipment is provided for performing the required work.

Restoring pride will require a long-term commitment by management. When workers are proud of their work, they will grow to the fullest extent of their job. Management can perform the following tasks to restore the pride of their workers:

- a. Giving their employees operational job descriptions.
- b. Providing the proper tools and materials.
- c. Stressing on a workers' understanding regarding his/her role in the total process

By restoring pride, everyone in the organization will be working for the common good. A barrier for people on salary is the annual rating of performance.

13. Encourage Education and Self-Improvement for Everyone

An organization needs people who improve with education. Management should commit itself to continuously train and educate people. Deming's 14 points and the organization's mission should be the foundation of education program. Everyone should be retrained because of the fact that an organization's requirements change to meet the changing environment.

14. Take Action to Accomplish the Transformation

Management has to accept its primary responsibility for the never-ending improvement of the process. It has to create a corporate structure to implement the philosophy. A cultural change is required from the previous "business as usual" attitude. Management should be committed, involved and accessible if the organization is to succeed in implementing the new philosophy.

Role of TQM Leaders

1. Everyone is responsible for quality, especially senior management and the CEO

- The General Electric training courses taught leadership approaches and models and provided the opportunity for teams to develop solutions for real business problems.
- Jack Welch supported the development of a leadership system whereas quality control leaders were developed at all levels and in all functions of the organization including research, marketing, manufacturing, sales, finance and human resources.
- Senior managers need to be provided with the skills to implement quality control techniques and actively participate in the quality council.

2. Management by Wandering Around (MBWA)

Management should get out of the office and visit customers, suppliers, departments within the organization and plants within the organization. That way, managers learn what is happening with a particular customer, supplier or project. MBWA can substantially reduce paperwork. Encourage subordinates to write only important messages that need to be part of the permanent record.

3. Push problem solving and decision making to the lowest appropriate level by delegating authority and responsibility

The idea is to let employees think for themselves. Senior management's role is no longer to make the final decision, but to make sure the team's decision is aligned with the quality statements of the organization.

4. Should have better knowledge of TQM to guide others

Total Quality Management

- Senior managers should stay informed on the topic of quality improvement by reading books and articles, attending seminars and talking to other TQM leaders.
- The needed resources should be provided to train employees in the TQM tools and techniques, the technical requirements of the job and safety.
- Resources in the form of the appropriate equipment to do the job should also be provided.

5. *Recognition and rewarding employees.*

- Senior managers should find time to celebrate the success of their organization's quality efforts by personally participating in award and recognition ceremonies.
- This activity is an excellent opportunity to reinforce the importance of the effort and to promote TQM.
- One of the duties of the quality council is to establish or revise the recognition and reward system.
- Also, provisions should be made to reward teams as well as creative individuals.

6. *Coaching teams and teaching seminars*

Senior managers should be visible and actively engaged in the quality effort by serving on teams, coaching teams and teaching seminars. They should lead by demonstrating, communicating and reinforcing the quality statement. As a rule of thumb, they should spend about one-third of their time on quality.

7. *Listening to internal and external customers*

A very important role of senior managers is listening to internal and external customers and suppliers through visits, focus groups and surveys. This information is translated into core values and process improvement projects

8. *Communication*

The objective is to create awareness of the importance of TQM and provide TQM results in an ongoing manner. The TQM message should be "sold" to personnel, for if they do not "buy" it, TQM will never happen. In addition to internal efforts, there should be external activities with customers and suppliers, media and advertising in trade magazines and interaction with the quality community.

Implementation

The TQM implementation process begins with senior management and, most importantly, with the CEO's commitment. Leadership is essential during every phase of the implementation process and particularly at the start. Delegation and rhetoric are insufficient. Instead, involvement is required.

Senior management needs to be educated in the TQM concepts. In addition to formal education, managers should visit successful TQM organizations, read selected articles and books and attend seminars and conferences. The next step is for senior management to develop an implementation plan.

Timing of the implementation process can be very important. Is the organization ready to embark on the total quality journey? There may be some foreseeable problems, such as a

reorganization, change in senior management personnel, interpersonal conflicts, a current crisis, or a time-consuming activity. These problems may postpone implementation to a more favorable time.

The next step is the formation of the Quality Council. Initiation of these duties is a substantial part of the implementation of TQM. The development of core values, a vision statement, a mission statement and a quality policy statement, with inputs from all personnel, should be completed first.

The active involvement of middle managers and first-line supervisors is essential to the success of the TQM effort. They are accountable for achieving many of the organization's performance goals and objectives. They form enduring links in the communication chain from senior management to the front-line workers. Without middle management's early and active support, the TQM effort could fail. The retreat will focus on TQM training, leadership skills and active involvement in the development of the organization's statements.

If there is a union, there should be early discussions with the representatives on TQM. Managers should involve union leaders by sharing with them implementation plans for TQM. As the quality effort progresses, managers and union leaders should work together on quality improvement activities.

At this stage of the implementation process, it is important to communicate TQM to the entire organization. Communication is important throughout the implementation stage and is necessary to create TQM awareness, interest, desire and action. Everyone needs to be trained in quality awareness and problem solving. This training is conducted when the employee is placed in a project team or the work group is ready for the training.

Core Values, Concepts and Framework

Unity of purpose is a key to leadership system. Core values and concepts provide that unity of purpose. The core values and concepts enable a framework for leaders throughout the organization to make the right decisions. They foster TQM behavior and define the culture. Each organization will need to develop its own values. Given here are the core values, concepts and framework for the Malcolm Baldrige National Quality Award. They can be used as a starting point for any organization as it develops its own.

Visionary Leadership

An organization's senior leaders need to set directions and high expectations and create a customer-oriented clear and visible quality values. Values, directions and expectations need to address all stakeholders. The leaders need to ensure the creation of strategies, systems and methods for achieving excellence. Strategies and values should help guide all activities and decisions of the organization. Senior leaders should commit to the development of the entire workforce. Further, they should encourage participation, learning, innovation and creativity by all employees. Through their personal roles in planning, communications, review or organization performance and employee recognition, senior leaders serve as role models, reinforcing the values and expectations and building leadership and initiative throughout the organization.

Customer-Driven Excellence

Quality is best judged by the customers. All product and service characteristics that contribute value to the customer and lead to customer satisfaction, preference and retention should be the focus of an organization's management system. Customer-driven excellence has both current and future components-- understanding today's customer desires and marketplace offerings as well as future innovations. Value and satisfaction may be influenced by many factors throughout the customer's overall purchase, ownership and service experiences.

Organizational and Personal Learning

Organizational learning can result in the following:

- Enhancing value to customers through new and improved products and services
- Developing new opportunities
- Reducing errors, defects, waste and related costs
- Improving responsiveness and cycle time performance
- Increasing productivity and effectiveness in the use of all resources
- Enhancing your organization's performance in fulfilling its public responsibilities and services as a good citizen.

Personal learning can result in the following:

- More satisfied and versatile employees who stay with the organization
- Organizational cross-functional learning
- An improved environment for innovation

Valuing Employees and Partners

An organization's success depends increasingly upon the skills, knowledge, creativity and motivation of its employees and partners. Valuing employee's means committing to their satisfaction, development and well-being. Increasingly, this involves more flexible, high performance work practices tailored to employees with diverse workplace and home life needs. Successful internal and external partnerships develop longer-term objectives, thereby creating a basis for mutual investments and respect.

Agility

Success in global markets demands agility. All aspects of e-commerce require and enable more rapid, flexible and customized responses. Organizations face ever-shorter cycles for the introduction of new and improved products and services, as well as for faster and more flexible response to customers. Major improvements in response time often require simplification of work units and processes and the ability for rapid changeover from one process to another. Cross-trained and empowered employees are vital assets in such a demanding environment.

Focus on the Future

Focus on the future requires understanding the short- and long-term factors that affect an organization and the marketplace. Pursuit of sustainable growth and market leadership requires a strong future orientation and a willingness to make long-term commitments to key stakeholders.

An organization's planning should anticipate many factors such as the following:

- Customers' expectations
- New business and partnering opportunities
- The increasingly global marketplace
- Technological developments
- The evolving e-commerce environment
- New customer and market segments
- Evolving regulatory requirements
- Societal expectations
- Strategic moves by competitors

Management by Fact

Organizations depend on the measurement and analysis of performance. Such measurements should derive from business needs and strategy, and should provide critical data and information about key processes, outputs and results. Many types of data and information are needed for performance management. Performance measurement should include the following:

- Customer, product and service performance
- Comparisons of operation, market and competitive performance

- Supplier, employee and cost and financial performance

Public Responsibility and Citizenship

An organization's leaders should stress the need to practice good citizenship. Basic expectations to adhere to business ethics and protection of public health, safety and the environment should be maintained. Protection of health, safety and the environment includes an organization's operations as well as the life cycles of products and services. Also, organizations should emphasize resource conservation and waste reduction at the source. Planning should anticipate adverse impacts from production, distribution, transportation, use and disposal of products .

Focus on Results and Creating Value

An organization's performance measurements need to focus on key results. Results should be used to create and balance value for key stakeholders-- customers, employees, stockholders, suppliers and partners, public and community. By creating value for key stakeholders, an organization builds loyalty and contributes to growing the economy. To meet the sometimes conflicting and changing aims that balancing value implies, organizational strategy should explicitly include key stakeholder requirements. This will help ensure that actions and plans meet differing stakeholder needs and avoid adverse impacts on any stakeholder. The use of a balanced composite of leading and lagging performance measures offers an effective means to communicate short- and long-term priorities, monitor actual performance and provide a clear basis for improving results.

Systems Perspective

The Baldrige criteria provides a systems perspective for managing an organization to achieve performance excellence. The core values form the building blocks and the integrating mechanism forms the system. However, successful management of overall performance requires organization-specific synthesis and alignment. Synthesis means looking at an organization as a whole and build upon key business requirements, including strategic objectives and action plans. Alignment means using the key linkages among requirements given in the Baldrige categories, including the key measures/indicators.

Strategic planning

Goals and objectives

Goal for long-term planning, objective for short-term planning.

Goals must be based on statistical evidence

Goals must be definitive, specific and understandable, using concrete results rather than behaviors or attitudes.

Seven steps to Strategic Planning

1. *Customer needs*
2. *Customer positioning*
3. *Predict the future*
4. *Gap analysis*
5. *Closing the gap*
6. *Alignment*
7. *Implementation*

- 1 . *Customer Needs*. The first step is to discover the future needs of the customers. Who will they be? Will your customer base change? What will they want? How will the organization meet and exceed expectation?
- 2 . *Customer- Positioning*. Next, the planners determine where the organization wants to be in relation to the customers. Do they want to retain, reduce, or expand the customer base? Products or services with poor quality performance should be targeted for breakthrough or eliminated. The organization needs to concentrate its efforts on areas of excellence.
- 3 . *Predict the future*. Next, the planners must look into their crystal balls to predict future conditions that will affect their product or service. Demographics, economic forecasts, and technical assessments or projections are tools that help predict the future. More than one organization's product or service has become obsolete because it failed to foresee the changing technology. Note that the rate of change is continually increasing.
- 4 . *Gap Analysis*. This step requires the planners to identify the gaps between the current state and the future state of the organization. An analysis of the core values and concepts, given earlier in the chapter, is an excellent technique for pinpointing gaps.
- 5 . *Closing the Gap*. The plan can now be developed to close the gap by establishing goals and responsibilities. All stakeholders should be included in the development of the plan.
- 6 . *Alignment*. As the plan is developed, it must be aligned with the mission, vision, and core values and concepts of the organization. Without this alignment, the plan will have little chance of success.
- 7 . *Implementation*. This last step is frequently the most difficult. Resources must be allocated to collecting data, designing changes, and overcoming resistance to change. Also part of this step is the monitoring activity to ensure that progress is being made. The planning group should meet at least once a year to assess progress and take any corrective action.

Communication:

All organizations communicate with their employees in one manner or another. Communications deliver the organization's values, expectations, and directions; provide information about corporate developments; and allow feedback from all levels. It is very important to keep information flowing back and forth between employees and various levels of management. For instance, managers at different levels communicate messages much in the same way as the head football coach communicates to the assistants who call the plays. The assistants assess what is happening on the field and communicate that back to the head coach, who further directs and motivates. In order for the communication system to be effective, there must be feedback. The culture must encourage two-way communication so that information flows up the ladder as well as down. A formal system to communicate employee concerns to the appropriate person can be instituted. Improving quality will be hampered if poor communications impedes the flow of information to and from the employees. Communications must be effective and not just information overload. Communications must be evaluated to determine that the message was understood and changed attitudes and behaviours. Surveys can be conducted periodically to determine if the organization's key messages are being understood and supported by the employees.

Interactive

The primary communication tool used by XEROX, The Ritz-Carlton Hotel, IBM, Texas Instruments and many more is face-to-face communications supplemented by newsletters.

Motorola uses immediate managers to communicate company goals. Communications training programs can be helpful for supervisors. Managers can communicate one-on-one or in a group setting. The group setting would most likely occur at the beginning of the shift and would cover topics such as quality, productivity, schedule and cost. Effective communication technique is to have

team meetings. This can occur at an informal breakfast or lunch. Interactive communication also occurs electronically by instant messaging and video conferencing.

Formal

Formal communication can occur using the printed page or electronics, such as e-mail or a weekly newsletter. Graphics in the form of charts and diagrams can be used to enhance e-mail and publications.

In MNCs messages must be tailored for different cultures and languages. Internet can be used for external communications and intranet for internal communications. Large multi-site organizations have found that satellite television can be effective medium. The presentations can be videotaped and replayed at other times for the convenience of the employees.

Decision Making

It can be regarded as a mental process (cognitive process) resulting in the selection of a course of action among two or several alternative scenario .Every decision making process produces a final choice. The output can be an action or an opinion of choice. A major part of the decision making involves the analysis of a finite set of alternatives described in terms of some evaluating criteria.

Decision Making Process

1. Outline goal and outcome. These keep one in a specific path.
2. Gather data- will have actual evidence to come up with a solution.
3. Brain storm alternatives- coming up with more than one solution will be able to see which can actually work.
4. List pros and cons of each alternative.
5. Make the decision.
6. Take action.
7. Learn from action and reflect on the decision making.

Module-3 Customer satisfaction and customer involvement

3.1 Introduction

The most important asset of an organization is its customer. An organization's success depends on how many customers it has, how much they buy and how often they buy. Customers that are satisfied will increase in number, buy more and buy more frequently. Satisfied customers also pay their bills promptly, which greatly improves cash flow - the lifeblood of any organization. Figure 1 best exemplifies just how important a customer is to any organization.

Increasingly, manufacturing and service organizations are using customer satisfaction as the measure of quality. The importance of customer satisfaction is not only due to national competition but also due to worldwide competition. This fact is reflected in the Malcolm Baldrige National Quality Awards, where customer satisfaction accounts for 30 percent of the total points. Similarly, customer satisfaction standards are woven throughout ISO 9000:2000. Customer satisfaction is one of the major purposes of a quality management system.

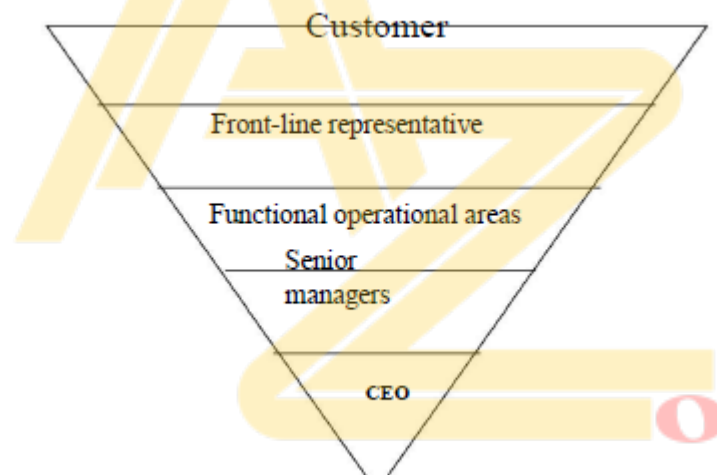


Fig 1: Customer satisfaction organizational diagram

Total Quality Management (TQM) implies an organizational obsession with meeting or exceeding customer expectations, so that customers are delighted. Understanding the customer's needs and expectations is essential to winning new business and keeping existing business. An organization should give its customers a quality product or service that meets their needs at a reasonable price, which includes on-time delivery and outstanding service. To attain this level, the organization needs to continually examine their quality system to see if it is responsive to ever-changing customer requirements and expectations.

A simplistic definition of customer satisfaction is illustrated by the Teboul model (figure 2). The circle represents the customer's needs and the square depicts the product or service offered by the organization. Total satisfaction is achieved when the offer matches the need, or the circle is superimposed on the square. The goal is to cover the expected performance level better than the competitors.

The customer as satisfying perceives that part of the square that lies within the circle and the part of the square outside the circle is perceived as unnecessary. It is important that the organization listens to the —voice of the customer and ensures that its marketing, design, production and distribution processes truly meet the expectations of the customer.

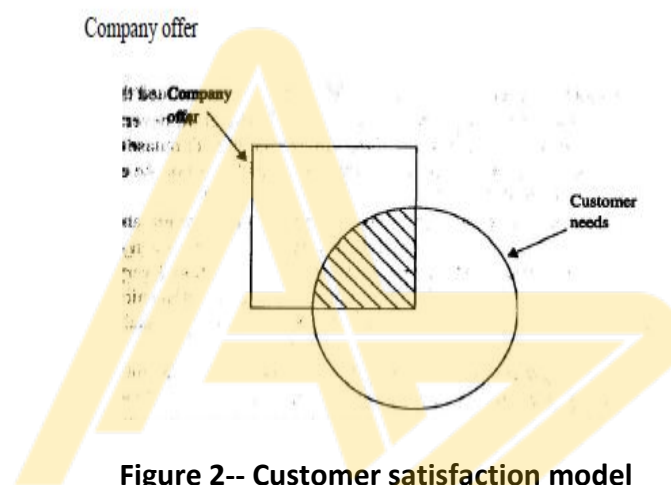


Figure 2-- Customer satisfaction model

3.11 Internal and External Customers

There are two distinct types of customers-- external and internal. An external customer can be defined in many ways, such as the one who uses the product or service, the one who purchases the product or service, or the one who influences the sale of the product or service. For instance, McDonald's determined the customer to be the child when they introduced their —happy meals. The child never paid for the meals but the child influenced the sale. Oftentimes, parents purchase lawnmowers and yet the teenage children use the lawnmowers. The identity of the external customer is not always easy to determine.

An external customer exists outside the organization and generally falls into three categories-- current, prospective and lost customers. Each category provides valuable customer satisfaction information for the organization. Every employee in an organization should know how his or her job enhances the total satisfaction of the external customer. Performance should be continually improved in order to retain existing customers and to gain new ones.

An internal customer is just as important. Every function, whether it is engineering, order processing, or production, has an internal customer-- each receives a product or service and, in exchange, provides a product or service. Every person in a process is considered a customer of the preceding operation. Each worker's goal is to make sure that the quality meets the expectations of the next person. When that happens throughout the manufacturing, sales and distribution chain, the satisfaction of the external customer should be assured.

All processes have outputs which are used by internal or external customers and inputs which are provided by internal or external suppliers. Each supplier performs work that produces some service or product that is used by another customer. As shown by figure 3, each forms a link in the customer/supplier chain where every chain ends with an external customer and starts with an external supplier. Every employee throughout the organization is part of the chain of internal customers and suppliers

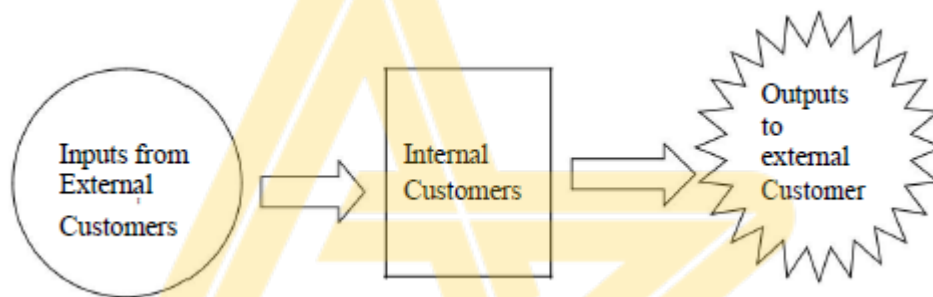


Figure 3-- Customer/supplier chain

3.2 Customer Perception of Quality***

One of the basic concepts of the TQM philosophy is continuous process improvement. This concept implies that there is no acceptable quality level because the customer's needs, values and expectations are constantly changing and becoming more demanding.

Before making a major purchase, some people check consumer magazines that rate product quality. During the period 1980 to 1988, the quality of the product and its performance ranked first, price was second and service was third. During the period 1989 to 1992, product quality remained the most important factor, but service ranked above price in importance.

An American Society for Quality (ASQ) survey on end user perceptions of important factors that influenced purchases showed the following ranking:

1. Performance
2. Features
3. Service
4. Warranty
5. Price
6. Reputation

The factors of performance, features, service and warranty are the parts of a product or service quality. Therefore, it is evident that product quality and service are more important than price. Although this information is based on the retail customer, it appears, to some extent, to be true for the commercial customer also.

1. Performance

Performance involves —fitness for use. It is a phrase that indicates that the product and service is ready for the customers use at the time of sale. Other considerations are as follows:

- Availability which is the probability that a product will operate when needed
- Reliability which is freedom from failure over time
- Maintainability which is the ease of keeping the product operable

2. Features

Identifiable features or attributes of a product or service are psychological, time-oriented, contractual, ethical and technological. Features are secondary characteristics of the product or service. For example, the primary function of an automobile is transportation, whereas a car stereo system is a feature of an automobile.

3. Service

An emphasis on customer service is emerging as a method for organizations to give the customer-added value. However, customer service is an intangible, i.e. it is made up of many small things, all geared to changing the customer's perception. Intangible characteristics are those traits that are though not quantifiable yet contribute greatly to customer satisfaction. Providing excellent customer service is different from and more difficult to achieve than excellent product quality. Organizations that emphasize service never stop looking for and finding ways to serve their customers better, even if their customers are not complaining. For instance, at Baptist Hospital in Pensacola, FL, janitors, after cleaning a room, ask if there is anything they can do for the patient. Often patients will have a request for a window shade to be drawn or a door closed.

4. Warranty

A product warranty represents the organization's public promise of a quality product backed up by a guarantee of customer satisfaction. Ideally, it also represents a public commitment to guarantee a level of service sufficient to satisfy the customer. A warranty forces the organization to focus on the customer's definition of product and service quality. An organization has to identify the characteristics of product and service quality and the importance the customer attaches to each of those characteristics. A warranty generates feedback by providing information on the product and service quality. It also forces the organization to develop a corrective action system.

Finally, a warranty builds marketing muscle. The warranty encourages customers to buy a service by reducing the risk of the purchase decision and it generates more sales from existing customers by enhancing loyalty.

5. Price

Today's customer is willing to pay a higher price to obtain value. Customers are constantly evaluating one organization's products and services against those of its competitors to determine who provides the greatest value. However, in our highly competitive environment, each customer's concept of value is continually changing. Ongoing efforts should be made by everyone having contact with customers to identify, verify and update each customer's perception of value in relation to each product and service.

6. Reputation

Most of us find ourselves rating organizations by our overall experience with them. Total customer satisfaction is based on the entire experience with the organization, not just the product. Good experiences are repeated to six people and bad experiences are repeated to 15 people. Therefore, it is more difficult to create a favorable reputation.

3.3 Feedback ***

Customer feedback should be continually solicited and monitored as customers continually change. They change their minds, their expectations and their supplier. Customer feedback is not a one-time effort. In fact, it is an ongoing and active probing of the customer's mind. Feedback enables the organization to do the following:

- Discover customer dissatisfaction
- Discover relative priorities of quality
- Compare performance with the competition

- Identify customers' needs
- Determine opportunities for improvement

Listening to the voice of a customer can be accomplished by numerous information collecting tools. The principal ones are the following:

1. Comment cards
2. Questionnaires
3. Focus groups
4. Toll free telephone lines
5. Customer visits
6. Report cards
7. The Internet
8. Employee feedback
9. Mass customization
10. The American Customer Satisfaction Index

1. Comment Card

A low-cost method of obtaining feedback from customers involves a comment card. It can be attached to the warranty card and included with the product at the time of purchase. The intent of the card is to get simple information, such as name, address, age, occupation and what influenced the customer's decision to buy the product. However, there is very little incentive for buyers to respond to this type of card and the quality of the response may not provide a true measure of customer's feeling. Generally, people respond only if something very good or very bad has happened. Comment cards are also used in the hospitality industry. Restaurants and hotels provide them at the ends of tables and in hotel rooms. They can even be found at the bottom of the restaurant sales receipts. Often, free meals or hotel stays are provided to rectify a poor experience noted on the comment card. Free meals and hotel stays can generate significant customer loyalty provided the organization also fixes the problems.

2. Customer Questionnaire

A customer questionnaire is a popular tool for obtaining opinions and perceptions about an organization and its products and services. However, they can be costly and time consuming. Surveys may be administered by mail or telephone. In the form of questionnaires, the customer is asked to furnish answers relating to the quality of products and services. One of the reasons the one-to-five or one-to-ten scale is used is because it easily produces a metric. For example, see the spouse satisfaction survey in figure 4.

		Highly Satisfied		Neutral	Highly Dissatisfied	
1.	Trash removal	5	4	3	2	1
2.	Personal hygiene	5	4	3	2	1
3.	Lawn maintenance	5	4	3	2	1
4.	Romance	5	4	3	2	1
5.	Thoughtfulness	5	4	3	2	1
6.	Listening skills	5	4	3	2	1
7.	Faithfulness	5	4	3	2	1
8.	Respect for mother-in-law	5	4	3	2	1
9.	Overall, how satisfied are you with your marriage?	5	4	3	2	1

Figure 4 : Spouse satisfaction survey-- A typical approach

Trash removal

How often do you expect the trash to be taken out by your spouse?
 _____ Not at all _____ Daily _____ When it's full _____ When reminded
 _____ When the stench arouses the anger of the neighbors

How often would you like the trash to be taken out by your spouse?
 _____ Not at all _____ Daily _____ When it's full _____ When reminded
 _____ When the stench arouses the anger of the neighbors

How often is the trash taken out by your spouse?
 _____ Not at all _____ Daily _____ When it's full _____ When reminded
 _____ When the stench arouses the anger of the neighbors

How satisfied are you with your spouse's trash removal?
 _____ Very Dissatisfied _____ Dissatisfied _____ Neutral _____ Satisfied _____

I Fantasize about it

On a scale of 1 to 8, please rank the importance of the following to happiness of your marriage, where 1 equals most important.

_____ Trash removal	_____ Thoughtfulness
_____ Personal hygiene	_____ Listening skill
_____ Lawn maintenance	_____ Faithfulness
_____ Romance	_____ Respect for mother-in-law

Figure 5-- Spouse satisfaction survey-- The right way

Although one- to-five scale is a typical approach to survey yet it probably is not entirely effective. It neither tells the surveyor how important trash removal is relative to other qualities

nor does it tell what the spouse wants or expects. A better way to do a spouse satisfaction survey is shown in figure 5.

3. Focus Groups

Customer focus groups are a popular way to obtain feedback, but they too can be very expensive. These groups are very effective for gathering information on customer expectations and requirements.

Surveying a focus group is a research method used to find out what customers are really thinking. A group of customers is assembled in a meeting room to answer a series of questions. These carefully structured questions are asked by a skilled moderator who probes into the participants' thoughts, ideas, perceptions or comments. Focus groups are sometimes used with an organization's employees to examine internal issues.

4. Toll Free Telephone Numbers

Toll free telephone numbers are an effective technique for receiving complaint feedback. With the help of these, organizations can respond faster and more cheaply to the complaint. Such a number does not, however, reach those who decided not to buy the product or those who discovered some likable feature(s) on a competitor's product. Toll free numbers are in use by at least 50% of all organizations with sales of at least \$10 million.

5. Customer Visits

Visits to a customer's place of business provide another way to gather information. An organization can proactively monitor its product's performance while it is in use and thereby identify any specific or recurring problems. Senior managers should be involved in these visits and not delegate them to someone else.

6. Report Card

Another very effective information-gathering tool is the report card. Figure 6 shows a typical report card. It is usually sent to each customer on a quarterly basis. The data are analyzed to determine areas for improvement. For instance, the University of California in San Diego uses a report card to grade the quality of campus business services such as the payroll department and the bookstore.

Quality Report Card

To our customers

We are continually striving to improve. To assist us in this endeavor, we need your feedback. Would you please grade our performance in each category? The grading scale is as follows:

A = Excellent
 B = Very good
 C = Average
 D = Poor
 F = Failing

1. Product Quality Grade _____
 Comments: _____

2. On-Time Delivery Grade _____
 Comments: _____

3. Services Grade _____
 Comments: _____

4. Overall Grade _____
 Comments: _____

Signed _____ Date _____
 Title _____ Organization _____

Figure 6 Sample report card

7. The Internet and Computers

Some managers are beginning to monitor discussions that take place on the Internet to find out what customers are saying about their products. Internet users frequently seek advice regarding their everyday activities or activities related to specific interests, hobbies or sports. Newsgroups, electronic bulletin boards and mailing lists can be scanned using keyword searches if one knows that company's product is of interest to participants in certain activities, hobbies or professions.

8. Employee Feedback

Employees are often an untapped source of information. Companies are listening more to the external customer but are still not listening to employees. Employees can offer insight into conditions that inhibit service quality in the organization. Employee groups can brainstorm ideas to come up with solutions to problems that customers have identified.

9. Mass Customization

The ultimate in customer satisfaction is giving customers exactly what they want. In the past, the price tag for this was prohibitive. But mass customization is a way to provide variety at an affordable cost. It is a direct result of advances made in manufacturing, such as flexible manufacturing technologies, just-in-time systems and cycle time reduction. It has been done in the car industry for years. Customers determine what type of seat coverings, color and stereo system they want. Mass customization is now being used in many other industries too. For instance, Levi Strauss customers are measured for jeans, choose the fabric and choose the pattern at a local store. The custom fit jeans are then manufactured to order at a central factory and sent to the local store. The voice of the Levi Strauss customer is heard at the fabrication stage of production.

The voice of a customer can be captured in mass customized products by using the hard data of what the customer bought instead of what the customer was thinking about buying. The customer satisfaction information obtained from mass customization can be used to provide more standardized products. The voice of the purchasing customer, however, provides no information about the non-purchasing customer. Figure 16.4 helps in better understanding the customer's involvement in mass customization.

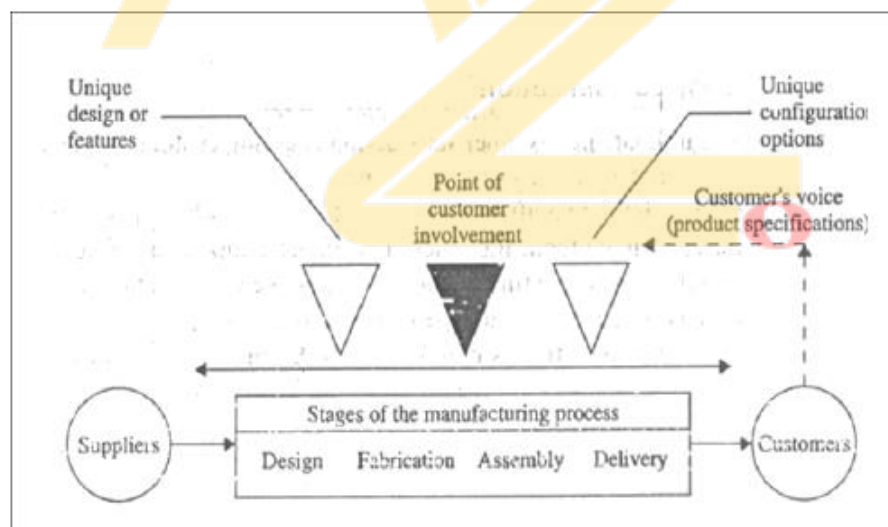


Figure 7 Point of customer improvement

3.4 Service Quality

Strategies that have produced significant results in production are often harder to implement in a service environment. Thanks to the teachings of Deming, Juran and others, significant strides have been made in manufacturing. The same results have been slower in service organizations or service activities in manufacturing.

Customer service is the set of activities an organization uses to win and retain customer's satisfaction. It can be provided before, during or after the sale of the product or exist on its own. The elements of customer services are as follows:

1. Organization

- Identify each market segment
- Write down the requirements
- Communicate the requirement
- Organize processes
- Organize physical spaces

2. Customer Care

- Meet the customer's expectations
- Get the customer's point of view
- Deliver what is promised
- Make the customer feel valued
- Respond to all complaints
- Over-respond to the customer
- Provide a clean and comfortable customer reception area

3. Communication

- Optimize the trade-off between time and personal attention
- Minimize the number of contact points
- Provide pleasant, knowledgeable and enthusiastic employees
- Write documents in customer-friendly language

4. Front-Line People

- Hire people who like people
- Challenge them to develop better methods
- Give them the authority to solve problems
- Serve them as internal customers
- Be sure they are adequately trained
- Recognize and reward performance

5. Leadership

- Lead by example
- Listen to the front-line people
- Strive for continuous process improvement.

3.4 Translating Needs into Requirements

The Kano model (figure 8) conceptualizes customer requirements. The model represents three major areas of customer satisfaction. The first area of customer satisfaction, represented by the diagonal line, represents explicit requirements. These include written or verbal requirements. These are easily identified, are expected to be met and are typically performance related. Satisfying the customer would be relatively simple if these were the only requirements.

The second area of customer satisfaction represents innovations, as shown by the curved line in the upper left corner of the figure. A customer's written instructions are often purposefully vague to avoid stifling new ideas during conceptualization and product definition. Because they are unexpected, these creative ideas often excite and delight the customer. These ideas quickly become expected.

The third and most significant area of customer satisfaction represents unstated or unspoken requirements, as shown by the curve in the lower right corner of the figure. The customer may indeed be unaware of these requirements, or they may assume that such requirements will be automatically supplied. Basic specifications often fail to take real world manufacturing requirements into account. Many of them are merely based on industry standards or past practice. These implied requirements are the hardest to define but prove very costly if ignored. They may be rediscovered during an after-the-fact analysis of lessons learned.

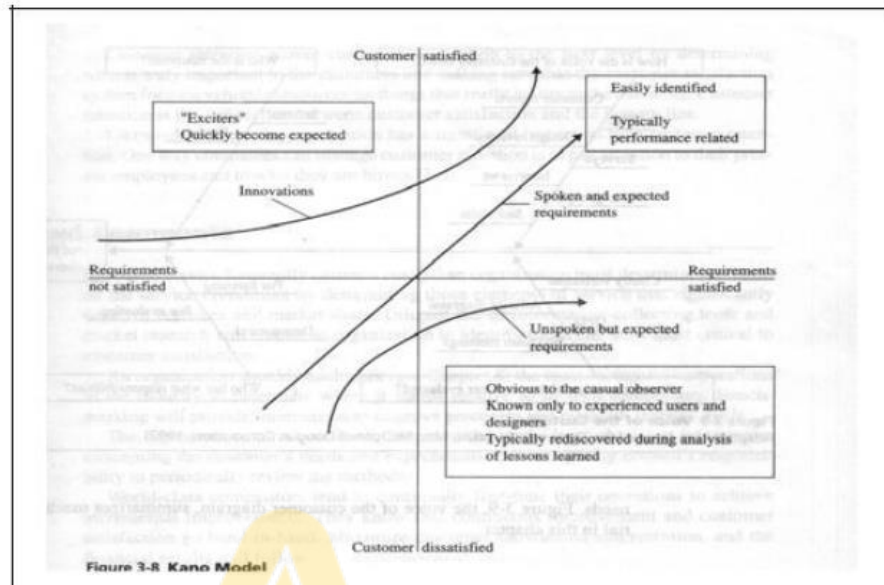
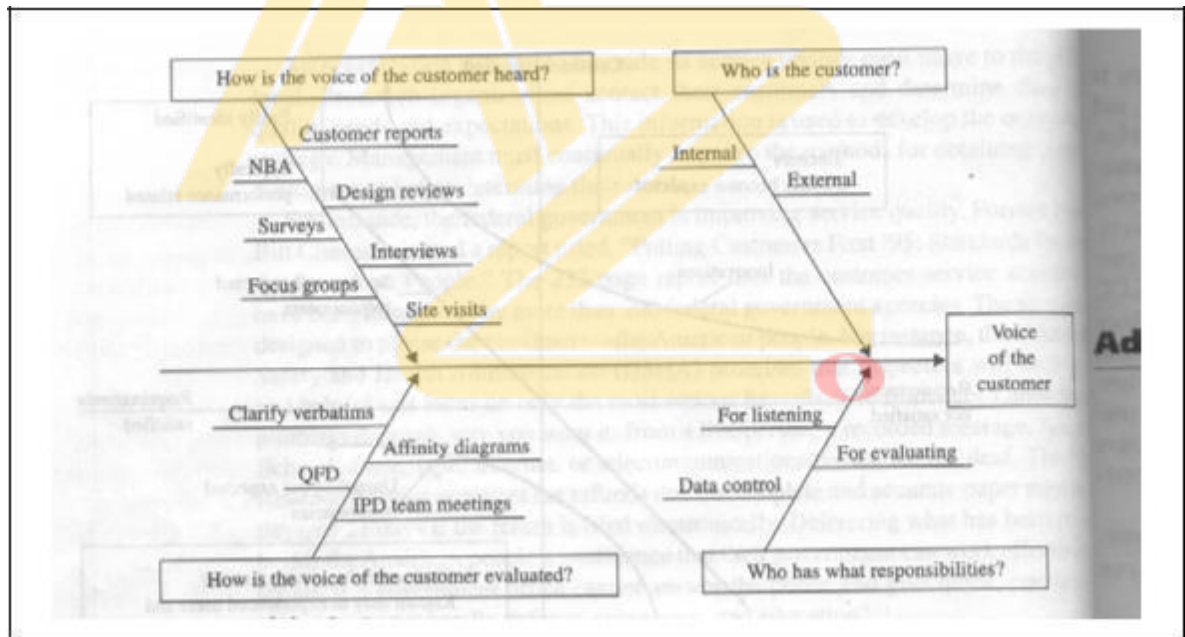


Fig 8 Kano model

The organization should exceed the customer's needs. Figure 9



3.5 Customer Retention

Customer retention is more powerful and effective than customer satisfaction. It represents the activities that produce the necessary customer satisfaction which creates customer loyalty and which actually improves the bottom line. Customer satisfaction surveys,

focus groups, interviews and observations can help determine what customers think of a service or a product. However, what people say and think is often different from what they do. Customers may be delighted with the tropical oils and aromas in a high-priced, well-advertised hair care product but still end up buying the generic equivalent. Therefore, customer satisfaction should also be measured by using the hard measures of cash register receipt, market share, the level of customer retention and the number of referrals from customers.

Employee involvement

Employee involvement is one approach to improve quality and productivity. It is a means to better meet the organization's goals for quality and productivity.

3.5 Motivation

Employee Involvement - any activity by which employees participate in work-related decisions and improvement activities, with the objectives of tapping the creative energies of all employees and improving their motivation; EI is rooted in the psychology of human need and supported by the motivation models of Maslow, Herzberg, and McGregor.

Maslow's Hierarchy of Needs



Fig 10. Maslow's Hierarchy of Needs

Maslow (1943, 1954) stated that people are motivated to achieve certain needs and that some needs take precedence over others. Our most basic need is for physical survival, and this will be the first thing that motivates our behavior. Once that level is fulfilled the next level up is what motivates us, and so on.

- 1. Physiological needs** are the need at the bottom of the triangle and include the lowest order need and most basic. This includes the need to satisfy the fundamental biological drives such as food, air, water and shelter. According to Maslow organizations must provide employees with a salary that enable them to afford adequate living conditions. The rationale here is that any hungry employee will hardly be able to make much of any contribution to his organization.
- 2. Safety needs** this occupies the second level of needs. Safety needs are activated after physiological needs are met. They refer to the need for a secure working environment free from any threats or harms. The rationale is that employees working in an environment free of harm do their jobs without fear of harm.
- 3. Social needs:** This represents the third level of needs. They are activated after safety needs are met. Social needs refer to the need to be affiliated that is (the needed to be loved and accepted by other people). To meet

these needs organizations encourage employees participation in social events such as picnics, organizations bowling etc.

4. **Esteem needs** this represents the fourth level of needs. It includes the need for self-respect and approval of others. Organizations introduce awards banquets to recognize distinguished achievements.
5. **Self-actualization:** This occupies the last level at the top of the triangle. This refers to the need to become all that one is capable of being to develop ones fullest potential. The rationale here holds to the point that self-actualized employees represent valuable assets to the organization human resource.



Module - 4

Continuous Process Improvement

Continuous process improvement is designed to utilize the resources of the organization to achieve a quality-driven culture.

Improvement is made by

- Viewing all work as process.
- All process effective, efficient and adaptable.
- Anticipating changing customer needs.
- Controlling in-process performance using measures such as scrap reduction, control charts
- Eliminating waste and re-work.
- Eliminating non-value added activities.
- Eliminating non-conformities.
- Using Benchmarking.
- Incorporating learned lessons into future activities.
- Using technical tools such as SPC, benchmarking, experimental design, QFD etc.

PROCESS

Process refers to business and production activities of an organization.

- **Processes for improvement**-eg. Design & Manufacturing, Marketing, Stores & Purchase,
- **Inputs of the Process**- Manpower, materials, money, data, etc.
- **Outputs**- Products, Services, data etc.
- Outputs need performance measures – main outcome being customer satisfaction.(**feedback** is used to improve the process)

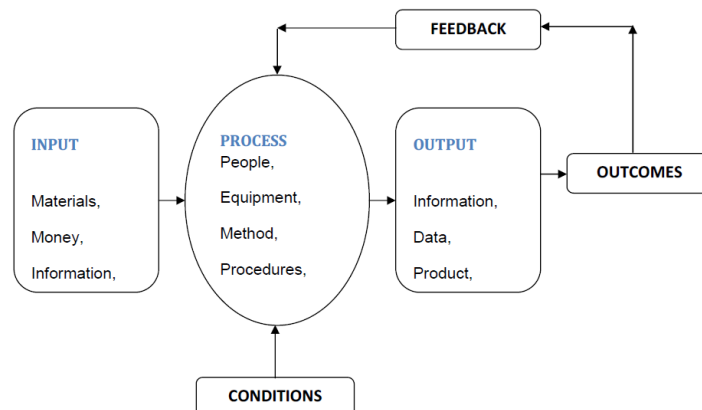


Fig. 4.1 Input / Output Process Model

There are five basic ways for improvement.

- Reduce resources.
- Reduce errors.
- Meet or exceed expectations of downstream customers.
- Make the process safer.
- Make the process more satisfying to the person doing it.

The Juran Trilogy Diagram

The Juran Trilogy consist three components - PLANNING, CONTROL AND IMPROVEMENT

Juran views quality as fitness for use.

Juran Trilogy is designed to reduce the cost of quality over time.

1. QUALITY PLANNING

1. Determine internal & external customers.
2. Their needs are discovered.
3. Develop product / service features.
4. Develop the processes able to produce the product / service features.
5. Transfer plans to operations.

2. QUALITY CONTROL

Control is used by operating forces to help meet the product, process and service requirements.

It consists of the following steps

1. Determine items to be controlled.
2. Set goals for the controls.
3. Measure actual performance.
4. Compare actual performance to goals.
5. Act on the difference.

3. QUALITY IMPROVEMENT

Aims to attain levels of performance that are higher than current levels.

It consists of the following steps

1. Establishment of quality council.
 2. Identify the improvement projects.
 3. Establish the project teams with a project leader.
 4. Provide the team with the resources.
- Juran developed the quality trilogy-- quality planning, quality control and quality improvement.
 - These three processes of the Juran trilogy are interrelated.

- The Juran trilogy diagram is a graph with time on the horizontal axis and cost of poor quality on the vertical axis (refer to figure 2).
- The initial activity is quality planning. The planners identify the customers and their needs. Then, they develop product and process designs to respond to those needs. Finally, the planners turn the plans over to the operating forces, “You run the process, produce the product features and meet the customers’ needs.”

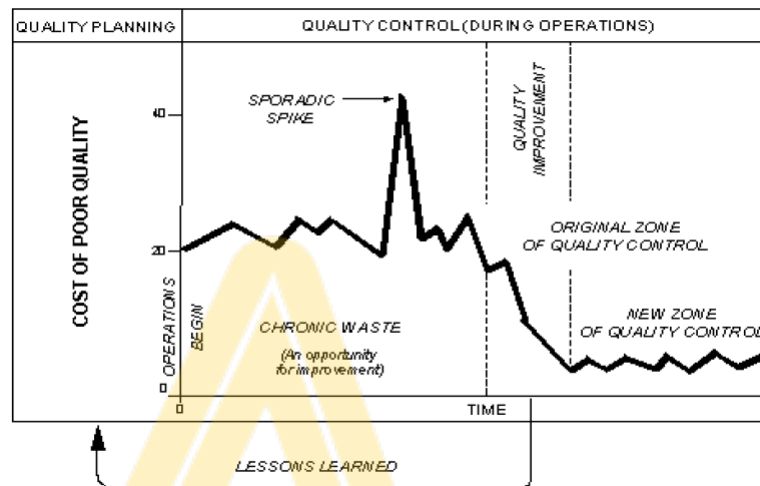


Fig.4. 2-- The Juran trilogy diagram

Chronic and Sporadic

- As operations proceed, it soon emerges that the process is unable to produce 100 percent good work. Fig. 2 shows that over 20 percent of the work usually has to be redone due to quality deficiencies. This waste is chronic as it goes on and on.
- The reason of this chronic waste is the wrong planning of operating process. What they can do is to carry out quality control, i.e. to prevent things from getting worse.
- Fig. 2 also shows a sudden sporadic spike that has raised the defect level to over 40 percent. This spike might be resulted from some unplanned event such as a power failure, process breakdown, or human error.
- As a part of their job of quality control, the operating forces converge on the scene and take action to restore the status quo. This is often called “corrective action,”
- “Troubleshooting,” “putting out the fire” and so on. The end result is to restore the error level back to the planned chronic level of about 20 percent.
- The figure also shows that, in due course, the chronic waste was driven down to a level far below the original level. This gain came from the third process in the trilogy--quality improvement.

- In effect, it was seen that the chronic waste was an opportunity for improvement and steps were taken to make that improvement.

The Trilogy Diagram and Product Deficiencies

The trilogy diagram relates to product deficiencies. The vertical scale exhibits units of measure such as cost of poor quality, error rate, percent defective, service rate and so on. On this same scale, perfection is at zero and what goes up is bad. The results of reducing deficiencies are reduction of the cost of poor quality, meeting more delivery promises, reduction of customer dissatisfaction and so on.

PDCA Cycle

It is an extremely practical, common sense based approach that is easy to understand. It can be used to test ideas for improvement quickly and easily based on existing ideas, research, feedback, theory, review, audit, etc. It encourages starting with small changes, which can build into large improvements in the service through successive quick cycles of change.



Phases Description

1. Plan

- Define the problem
- Analyse the causes and draft an action plan for solving the problem.
- Determine the quality objectives and the critical factors.
- Define the performance indicators.
- Collect and analyse the necessary process data.
- Generate possible solutions
- Select the most feasible solution; and work it out.

2. Do

- First, implement the plan on a limited scale or conduct an experiment to test the proposed improvement. Collection data is hereby essential.

- Train all involved employees in the use of quality improvement methods and techniques.
- Describe the process which is considered for improvement and form project teams to lead the process.

3. Check

- Evaluate the trial project with the performance indicators.
- Verify whether the improvement has been successful or not.

4. Act

- Act to implement proven improvements. The choices are: introduce the plan, adjust or reject it.
- The improvements are documented in standard procedures so all employees are well informed on how to handle in future.
- Usually, the cycle will be repeated under the different circumstances and conditions to test how consistent the results are.

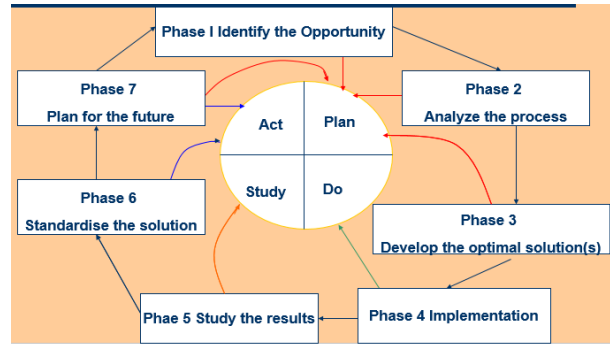
PROBLEM SOLVING METHOD

1. Identify the Opportunity

- Identify the Problem
- Pareto analysis of external alarm signals such as field analysis, such as field failures, complaints, returns etc.
- Pareto analysis of internal alarm signals such as scrap, rework, sorting etc.
- Proposals from key insiders such as managers, supervisors, union leaders etc.
- Proposals from suggestion schemes.
- Field study of user's needs.
- Comments of key people outside the organization.
- Customer surveys.
- Employee surveys.
- Brainstorming by work groups.

Form the Team

- Team should be selected.
- Goals and milestones are established.
- Define the Scope.



2. Analyze the Current Process

The objective is to understand the process and how it is currently performed.

Step 1: The team to develop a process flow diagram.

Step 2: The target performance measures are defined.

Step 3: Collection of all available data and information.

Common items of data and information are

- | | | | |
|-------------------------|-------------------------|------------------------|----------------------------|
| 1. Customer information | 2. Design information | 3. Process information | 4. Statistical information |
| 5. Quality information | 6. Supplier information | | |

3. Develop the Optimal Solution(S)

This phase has the objective of establishing potential and feasible solutions and recommending the best solution to improve the process. Creativity plays the major role, and brainstorming is the principal technique.

There are three types of creativity:

- Create new processes
- Combine different processes
- Modify the existing process

4. Implement Changes

This phase has the objective of preparing the implementation plan, obtaining approval and implementing the process improvements.

- Approval of the quality council.
- Obtain the advice and consent of departments, functional areas, teams, individuals etc.
- Monitor the activity.

5. Study the Results

This phase has the objective of monitoring and evaluating the change by tracking and studying the effectiveness of the improvement efforts.

6. Standardize the Solution

- Institutionalize by positive control of the process.
- The quality peripherals – the system, environment and supervision must be certified.
- Operators must be certified.

7. Plan for the Future

- The objective is to achieve improved level of process performance.
- Regularly conduct reviews of progress by the quality council.
- Establish the systems to identify area for future improvements.
- Track performance with respective internal & external customers.
- TQM tools and techniques are used to improve quality, delivery and cost.

Benefits of the PDSA Cycle

The benefits of the PDSA cycle can be experienced in the following areas:

- Daily routine management – for the individual and / or the team.
- Problem-solving process.
- Project management
- Continuous development
- Vendor development
- Human resources development
- New product development
- Process trials

Introduction to Kaizen

- Kaizen- defines the management's role in continuously encouraging and implementing small improvements in the individual & organization.
- Break the complex process into sub-processes and then improve the sub-processes.
- Continuous improvements in small increments make the process more efficient, controllable and adaptable.
- Does not rely on more expense, or sophisticated equipment and techniques.

The kaizen improvement focus on the following factors.

- Value and non-value added work activities
- Muda-which refers to seven classes of waste such as over production, delay, transportation, processing, inventory, motion, and defective components.
- Principles of time and motion study
- Principles of materials handling and use of one-piece flow

- Documentation of standard operating procedures
- The 5S's
- Visual displays for communicating to factory personnel
- JIT- to produce right quantities at right time and with right resources
- Poka-yoke to prevent or detect errors
- Team dynamics – problem solving, communication, conflict resolution.

One of the key aspects of Kaizen is that it is an on-going, never-ending improvement process.

- The concept of continuous improvement is applied in all directions. Industrial processes and working methods can be improved.
- Quality defects can be eliminated and waste can be reduced.
- Customer service can be made better. The work environment can be improved.

What is 5s and why do we want to do it?

5S represents five disciplines for maintaining a visual workplace. These are foundational to Kaizen and a manufacturing strategy based "Lean Manufacturing" concepts. 5S is the starting point for improvement activities that ensure our company's survival. The five disciplines are:

1. Sort

Remove all items from the workplace that are not needed for current operations. Leave only the bare essentials.

2. Set in Order

Arrange needed items so that they are easy to find, use and put away.

3. Shine

Sweeping, wiping-off equipment, painting and assuring everything stays clean.

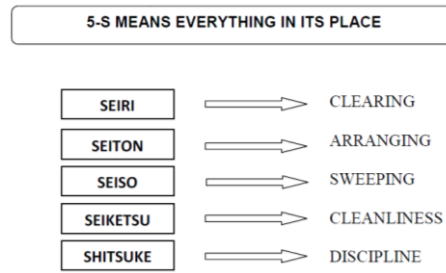
4. Standardize

Method to maintain the first three disciplines (sort, set-in-order, and shine)

5. Sustain

A top-down support of the ongoing 5S process should:

- Create the conditions to support 5S
- Allocate time
- Create awareness
- Provide a structure
- Show support
- Offer rewards and recognition
- Encourage training/participation



Kaizen and Innovation

Innovation means to make improvements by investing a large sum of money in equipment, or introducing a latest technology to make a big change. While Kaizen subscribes to a gradual improvement, innovation subscribes to a big revolutionary change. In today's stagnant business environment, Kaizen may be a more desirable alternative than innovation.

	Kaizen	Innovation
1. Effect	Long-term and long-lasting but un-dramatic	Short-term but dramatic
2. Pace	Small steps	Big steps
3. Timeframe	Continuous and incremental	Intermittent and non-incremental
4. Change	Gradual and constant	Abrupt and volatile
5. Involvement	Everybody	Select few "champions"
6. Approach	Collectivism, group efforts, systems approach	Rugged individualism, individual ideas and efforts
7. Mode	Maintenance and improvement	Scrap and rebuild
8. Spark	Conventional know-how and state of the art	Technological breakthroughs, new inventions, new theories
9. Practical requirements	Requires little investment but great effort to maintain it	Requires large investment but little effort to maintain it
10. Effort orientation	People	Technology
11. Evaluation criteria	Process and efforts for better results	Results for profits
12. Advantage	Works well in slow-growth economy	Better suited to fast-growth economy

REENGINEERING

Reengineering is the systematic transformation of an existing system into a new form to realize quality improvements in operation, system capability, functionality, performance, or evaluability at a lower cost, schedule, or risk to the customer."

Why Reengineering?

- Evolutionary reasons
- Current system lacks desired functionality (new technology)

- Time and Money savings
- Less cost than a new system
- Quicker to Implement
- Increased Developer Productivity

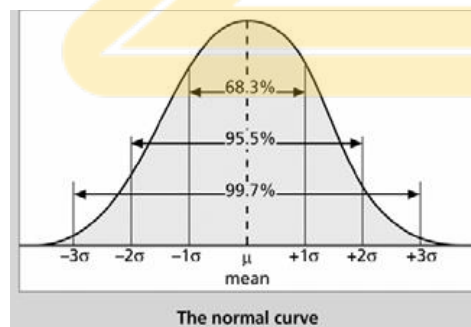
SIX SIGMA

Sigma

The term sigma means standard deviation. Standard deviation measures how much variation exists in a distribution of data. It is a key factor in determining the acceptable number of defective units found in a population. Six sigma projects strive for no more than 3.4 defects per million opportunities, yet this number is confusing to many statisticians.

Standard Deviation

Small standard deviation means that data cluster closely around the middle of a distribution and there is little variability among the data. Normal distribution is the bell-shaped curve that is symmetrical about the mean or average value of a population.



Definition

Six sigma at many organizations simply means a measure of quality that strives for near-perfection. Six sigma is a disciplined, data-driven approach and methodology for eliminating defects (driving toward six standard deviations between the mean and the nearest specification limit) in any process-- from manufacturing to transactional and from product to service.

- **Six sigma** stands for six standard deviation from mean (sigma is the Greek letter used to represent standard deviation in statistics).
- Six sigma, similar to Zero Defect (ZD), is a philosophical benchmark or standard of excellence proposed by Philip Crosby.
- Six sigma methodology provides the techniques and tools to improve the capability and reduce the defects in any process.
- It was started by Motorola in 1987, in its manufacturing division.
- Six sigma strives for perfection. **It allows for only 3.4 defects per million opportunities (or 99.999666 percent accuracy).** Here a defect can be anything from a faulty party to an incorrect customer bill.
- Six sigma improves the process performance, decrease variation and maintains **consistent quality** of the process output. This leads to defect reduction and improvements in profits, product quality and customer satisfaction.
- Six sigma incorporates the basic principles and techniques used in business, statistics and engineering.
- **The objective of six sigma principle** is to achieve zero defects products/process. It allows 3.4 defects per million opportunities.
- Unlike the statistical term, “sigma” is a measure of conformance to specification. Table 12.1 shows examples.

Six Sigma and Defective Units

Table 12.1-- Data for the short-term process output

Specification Range (in +/- Sigmas)	Percent of Population Within Range	Defective Units Per Billion
1	68.27	317,300,000
2	95.45	45,400,000
3	99.73	2,700,000
4	99.9937	63,000
5	99.999943	57
6	99.9999998	2

As non-conforming rate decreases, “sigma” rating increases. The sigma rating is based on the distribution of a process output as related to a customer requirement. Figure 12.2 shows the short-term process output (solid blue) which is centered in the specification. The short-term variability of the process output is such that the Upper Specification Limit (USL) and the Lower

Specification Limit (LSL) are both six standard deviations (called σ or sigma in statistical parlance) away from the center. Recognizing that most of the processes shift somewhat over

a long period of time, an arbitrary change of plus or minus 1.5σ is expected to happen, leaving

4.5σ between the shifted average and the specification limit. This means that a process running at a six sigma level in the short term can tolerate a relatively large amount of drift and still make only 3.4 PPM nonconforming over the long term with the dashed blue line.

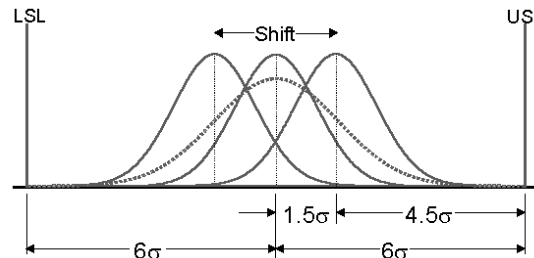


Figure 12.2-- Short-term process output

Phases of Six Sigma

There are six generic implementation phases for six sigma. These are as follows:

- Establish management commitment
- Business diagnostics
- Develop the management infrastructure
- Business process identification and metrics
- Project selection
- Deployment
- Training
- Project execution
- Review

DMAIC methodology provides a structured framework for solving business problems by assuring correct and effective process execution.

This methodology has 6 phases in which, in the case of Six Sigma, teams take total employee involvement approaches to complete the cycle of process management and use self-diagnosis skills to fulfil the goals of each phase.

DMAIC – It is used for improving existing processes/products.

DMADV – It is applied to a new processes/products.

Why is it important?

World-class companies typically operate at about four sigma or 99% perfection. To get to the six-sigma level means cutting down on huge costs and thereby wasted dollars. For example, if you were at four-sigma level, you would be producing products at the rate of 6,200 defectives for every million you produce vs. 3.4 defectives if you are at the six-sigma level. The popularity of six sigma is growing.

Each Six Sigma project carried out within an organization follows a defined sequence of steps and has quantified value targets, for example: reduce process cycle time, reduce pollution, reduce costs, increase customer satisfaction, and increase profits.

Some of the companies that have successfully implemented six sigma are as follows:

- | | | |
|--------------------|-----------------------------|---------------|
| 1. Motorola (1987) | 2. Texas Instruments (1988) | 3. IBM (1990) |
| 4. GE (1995) | 5. Whirlpool | 6. Sony |
| 7. Honda | 8. Hitachi | 9. Canon etc. |

Recently, Ford, DuPont, Dow Chemical, Microsoft and American Express have started working on instituting six sigma processes.

Application of six sigma

Today six sigma can apply to many fields such as services, medical and insurance procedures, call centers etc.,

Pareto and Process Flow Diagram

4.1 Pareto Diagram

Alfredo Pareto (1848-1923) conducted extensive studies of distributions of wealth in Europe. He found that there were a few people with a lot of money and many people with little money. This unequal distribution of wealth became an integral part of economic theory. Dr. Joseph Juran recognized this concept as a universal truth that could be applied to many fields. He coined the phrases —vital few and —useful many.

In restaurant quality problems, the activity could be customer complaints and the factor could be —discourteous customer. For a manufacturer, the activity could be product defect and a factor could be —missing product. Pareto concept, called the 80/20 rule, is that 80 percent of the activity is caused by 20 percent of factors. By concentrating on the 20 percent of the factors (the vital few), a manager can attack 80 percent of the quality problems.

Examples of the vital few are as follows:

- A few customers account for the majority of sales.
- A few processes account for the bulk of the scrap or rework cost.
- A few nonconformities account for the majority of customer complaints.
- A few suppliers account for the majority of rejected parts.
- A few problems account for the bulk of the process downtime.
- A few products account for the majority of the profit.
- A few items account for the bulk of the inventory cost.

Some Sample 80/20 Rule Applications

- 80% of process defects arise from 20% of the process issues.
- 20% of your sales force produces 80% of your company revenue.

- 80% of delays in schedule arise from 20% of the possible causes of the delays.
- 80% of customer complaints arise from 20% of your products or services.

The few vital factors can be identified with a Pareto chart or diagram, a bar chart on which the factors are plotted in decreasing order of frequency along the horizontal axis. The chart has two vertical axes, the one on the left showing frequency (as in a histogram) and the one on the right showing the cumulative percentage of frequency. The cumulative frequency curve identifies the few vital factors that warrant immediate managerial attention.

Construction

- Determine the categories and the units for comparison of the data, such as frequency, cost or time.
- Total the raw data in each category and then determine the grand total by adding the totals of each category.
- Reorder the categories from largest to smallest.
- Determine the cumulative percent of each category (i.e. the sum of each category plus all categories that precede it in the rank order, divided by the grand total and multiplied by 100).
- Draw and label the left-hand vertical axis with the unit of comparison, such as frequency, cost or time.
- Draw and label the horizontal axis with the categories. List from left to right in rank order.
- Draw and label the right-hand vertical axis from 0 to 100 percent. The 100 percent should line up with the grand total on the left hand vertical axis.
- Beginning with the largest category, draw in bars for each category representing the total for that category.
- Draw a line graph beginning at the right hand corner of the first bar to represent the cumulative percent for each category as measured on the right hand axis.
- Analyze the chart. Usually, the top 20% of the categories will comprise roughly 80% of the cumulative total.

Example-- Pareto Chart for a Restaurant

The manager of a neighbourhood restaurant is concerned about the smallest numbers of customers patronizing his eatery. The numbers of complaints have been rising of late. He would like some means of finding out what issues to address and of presenting the findings in a way his employees can understand them.

Solution

The manger surveyed his customers over several weeks and collected the following data:

Complaint	Frequency
Discourteous server	12
Slow service	42
Cold dinner	5
Cramped tables	20
Smoky air	10

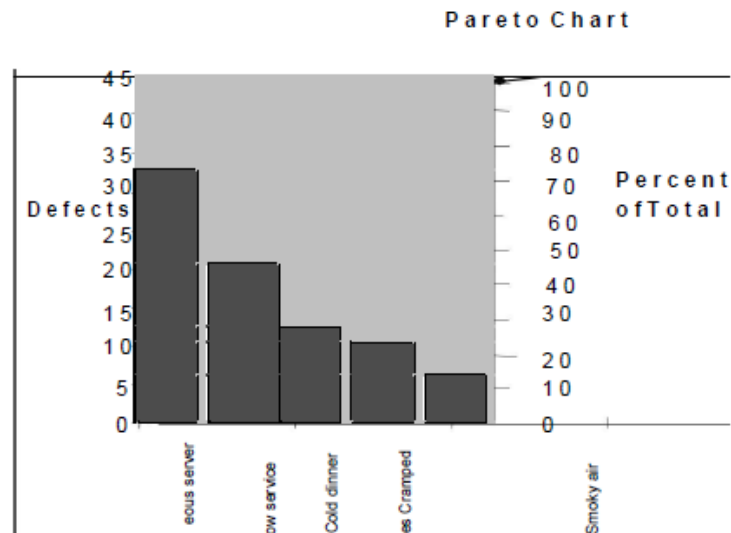


Figure 21.1– Pareto chart

Decision

It was clear to the manager and all employees which complaints, if rectified, would cover most of the quality problems in restaurant. First, slow service will be addressed by training the existing staff, adding another server and improving the food preparation process. Removing some decorative, but otherwise unnecessary, furniture from dining area and spacing the tables better will solve the problems with cramped tables. The Pareto chart shows that these two problems, if rectified, will account for almost 70 percent of the complaints.

Some possible uses could include the following:

Hotels-- Customer complaints at reception, noise levels in rooms, heating in rooms etc.

Accidents and injuries-- Fractures, eye and foreign bodies, muscle injuries, back injuries, burns, cuts, bruises etc.

4.2 Process Flow Diagram

Purpose

A flowchart is a pictorial representation of the steps in a given process. The steps are presented graphically in sequence so that team members can examine the order presented and come to a common understanding of how the process operates.

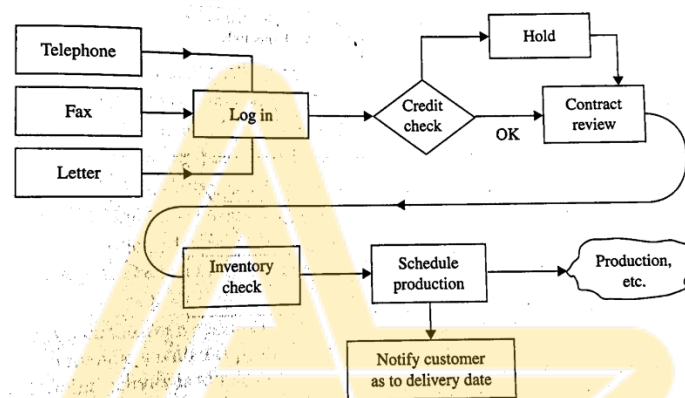
Flowcharts can be used to describe an existing process or to present a proposed change in the flow of a process. Flowcharts are the easiest way to "picture" a process, especially if it is very complex. Flowcharts should include every activity in the process. A flowchart should be the first step in identifying problems and targeting areas for improvement.

Steps in Flowcharting a Process

- Decide on the process of flowchart.
- Define the boundaries of the process-- the beginning and the end.
- Describe the beginning step of the process in an oval.

- Ask yourself "what happens next?" and add the step to the flowchart as a rectangle. Continue mapping out the steps as rectangles connected by one-way arrows.
- When a decision point is reached, write the decision in the form of a question in a diamond and develop the "yes" and "no" paths. Each yes/no path should re-enter the process or exit somewhere.
- Repeat steps 4 and 5 until the last step in the process is reached.
- Describe the ending boundary/step in an oval.

When drawing a flowchart, constantly ask "what happens next," "is there a decision made at this point," "does this reflect reality," "who else knows this process" etc. When possible, do a walk-through of the process to see if any steps have been left out or extras added that should not be there. The key is not to draw a flowchart representing how the process is supposed to operate, but to determine how it actually does operate.



4.3 Check Sheets

The main purpose of check sheets is to ensure that operating personnel collect the data carefully accurately. Data should be collected in such a manner that it can be quickly and easily used and analyzed. The form of the check sheet is individualized for each situation and is designed by the project team. Figure below shows a check sheet for paint non-conformities for bicycles.

Figure below shows a check sheet for temperature. The scale on the left represents midpoint and boundaries for each temperature range. Data for this type of check sheet is frequently recorded by placing an —X in the appropriate square. In this case, the time has been recorded in order to provide additional information for problem solving.

Whenever possible, check sheets are also designed to show location. For example the check sheet for bicycle paint non-conformities could show an outline of a bicycle with X's indicating the location of the non-conformities. Creativity plays a major role in the design of a check sheet. It should be user-friendly and whenever possible should include information on time and location.

CHECK SHEET		
Product: Bicycle 32	Number inspected: 2217	
Nonconformity type	Check	Total
Blister		21
Light spray		38
Drips		22
Overspray		11
Runs		47
Others		5
	Total	144
Number Nonconforming		113

Check sheet for bicycle paint non-conformities

387.4							
385							
382.5							
382.4							
380							
377.5							
37							
375	10.0						
372.5							
372.4							
370							
367.5							
367.4							
365	7.0	7.5	9.0				
362.5							
362.4							
360	8.0	8.5					
357.5							
357.4							
355	9.5						
352.5							

Check sheet for temperature

4.4 Histogram

Histogram is used to display in bar graph format measurement data distributed by categories.

A histogram is used for the following:

Making decisions about a process, product or procedure that could be improved after examining the variation. For example, should the school invest in a computer-based tutoring program for low achieving students in Algebra after examining the grade distribution, are more shafts being produced out of specifications that are too big rather than too small?

Displaying easily the variation in the process. For example, which units are causing maximum difficulty for students, is the variation in a process due to parts that are too long or parts that are too short?

Steps in Constructing a Histogram

- Gather and tabulate data on a process, product or procedure. This could be time, weight, size, frequency of occurrences, test scores, GPA's, pass/fail rates, number of days to complete a cycle, diameter of shafts built etc.
- Calculate the range of the data by subtracting the smallest number in the data set from the largest. Call this value R.
- Decide about how many bars (or classes) you want to display in your eventual histogram. Call this number K. This number should never be less than four and seldom exceeds 12. With 100 numbers, K=7 generally works well. With 1000 pieces of data, K=11 works well.
- Determine the fixed width of each class by dividing the range, R by the number of classes K. This value should be rounded to a "nice" number, generally a number ending in a zero. For example, 11.3 would not be a "nice" number. 10 would be considered a "nice" number. Call this number i, for interval width. It is important to use "nice" numbers else the histogram created will have strange scales on the X-axis.
- Create a table of upper and lower class limits. Add the interval width (i) to the first "nice" number less than the lowest value in the data set to determine the upper limit of the first class. This first "nice" number becomes the lowest lower limit of the first class. The upper limit of the first class becomes the lower limit of the second class. Adding the interval width (i) to the lower limit of the second class, it determines the upper limit for the second class. Repeat this process until the largest upper limit exceeds the biggest piece of data. You should have approximately K classes or categories in total.
- Sort, organize or categorize the data in such a way that you can count or tabulate how many pieces of data fall into each of the classes or categories in your table above. These are the frequency counts and will be plotted on the Y-axis of the histogram.
- Create the framework for the horizontal and vertical axes of the histogram. On the horizontal axis, plot the lower and upper limits of each class determined above. The scale on the vertical axis should run from zero to the first "nice" number greater than the largest frequency count determined above.
- Plot the frequency data on the histogram framework by drawing vertical bars for each class. The height of each bar represents the number or frequency of values occurring between the lower and upper limits of that class.
- Interpret the histogram for skew and clustering problems

Example

The data below are the spelling test scores for 20 students on a 50- word spelling test. The scores (number correct) are 48, 49, 50, 46, 47, 47, 35, 38, 40, 42, 45, 47, 48, 44, 43, 46, 45, 42, 43 and 47.

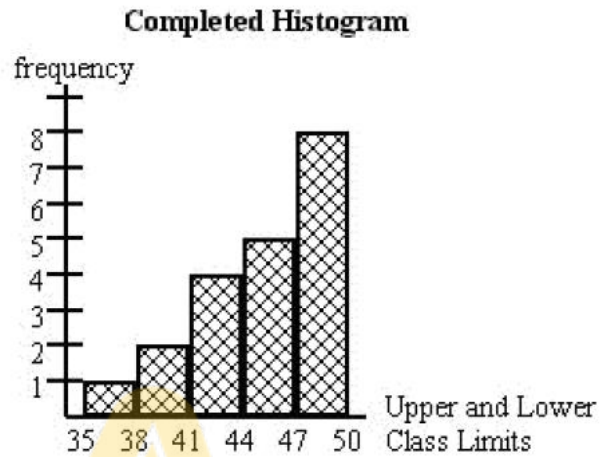
The largest number is 50 and the smallest is 35. Thus, the range, $R = 15$. We will use 5 classes, so $K=5$. The interval width $i = R/K = 15/5 = 3$.

Then we will make our lowest lower limit, the lower limit for the first class 35. Thus, the first upper limit is $35+3$ or 38. The second class will have a lower limit of 38 and an upper limit of 41.

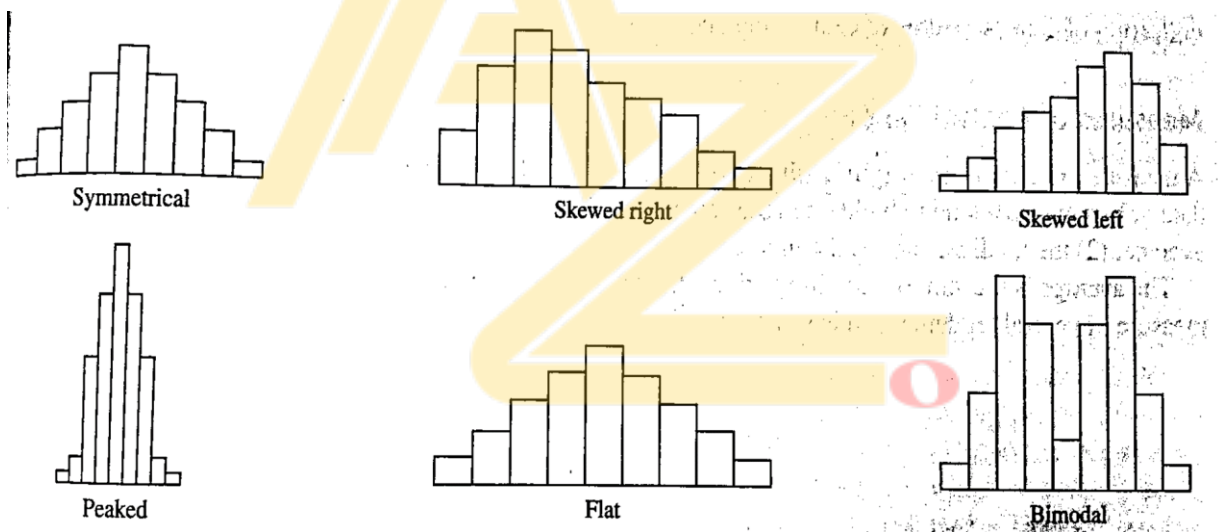
The completed table (with frequencies tabulated) will look like the following:

Class	Lower Limit	Upper Limit	Frequency
1	35	38	1

2	38	41	2
3	41	44	4
4	44	47	5
5	47	50	8



Examples of Typical Distributions



Limitations of Technique

Histograms are limited in their use due to the random order in which samples are taken and lack of information about the state of control of the process. Because samples are gathered without regard to order, the time-dependent or time-related trends in the process are not captured. So, what may appear to be the central tendency of the data may be deceiving. With respect to process statistical control, the histogram gives no indication whether the process was operating at its best when the data was collected. This lack of information on process control may lead to incorrect conclusions being drawn and, hence, inappropriate decisions being made. Still, with these considerations in

mind, the histogram's simplicity of construction and ease of use make it an invaluable tool in the elementary stages of data analysis.

4.5 Control Charts

Introduction to Control Charts

Sources of Variation

As we know, no two products or services are exactly alike because the processes used to produce them contain many sources of variation, even if the processes are working as intended. For example, the diameter of two crankshafts may vary because of differences in tool wear, material hardness, operator skill, or temperature during the period in which they were produced. Similarly, time required to process two credit card applications varies because of the load on the credit card department, the financial background of the applicant and the skill and attributes of the employees. Nothing can be done to eliminate variation in process output completely, but management can investigate the causes of variation to minimize it.

Common Causes

There are two basic categories of variation in output:

Common Causes and Assignable Causes

Common causes of variation are purely random, unpredictable sources of variation that are unavoidable with the current process. For example, a machine that fills cereal boxes will not put exactly the same amount of cereal in each box. If you weighed a large number of boxes filled by the machine and plotted the results in a scatter diagram, the data would tend to form a pattern that can be described as a distribution. The mean, spread and the shape may characterize such a distribution.

1. Mean is the sum of the observations divided by the total number of observations:

$$\bar{x} = \frac{\sum_{i=1}^n x_i}{n}$$

x_i = Observations of a quality characteristic (such as weight)

\bar{x} = Mean

n = total no. of observations

Spread is the measure of the dispersion of observations about the mean. Two measures commonly used in practice are the range and the standard deviation. Range is the difference between the largest observation in a sample and the smallest. Standard deviation is the square root of the variance of distribution. An estimate of the population standard deviation based on sample is given by

$$\sigma = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n - 1}}$$

x_i = Observations of a quality characteristic (such as weight)

\bar{x} = Mean

n = total no. of observations

= Standard deviation of a sample.

Two common shapes of process distribution are symmetric and skewed. A Symmetric distribution has the same number of observations above and below the mean. A skewed distribution has preponderance of observations either the above or below the mean.

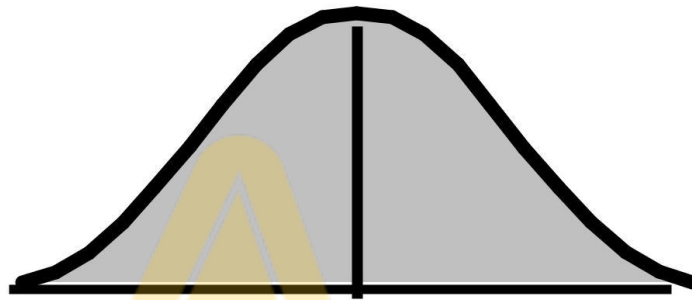


Figure- Distribution for the box-filling machine

If the process variability comes solely from causes of variation, a typical assumption is that distribution is symmetric, with most of observations near the center. Figure shows the distribution for the box-filling machine when only common causes of variation are present. The mean weight is 425 grams and the distribution is symmetric relative to mean.

Assignable Causes

The second category of variation, assignable causes of variation, also known as special causes, includes any variation causing factors that can be identified and eliminated. Assignable causes of variation include an employee needing training, or a machine needing repair. Let us return to the example of box filling machine.

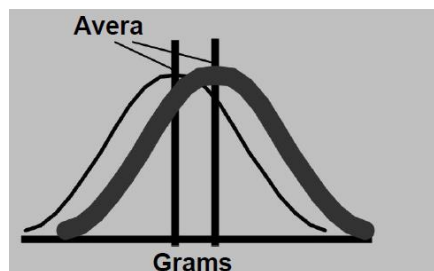


Figure (a) Location

Above figure shows how assignable causes can change the distribution of the output for the box-filling machine. The thin curve shows is the process distribution when only common causes of variation are present. The thick line curve depicts a change in the distribution because of assignable causes.

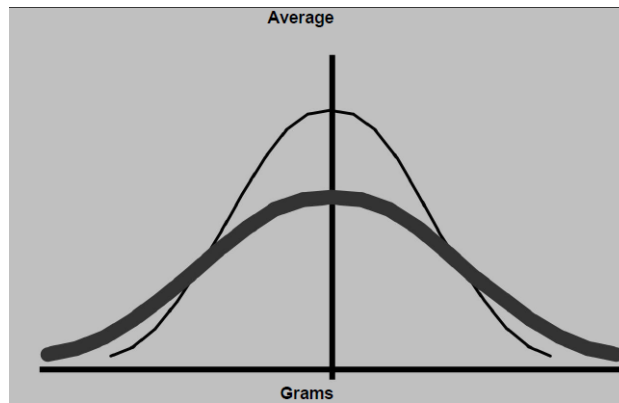


Figure (b). spread

In above figure (a), the thick curve indicates that the machine put more cereal than planned in all the boxes, thereby increasing the average weight of each box. In figure (b), an increase in the variability of the weight of cereal in each box affected the spread of distribution. Finally in figure (c), the thick line indicates that the machine produced lighter than heavier boxes. Such a distribution is skewed, i.e. it is no longer symmetric to the average value.

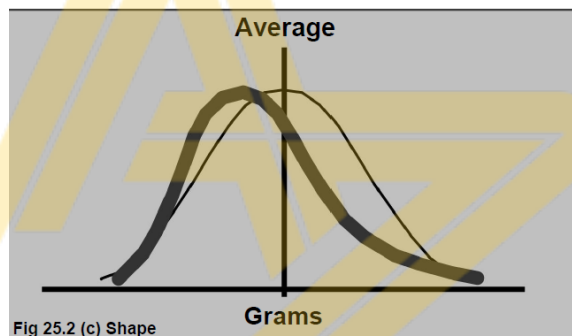


Fig 25.2 (c) Shape

Figure (c) Shape

A process is said to be in statistical control when the location, spread or shape of its distribution does not change over time. After the process is in statistical control, managers use SPC procedures to detect the onset of assignable causes so that they can be eliminated.

Figure (a) shows the differences between a process that is in statistical control and the one that is not. In figure (a), the machine is generating different distributions of cereal box weight over time, indicating assignable causes that need to be eliminated. In figure (b), the distribution of weight is stable over time. Consequently, the process is in statistical control.

TQM- MODULE 5

a) Total Productive Maintenance (TPM):

Definition, Types of Maintenance, Steps in introduction of TPM in an organization, Pillars of TPM – 5S, Jishu Hozen, Quality Maintenance, Planned Maintenance.

b) Quality by Design (QbD): Definition, Key components of QbD, Role of QbD in Pharmaceutical Industry, Benefits and Challenges of QbD.

c) Environmental Management Systems (EMS): Definition, Basic EMS, EMS under ISO 14001, Costs and Benefits of EMS.

CONTENTS

1. Total Productive Maintenance (TPM):

2. Quality by Design (QbD)

3. Environmental Management Systems (EMS):

TOTAL PRODUCTIVE MAINTENANCE (TPM)

TPM (Total Productive Maintenance) is a unified approach used for equipment maintenance. TPM aims to make the production process free from breakdown, defect free, slowing down of the production line, and setup time losses. It also aims to provide safe working conditions. TPM ensures everyone works together in the industry to achieve peak performance and productivity.

- Keeping the current plant and equipment at the highest productive level through the cooperation of all the areas of organization
- Total – everyone working together
- Productive – production of goods and services to meet or exceed the expectation of the customer
- Maintenance – keep equipment in good or better than original condition at all times

Total Productive Maintenance (TPM) is a maintenance program which involves a newly defined concept for maintaining plants and equipment.

TPM seeks to maximize equipment's effectiveness throughout the life time of that equipment. It strives to maintain optimum equipment conditions in order to prevent unexpected break downs, speed losses, and quality defects arising from process activities.

- ▶ **Total** = all encompassing by maintenance and production individuals working together.
- ▶ **Productive** = Production of goods and services that meet or exceed customer's expectations.
- ▶ **Maintenance** = Keeping equipments and plant in as good as or better than the original condition at all times

Goals of Total Productive Maintenance(TPM)

- Maintaining and improving equipment capacity
Maintaining equipments for life
- Using support from all areas of the operation
- Encouraging inputs from all employees
- Using teams for continuous improvement
- Goal of the TPM program is to markedly increase production while, at the same time, increasing employee morale and job satisfaction.
- TPM brings maintenance into focus as a necessary and vitally important part of the business. It is no longer regarded as a non-profit activity. Down time for maintenance is scheduled as a part of the manufacturing day and, in some cases, as an integral part of the manufacturing process.
- The goal is to hold emergency and unscheduled maintenance to a minimum.

Why TPM / the objective of TPM

TPM was introduced to achieve the following objectives:

- Avoid wastage in a quickly changing economic environment.
- Producing goods without reducing product quality.
- Reduce cost.
- Produce target quantity at the earliest possible time.
- Goods sent to the customers must be non-defective.

To fulfil those objectives and the goal TPM has dual targets: 1. Zero defects, zero accidents and zero loss; 2. Zero breakdown (100% equipment availability). It is true that when defects and breakdown are reduced the operating costs come down and hence productivity increases and the products are delivered to the customer

at a reasonable cost and at the right time.

Eight Pillars of TPM

Eight pillars of TPM are displayed in the following picture. TPM is achieved with the help of 5S (seiri (Sort), seiton (Set in Order), seiso (Shine), seiketsu (Standardise), and shitsuke (Sustain)). 5S make the foundation for a TPM program. TPM begins by making setting everything in order, in right place, neat and tidy.

Focused Improvement: In TPM, everyone focuses towards improvement. Small focus work groups improve the quality continuously by removing root causes of errors. They work together to reduce the number of defects.

Autonomous maintenance: Autonomous maintenance makes works responsible for maintenance of machines they work with. This eliminates the need for an expert and also develops a sense of ownership among workers. This is termed as *JISHU HOZEN* in Japanese language. Workers become more knowledgeable about work and the machine they are working with.

Planned maintenance: In planned maintenance, we follow proactive methods to avoid breakdown than firefighting. This significantly reduces the work stoppages and unnecessary inventory buildup.

Training and education: Training and education is an integral part of TPM program. Everyone are trained and educated to make them understand the benefits of TPM. Workers are trained about their machines; managers are trained about principles of TPM and human resource management.

Six core principles of TPM

1. Obtain Minimum 90% OEE (Overall Equipment Effectiveness) Run the machines even during lunch. (Lunch is for operators and not for machines!)
2. Operate in a manner, so that there are no customer complaints.
3. Reduce the manufacturing cost by 30%.
4. Achieve 100% success in delivering the goods as required by the customer.
5. Maintain an accident free environment.
6. Increase the suggestions by 3 times. Develop Multi-skilled and flexible workers.

Direct benefits of TPM

1. Increase productivity and OPE (Overall Plant Efficiency) by 1.5 or 2 times.
2. Rectify customer complaints.
3. Reduce the manufacturing cost by 30%.
4. Satisfy the customer needs by 100 % (Delivering the right quantity at the right time, in the required quality)
5. Reduce accidents.
6. Follow pollution control measures.

Indirect benefits of TPM

1. Higher confidence level among the employees.
2. Keep the work place clean, neat and attractive.
3. Favorable change in the attitude of the operators.
4. Achieve goals by working as team.
5. Horizontal deployment of a new concept in all areas of the organization.
6. Share knowledge and experience.
7. The workers get a feeling of owning the machine.

Steps in Introduction of TPM in an Organization

Stage A-Preparatory Stage

1 - Announcement by Management to all about TPM introduction in the organization:

Proper understanding, commitment and active involvement of the top management is needed for this step. Senior management should have awareness programmes, after which announcement is made to all. Publish it in the house magazine and put it in the notice board. Send a letter to all concerned individuals if required.

2- Initial education and propaganda for TPM:

Training is to be done based on the need. Some need intensive training and some just an awareness. Take people who matters to places where TPM already successfully implemented.

3 - Setting up TPM and departmental committees:

TPM includes improvement, autonomous maintenance, quality maintenance etc., as part of it. When committees are set up it should take care of all those needs.

4 - Establishing the TPM working system and target:

Now each area is benchmarked and fix up a target for achievement.

5 - A master plan for institutionalizing:

Next step is implementation leading to institutionalizing wherein TPM becomes an organizational culture. Achieving PM award is the proof of reaching a satisfactory level.

Stage - B - Introduction Stage

This is a ceremony and we should invite all. Suppliers as they should know that we want quality supply from them. Related companies and affiliated companies who can be our customers, some may learn from us and some can help us and customers will get the communication from us that we care for quality output.

Stage C - Implementation

In this stage eight activities are carried which are called eight pillars in the development of TPM activity. Of these four activities are for establishing the system for production efficiency, one for initial control system of new products and equipment, one for improving the efficiency of administration and are for control of safety, sanitation as working environment.

Stage D - Institutionalizing Stage

By all these activities one would have reached maturity stage. Now is the time for applying for PM award. Also think of challenging level to which you can take this movement.

Expected Questions

- 1) *Explain the concept of product liability.*
- 2) *What measures are taken to prevent product failures? Explain.*
- 3) *What is total productive maintenance? What are its objectives?*
- 4) *Explain 8 pillars of TPM*
- 5) *How do you measure TPM? Explain.*

QUALITY BY DESIGN

Quality by Design (QbD): Definition, Key components of QbD,

Role of QbD in Pharmaceutical Industry,

Benefits and Challenges of QbD.

Introduction

- Quality by design is the practice of using a multidisciplinary team to conduct conceptual thinking, product design and production planning all at one time, it is also known as concurrent engineering, simultaneous engineering or parallel engineering.
- Quality by design has recently encouraged changes in management structures.
- The major functions within an organization would complete their task by “throwing it over the wall” to the next department in the sequence and would not be concerned with any internal customer problems that might arise, quality by design or concurrent engineering requires the major functions to be performed at the same time. This system provides for immediate feedback, which prevents problems with quality and productivity from occurring. Fig. 5.3. Shows the flow diagram for both sequential or traditional engineering on the left and quality by design or concurrent engineering on the right.
- When each of the specialists early input to the product definition and specifications, cost is minimized and performance is maximized. Thus, better-quality products are manufactured for less cost with shorter time to market.
- The quality by design or concurrent engineering method combines all these steps into one. The product is designed to be successful at each stage of its life cycle. It is designed correctly the first time, considering all attributes and facets of its life, such as marketability, assembly and service ability, before release to testing and small production.

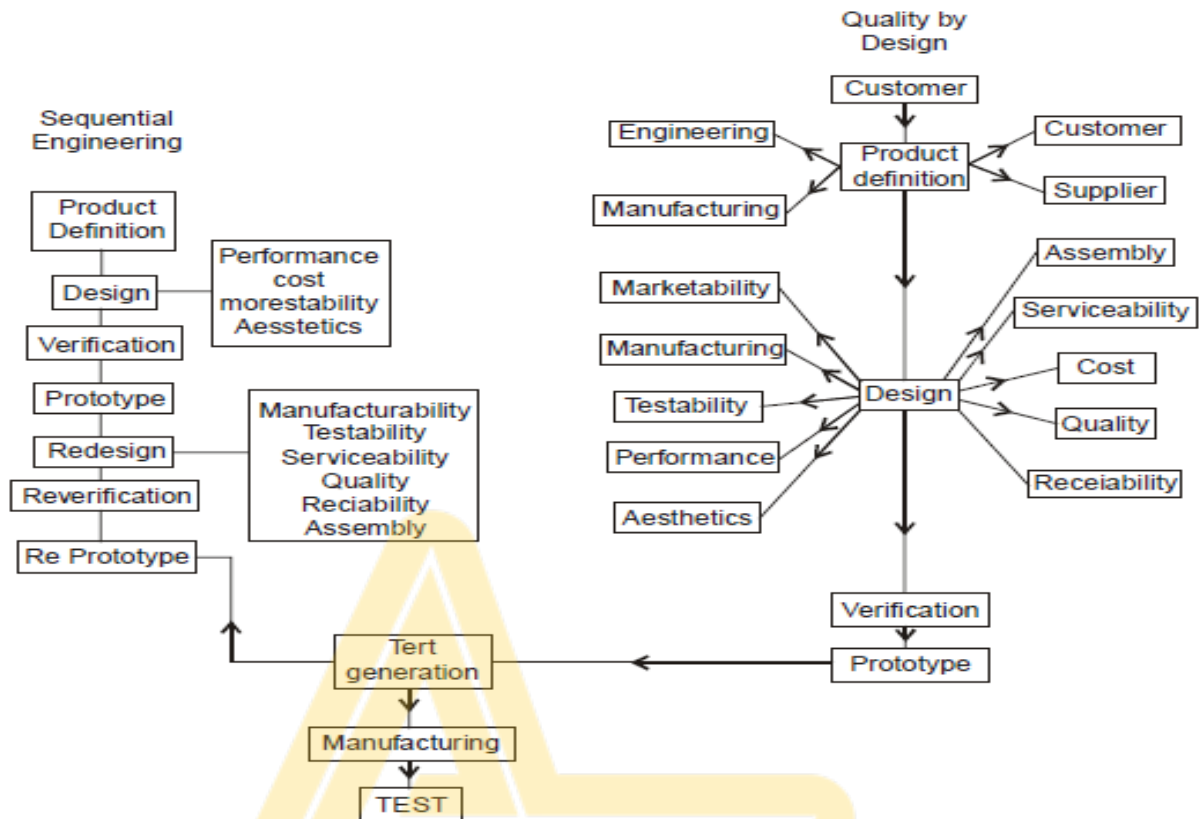
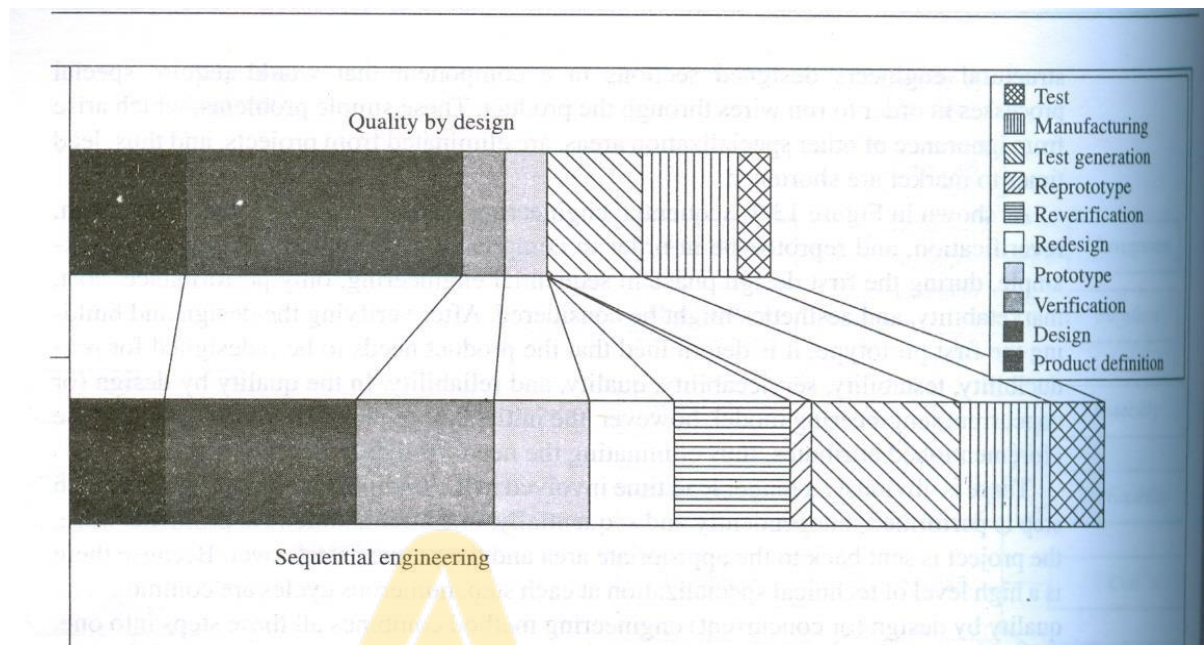


Fig. 5.3. Product development flow diagram. Source: Shoji shiba, et.al., A new American TQM, four revolutions of Management, productivity press, 1990.

Rationale for Implementation of Quality by Design.

- The amount of time required in the quality by design model for product-definition and specifications can be significantly greater than that required in the sequential engineering model.
- By using quality by design, the product is designed within production capabilities in order for statistical process control to be effective.
- Producing products well within process capabilities will cause a chain reaction of customer satisfaction.
- Customer's returns will decrease and rework costs will also decrease.



Source: Shoji shiba, et.al., A new American TQM, four revolutions of Management, productivity press, 1990.



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Concurrent engineering implementation assessment: A case study in an Indonesian manufacturing company

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Abstract

Concurrent Engineering or Simultaneous Engineering has been utilized by companies since 1980s as an approach to design a new product in integrative manner. It replaces traditional product development method which is a serial process with little coordination between different functions and lack of product life cycle perspectives. Concurrent Engineering (CE) offers opportunity for creating new products in short time while maintaining the highest quality at lowest cost which is considered to answer today's market demand. While benefit of CE is promising, implementing CE is not easy. There are a vast amount research that uncover difficulties during CE implementation. However, study of CE implementation in Indonesian company is only a few. One of them is conducted in 1998 at company X, one Indonesian high technology industry. Thus, this research aims to re-evaluate progress of CE implementation in company X today. In this research, CE implementation achievement level in company X is assessed by using Simultaneous Engineering Gap Analysis (SEGAPAN) and Analytical Hierarchical Process (AHP). The result shows that management's role, cultural change, and the cross functional team are three factors that have the least level of CE implementation compliance. In other words, these three factors are the most difficult barrier to implement CE successfully in company X. Next, Five Whys method is utilized to investigate the root cause of these impediments and some recommendations are proposed to reduce or to eliminate these CE implementation impediments accordingly.

Expected Questions

1. What is quality by design? How is it different from sequential engineering?
2. Why do we need to implement quality by design?
3. What are the potential benefits of Quality by Design?
4. What are the barriers and misconceptions about Quality by Design?

Environmental Management System

The overall aim of the Environmental Management systems is **to provide protection to the environment and to prevent pollution.**

- ☐ The success of ISO 9000 along with increased emphasis on Environmental issues were instrumental in ISO's decision to develop Environmental Management Standards.
- ☐ In 1991, ISO formed the Strategic Advisory Group on the Environment (SAGE) which led to the formation of Technical Committee (TC) 207 in 1992.
- ☐ Mission of TC207 is to develop standards for an Environmental Management System (EMS) which was identified as ISO 14000.
- ☐ TC 207 has established six sub-committees

1. Environmental Management System (EMS)
2. Environmental Auditing (EA)
3. Environmental labelling (EL)
4. Environmental Performance Evaluation (EPE)
5. Life-Cycle Assessment (LCA)
6. Terms & Definitions

EMS has two Evaluation Standards. They are

1. Organization Evaluation Standards
2. Product Evaluation Standards

REQUIREMENT OF ISO 14001

There are six elements

1. GENERAL REQUIREMENTS

☐ EMS should include policy, planning implementation & operation, checking & corrective action, management review.

2. ENVIRONMENTAL POLICY (Should be based on mission)

- The policy must be relevant to the organization's nature.
- Management's Commitment (for continual improvement & preventing pollution).

- Should be a framework (for Environmental objectives & Targets).
- Must be Documented, Implemented, & Maintained.

3. PLANNING

- Environmental Aspects
- Legal & other Requirements
- Objectives & Targets
- Environmental Management Programs

4. IMPLEMENTATION & OPERATION

- Structure & Responsibility
- Training, Awareness & Competency
- Communication
- EMS Documentation
- Document Control
- Operational Control
- Emergency Preparedness & Response

5. CHECKING & CORRECTIVE ACTION

- Monitoring & Measuring
- Nonconformance & Corrective & Preventive action
- Records
- EMS Audit

6. MANAGEMENT REVIEW

- Review of objectives & targets
- Review of Environmental performance against legal & other requirement
- Effectiveness of EMS elements
- Evaluation of the continuation of the policy

BENEFITS OF ENVIRONMENTAL MANAGEMENT SYSTEM:

1. GLOBAL BENEFITS

- Facilitate trade & remove trade barrier
- Improve environmental performance of planet earth
- Build consensus that there is a need for environmental management and a common terminology for EMS

2. ORGANIZATIONAL BENEFITS

- Assuring customers of a commitment to environmental management
- Meeting customer requirement
- Improve public relation
- Increase investor satisfaction
- Market share increase
- Conserving input material & energy
- Better industry/government relation

- Low cost insurance, easy attainment of permits & authorization

Quality Management Systems

Introduction

The central need for reliable products in the Second World War defence procurement focused on tight specifications and consistency in product. Not surprisingly, therefore, post-war developments saw the quality drive being governed by different industries with different systems of standards.

ISO 9000

- The International Organization for Standardization (ISO) was founded in 1946. It is headquartered in Geneva, Switzerland. Its mandate is to promote the development of international standards to facilitate the exchange of goods and standards worldwide.
- The purpose of ISO is to facilitate global consensus agreements on international quality standards. It has resulted in a system for certifying suppliers to make sure they meet internationally accepted standards for quality management.
- It is a non-government organization. ISO has as its members the national standards organizations for more than 130 countries.
- During the 1970s it was generally acknowledged that the word quality had different meanings within and among industries and countries and around the world.
- The ISO 9000 series of quality-management standards, guidelines and technical reports was first published in 1987 and it is reviewed at least every five years.
- In the United States, the American National Institute/American Society publishes the national standards for Quality (ANSI/ASQ) as the ANSI/ASQ Q9000 series.
- Its purpose is to unify quality terms and definitions used by industrialized nations and use those terms to demonstrate a supplier's capability of controlling its processes.
- In very simplified terms, the standards require an organization to say what it is doing to ensure quality, then do what it says and finally document or prove that it has done what it said.
- The objective of quality management is to quickly produce safe products with low costs to achieve customer satisfaction.

ISO 9000 Series of Standards

- The ISO 9000 series of standards is generic in scope. By design, the series can be tailored to fit any organization's needs, whether it is large or small, a manufacturer or a service organization.

- It can be applied to construction, engineering, health care, legal and other professional services as well as the manufacturing of anything from nuts and bolts to spacecraft.

A. The ISO 9000 series was most recently revised and updated in 2000.

1. ISO 9000:2000: Quality Management Systems-Fundamentals and Vocabulary, is the starting point for understanding the standards. It defines the fundamental terms and definitions used in the ISO 9000 family of standards, guidelines and technical reports.

2. ISO 9001:2000: Quality Management Systems-Requirements, is the standard a company uses to assess its ability to meet customer and applicable regulatory requirements in order to achieve customer satisfaction.

3. ISO 9004:2000: Quality Management Systems-Guidelines for performance improvements, provides detailed guidance to a company for the continual improvement of its quality-management system in order to achieve and sustain customer satisfaction.

4. ISO 9001, 9002 and 9003 standards have been consolidated into the single revised ISO 9001:2000 standard.

5. The ISO 9001:2000 standard replaces the ISO 9001:1994, ISO 9002:1994 and ISO 9003:1994 standards. Although an organization can continue to be certified to these standards until December 2003, if they so choose.

Forms of ISO certification (TYPES OF QUALITY AUDIT)

- If a manufacturer wants to purchase from a non-certified supplier, the manufacturer should visit the supplier and examine its processes, past performances, workers' credentials and so on to verify that the supplier can meet the required quality levels and performance schedule.
- It is easier, cheaper, quicker and legally safer to select an already certified supplier.

There are three forms of certification which are as follows:

1. First party-- A firm audits itself against ISO 9000 standards.
 2. Second party-- A customer audits its supplier.
 3. Third party-- A "qualified" national or international standards or certifying agency serves as auditor.
- Certification involves getting the proper documents, initiating the required procedures and practices, and conducting internal audits (first party certification).
 - This can be followed by a second- or third-party audit as desired.
 - In a two-party system, a customer would audit the quality system of a supplier for acceptability resulting in costly multiple audits.

- The best certification of a firm is through a third party.
- A third-party company called a registrar is the only authorized entity that can award ISO 9000 certification.
- Registrars are accredited by an authoritative national body and are contracted by companies for a fee to evaluate their quality-management system to see if it meets the ISO 9000 standards.
- A quality system certification involves the assessment and periodic surveillance audit of the adequacy of a supplier's quality system by a registrar.
- When a supplier's system conforms to the registrar's interpretation of the standard, the registrar issues a certification to that effect to the supplier.
- This certification ensures customers or potential customers that a supplier has a quality system in place and it is being monitored.
- Once passed by the third-party audit, a firm is certified and may be registered and recorded as having achieved ISO 9000 status and it becomes part of a registry of certified companies recognized throughout the world.

Sector-specific standards

AS 9000 (The Aerospace Standards)

The aerospace industry requires that all elements of production and supply chain operate to levels of quality and performance that assure safe and reliable products. The Americas Aerospace Quality Group (AAQG) in cooperation with many aerospace companies developed specific requirements for quality systems that are to be implemented and maintained by the complete production and supply chain in the manufacture of products used in aviation and space applications.

AS9000/AS9100

AS9100 includes ASQ9001:2000 quality system requirements and specifies additional requirements for the quality system of the aerospace industry.

Examples of common and unique aerospace requirements found in AS9000/AS9100 are as follows:

- Identification and Control of Key Characteristics
- Stamp Control
- Foreign Object Detection (FOD)
- Requirements Flow Down
- Tooling Control
- Customer and Regulatory Agency Involvement and Approval

AS9101A Quality System Assessment

The checklist corresponding to AS9100 Revision A.

AS9102 Aerospace First Article Inspection Requirement

Established the requirements for First Article Inspection. The purpose of First Article Inspection is to provide objective evidence that all engineering design and specification requirements are properly understood, accounted for, verified and documented.

AS9103 Variation Management of Key Characteristics

Established variation management requirements for key characteristics. This standard also specifies general requirements and provides a process to achieve those requirements.

AS9120

This standard includes ISO 9001:2000 quality management system requirements and specifies additional requirements for a quality management system for the aerospace industry applicable to stockiest distributors.

AS9131 Quality Systems Non-Conformance Documentation

This document defines to supplier/subcontractor common information and documentation required to inform customers, when applicable about nonconformity (Customer-provider use).

ISO 9001 Requirements

CLAUSES (ELEMENTS) OF ISO 9000 (During the year 2000)

1. Scope
2. Normative Reference
3. Terms and Definitions
4. Quality Management System (QMS)
 - General Requirements
 - Documentation
5. Management Responsibility
 - Management Commitment
 - Customer Focus
 - Quality Policy
 - Planning
 - Responsibility, Authority and Communication
 - Management Review
6. Resource Management
 - Provision of Resources
 - Human Resources
 - Infrastructure
 - Work Environment
7. Product Realization
 - Planning of Product Realization

- Customer related processes
 - Design and Development
 - Purchasing
 - Production and Service Provision
 - Control of Monitoring and Measuring devices
8. Monitoring and Measurement
- General
 - Monitoring and Measurement
 - Control of Non-Conforming Product
 - Analysis of Data
 - Improvement

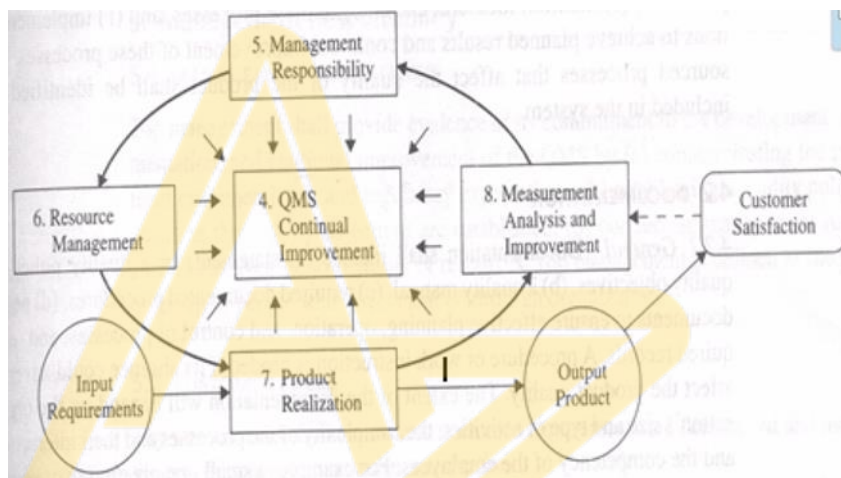


Figure 27.2-- Model of a process-based quality management system

Reasons for implementing ISO Standard

There are various reasons for implementing a quality system that conforms to an ISO standard:

- Customer or marketing are suggesting or demanding compliance to a quality system
- Need for improvements in processes or systems
- Desire for global deployment of products and services
- As more and more organizations become registered, they are requiring their subcontractors or suppliers to be registered, creating a snowball effect

Consequently, in order to maintain or increase market share, many organizations are finding that they should be in conformance with an ISO standard.

- Internal benefits that can be received from developing and implementing a well-documented quality system can far outweigh the external pressures.

- A study of 100 Italian manufacturing firms was undertaken to determine if there was any improvement in performance after registration. Significant improvement was noted in the following areas:
 - Internal quality as measured by the percent of scrap, rework and nonconformities at final inspection.
 - Production reliability as measured by the number of breakdowns per month, percent of time dedicated to emergencies and percent of downtime per shift
 - External quality as measured by product accepted by customers without inspection, claims of nonconforming product and returned product
 - Time performance as measured by time to market, on-time delivery and throughput time
 - Cost of poor quality as measured by external nonconformities, scrap and rework
 - On the negative side, prevention and appraisal costs increased.

IMPLEMENTATION OF QUALITY MANAGEMENT SYSTEM:

1. Top Management Commitment
2. Appoint the Management Representative
3. Awareness
4. Appoint an Implementation Team
5. Training
6. Time Schedule
7. Select Element Owners
8. Review the Present System
9. Write the Documents
10. Install the New System
11. Internal Audit
12. Management Review
13. Pre-assessment
14. Registration

DOCUMENTATION

In every organization, the quality system must be documented properly. The documentation of the system can be seen as a hierarchical format as shown.

- 1 POLICY
- 2 PROCEDURES
- 3 PRACTICES
- 4 PROOFS

Benefits of ISO Registration

Most of the organizations have found that implementing ISO 9000 systems have benefited them in the

following ways:

- Fewer on-site audits by customers
- Increased market share
- Improved quality, both internally and externally (fewer complaints)
- Improved product and service quality levels from suppliers
- Greater awareness of quality by employees
- A documented formal system
- Reduced operating costs

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- Low cost insurance, easy attainment of permits & authorization

Quality Function Deployment

- Ultimately the goal of QFD is to translate often subjective quality criteria into objective ones. That can be quantified and measured and which can then be used to design and manufacture the product.
- It is a complimentary method for determining how and where priorities are to be assigned in product development.
- Quality Function Deployment was developed by Yoji Akao in Japan in 1966.

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)

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.

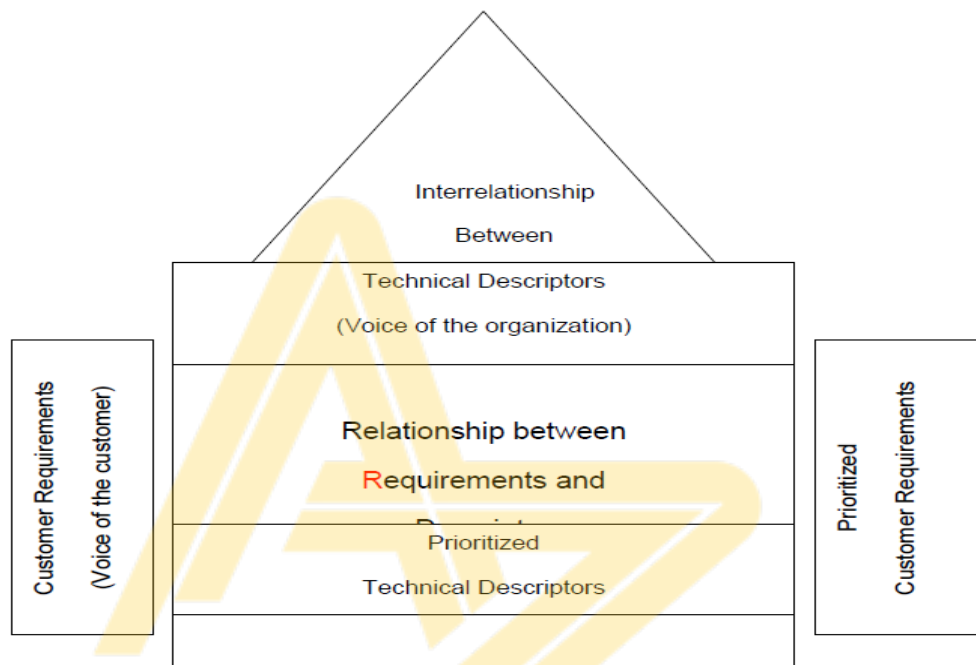


Fig. House of Quality

The Steps in Building a House of Quality are:

1. List Customer Requirements (WHAT's)
2. List Technical Descriptors (HOW's)
3. Develop a Relationship Matrix between WHAT's and HOW's
4. Develop an Inter-relationship Matrix between HOW's
5. Competitive Assessments
 - a. Customer Competitive Assessments
 - b. Technical Competitive Assessments
6. Develop Prioritized Customer Requirements
7. Develop Prioritized Technical Descriptors

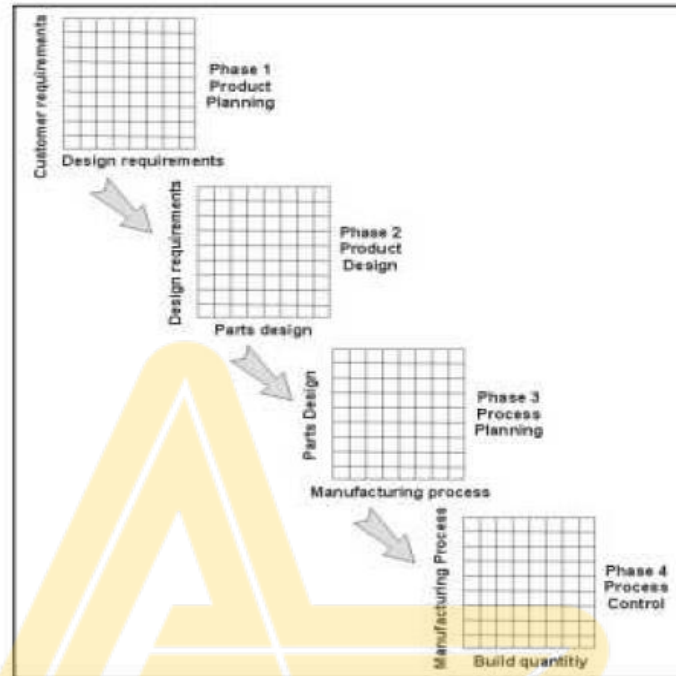
Phase 1, Product Planning: Building the House of Quality. Led by the marketing department,

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.

Significance of QFD

QFD is a way to assure the design quality while the product is still in the design stage.

- ☐ QFD is a planning tool used to fulfil customer expectations.
- ☐ QFD focuses on customer expectations or requirements, often referred to as voice of the customer.