

## Quality Management (NOE-072)

UNIT-I : Quality Concepts: Evolution of Quality Control, concept change, TQM Modern concept, Quality concept in design, Review of design, Evolution of proto type. Control on Purchased Product: Procurement of various products, evaluation of supplies, capacity verification, Development of sources, procurement procedure.

Manufacturing Quality: Methods and techniques for manufacture, inspection and control of product, quality in sales and services, guarantee, analysis of claims.

UNIT-II: Quality Management: Organization structure and design, quality function, decentralization, designing and fitting, organization for different type products and company, economics of quality value and contribution, quality cost, optimizing quality cost, seduction program. Human Factor in quality Attitude of top management, cooperation of groups, operators attitude, responsibility, causes of apparatus error and corrective methods.

UNIT-III: Control Charts, Theory of control charts, measurement range, construction and analysis of R charts, process capability study, use of control charts. Attributes of Control Chart, Defects, construction and analysis of charts, improvement by control chart, variable sample size, construction and analysis of C charts.

UNIT -IV : Defects diagnosis and prevention defect study, identification and analysis of defects, correcting measure, factors affecting reliability, MTTF, calculation of reliability, building reliability in the product, evaluation of reliability, interpretation of test results, reliability control, maintainability, zero defects, quality circle.

UNIT –V: ISO-9000 and its concept of Quality Management, ISO 9000 series, Taguchi method, JIT in some details.

## Unit 1

### Quality Management

Quality has been the most exploited word but at the same time most mis-understood word. Quality is an off shoot of the work we do. It is a bi-product of an act. It shows the level of commitment in doing our activity.

Examples such as: High quality at low price, Quality Hawaii chappal, High class quality etc., are being mentioned.

**Definition:** The Quality is defined in many ways:

**Quality is Excellence:** When quality is defined as excellence, it loses its measurability. Each person understands to the level of his own excellence and involves in his work. It is often misunderstood that high cost is high quality. Judgmental in nature. Ex. (Rolex watches, BMW automobiles).

**Quality is Value:** With this definition the performance and features or the usefulness of the products are compared to only the cost of price of the product. Many a times the utility/ possession value is more than the value of the product. Ex: the features of the product are compared to the cost of the product.

**Quality is Conformance to Requirements:** This definition has a manufacturing orientation. It requires that the customer gives the specification and the products are manufactured to that requirement.

**Quality is degree to which the inherent capabilities of the product satisfy (implicit and explicit) Requirements (Customer driven).**

### **Need for Quality**

- Good quality of goods and services can provide an organization with competitive edge.
- Good quality reduces costs due to product returns, rework and scrap
- Good quality increases productivity, profits and other measures of success such as brand image, product image and company goodwill.
- Most importantly, good quality generates satisfied customers today and tomorrow.
- Good quality creates an atmosphere for high employee morale, which improves productivity.

## QUALITY MANAGEMENT

Management activities and functions involved in determination of quality policy and its implementation through means such as quality planning and quality assurance (including quality control).

### FUNCTIONS OF MANAGEMENT

The following are the four basic functions of management that make up the management process:

1. Planning
2. Organizing
3. Directing
4. Controlling.

**Planning:** Planning involves choosing tasks that must be performed to attain organizational goals, outlining how the tasks must be performed, and indicating when they should be performed.

Planning activity focuses on attaining goals. Managers outline exactly what organizations should do to be successful. Planning is concerned with the success of the organization in the short term as well as in the long term.

**Organizing:** Organizing can be assignment of the tasks developed in the planning stages, to various individuals or groups within the organization. Organizing is to create a mechanism to put plans into action.

People within the organization are given work assignments that contribute to the company's goals. Tasks are organized so that the output of each individual contributes to the success of departments, which, in turn, contributes to the success of divisions, which ultimately contributes to the success of the organization.

**Directing:** Directing is also referred as motivating, leading or influencing. It can be defined as guiding the activities of organization members in the direction that helps the organization move towards the fulfilment of the goals.

The purpose of influencing is to increase productivity. Human-oriented work situations usually generate higher levels of production over the long term than do task oriented work situations because people find the latter type distasteful.

**Controlling:** Controlling referred to the following roles played by the manager:

1. Gather information that measures performance

2. Compare present performance to pre established performance norms.
  3. Determine the next action plan and modifications for meeting the desired performance parameters.
- Controlling is an ongoing process.

### QUALITY CONCEPT

Quality of product signifies the degree of its excellence and fitness for the purpose. The quality of product means all those activity which are directed to maintain and to improve. Such as setting of quality targets, appraisal of conformance, taking corrective action where any deviation is noticed and planning for improvements in quality.

Quality is a measure of the user satisfaction provided by a product. It includes functional efficiency, appearance, ease of installation and operation, safety reliability, maintainability, running and maintenance cost.

### DEFINITIONS OF QUALITY

1. Quality is conformance to requirements
2. Quality is fitness for use
3. Quality is the degree to which performance meets expectations
4. Quality denotes an excellence in goods and services

### QUALITY CONTROL

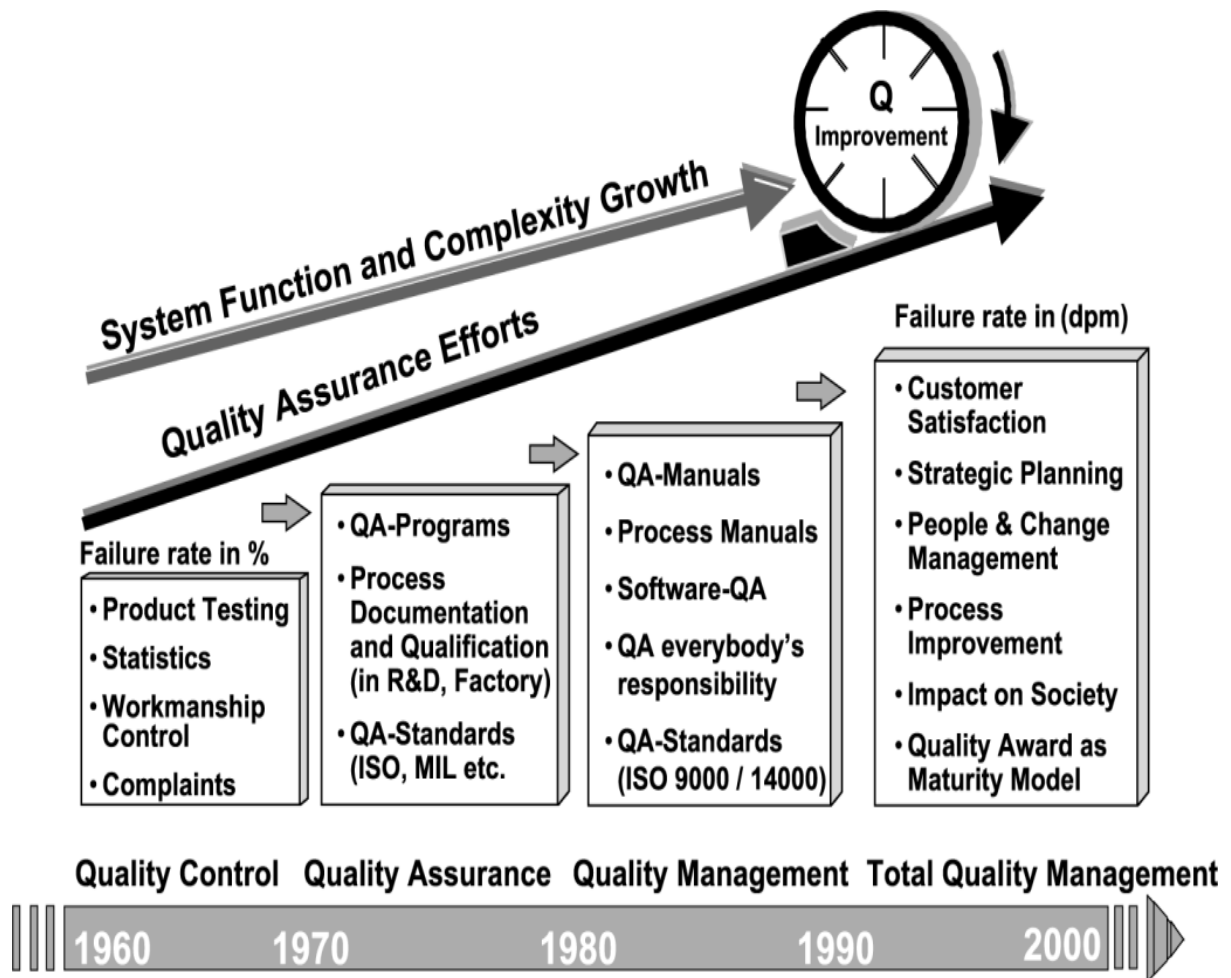
Quality Control (QC) may be defined as: The operational techniques and activities that are used to fulfil the requirements for quality. Following are the three steps for QC:

1. Evaluate actual operating performance
2. Compare actual performance to goals
3. Act on the difference



### Evolution of Quality

Before the concepts and ideas of TQM were formalised, much work had taken place over the centuries to reach this stage. This section charts the evolution, from inspection through to the present day concepts of total quality.



**From inspection to total quality inspection** Inspection involves measuring, examining, and testing products, process and services against specified requirements to determine conformity. In the late Middle Ages, special measures were taken to inspect the work of apprentices and journeymen in order to guard the Guild against claims of makeshift or shoddy work.

During the early years of manufacturing, inspection was used to decide whether a worker's job or a product met the requirements; therefore, acceptable. It was not done in a systematic way, but worked well when the volume of production was reasonably low. However, as organisations became larger, the need for more effective operations became apparent.

In 1911, Frederick W. Taylor helped to satisfy this need. He published 'The Principles of Scientific Management' which provided a framework for the effective use of people in industrial organisations. One of Taylor's concepts was clearly defined tasks performed under standard conditions. Inspection was one of these tasks and

- was intended to ensure that no faulty product left the factory or workshop;
- focuses on the product and the detection of problems in the product;
- involves testing every item to ensure that it complies with product specifications;
- is carried out at the end of the production process; and relies on specially trained inspectors.

Accompanying the creation of inspection functions, other problems arose

- More technical problems occurred, requiring specialised skills, often not possessed by production workers
- The inspectors lacked training
- Inspectors were ordered to accept defective goods, to increase output
- Skilled workers were promoted into other roles, leaving less skilled workers to perform the operational jobs, such as manufacturing

This movement led to the emergence of a separate inspection department. An important new idea that emerged from this new department was defect prevention, which led to quality control.

### **Quality in Japan**

In the 1940s, Japanese products were perceived as cheap, shoddy imitations. Japanese industrial leaders recognised this problem and aimed to produce innovative high quality products. They invited a few quality gurus, such as Deming, Juran, and Feigenbaum to learn how to achieve this aim. In the 1950s, quality control and management developed quickly and became a main theme of Japanese management. The idea of quality did not stop at the management level. Quality circles started in the early 60s. A quality circle is a volunteer group of workers who meet and discuss issues to improve any aspects of workplace, and make presentations to management with their ideas. A by-product of quality circles was employee motivation. Workers felt that they were involved and heard. Another by-product was the idea of improving not only quality of the products, but also every aspect of organisational issues. This probably was the start of the idea, total quality.

### EVOLUTION OF QUALITY CONTROL

- The quality movement started from medieval Europe.
- Craftsmen organized unions called guilds in the late thirteenth century.
- The product inspection started in Great Britain in the mid 1750s and brought Industrial Revolution in the early nineteenth century.
- The concept of producing interchangeable parts to simplify assembly was introduced in 1798.
- World War II gave birth to quality in manufacturing industries and military application. A quality revolution in Japan followed World War II. The Japanese became leader in quality by the 1970s.
- Japanese manufacturers penetrated in American markets which affected the United States. The emphasis became not only on statistics but approaches which involved the entire organization.
- This movement led to Total Quality Management (TQM). Several quality standards followed and one of them is ISO 9000 quality system standards published in 1987.

### CONCEPT CHANGE

A change concept is a general notion or approach to change that has been found to be useful in developing specific ideas for changes that lead to improvement. There are several individuals who made significant contributions to quality control and improvement. The philosophy of W. Edward Deming, the best known quality expert, was summarised in the following fourteen points:

1. **Create constancy of purpose toward improvement of product and service**, with the aim to become competitive and to stay in business, and to provide jobs.
2. **Adopt the new philosophy**. We are in a new economic age. Western management must awaken to the challenge, must learn their responsibilities, and take on leadership for change.
3. **Cease dependence on inspection to achieve quality**. Eliminate the need for inspection on a mass basis by building quality into the product in the first place.
4. **End the practice of awarding business on the basis of price tag**. Instead, minimize total cost. Move toward a single supplier for any one item, on a long-term relationship of loyalty and trust.
5. **Improve constantly and forever the system of production and service**, to improve quality

and productivity, and thus constantly decrease costs.

6. **Institute training** on the job.
7. **Institute leadership**. The aim of supervision should be to help people and machines and gadgets to do a better job. Supervision of management is in need of overhaul as well as supervision of production workers.
8. **Drive out fear**, so that everyone may work effectively for the company
9. **Break down barriers between departments**. People in research, design, sales, and production must work as a team, to foresee problems of production and in use that may be encountered with the product or service.
10. **Eliminate slogans, exhortations, and targets for the work force** asking for zero defects and new levels of productivity. Such exhortations only create adversarial relationships, as the bulk of the causes of low quality and low productivity belong to the system and thus lie beyond the power of the work force.
11. **Eliminate work standards (quotas)** on the factory floor.  
**Eliminate management by objective**. Eliminate management by numbers, numerical goals.
12. **Remove barriers that rob the hourly worker of his right to joy of workmanship**. The responsibility of supervisors must be changed from sheer numbers to quality.  
**Remove barriers that rob people in management and in engineering of their right to joy of workmanship**. This means abolishment of the annual merit rating and of management by objective
13. **Institute a vigorous program of education and self-improvement**.
14. **Put everybody in the company to work to accomplish the transformation**. The transformation is everybody's job.

### TQM MODERN CONCEPT

Total Quality Management (TQM) is the new concept on Quality Control. TQM deals with the product in its totality. Quality is determined by the combined effects of various departments such as Design, Engineering, Purchase, Production and Inspection. This is basically an integrated system covering all quality control activities during various phases of product development.

#### Dimensions of Quality

1. Performance
2. Features
3. Durability
4. Reliability

5. Serviceability
6. Appearance
7. Uniformity
8. Consistency and conformance
9. Safety
10. Time
11. Customer service
12. Comparability

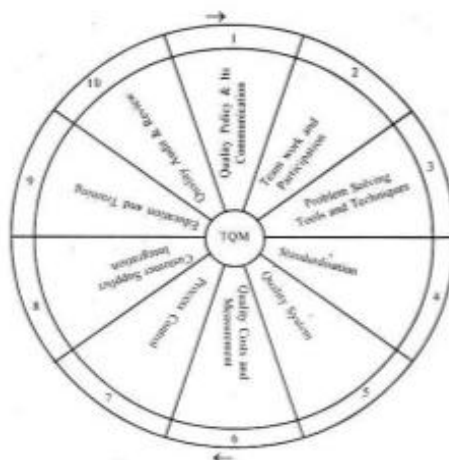
TQM involves all the aspects of the firm in satisfying a customer. TQM involves:

1. Customer-supplier relationship based on mutual trust and respect.
2. Firm in-house requirements by the customer.
3. Suppliers are partners in achieving zero-defect situation.
4. Regular monitoring of supplier processes and products by the customer.

**Objectives of TQM**

- a. Customer focus, customer delight/satisfaction.
- b. Continuous improvement of culture of the organization.
- c. Focused, continuous and relentless cost reduction.
- d. Focused, continuous and relentless quality improvement.
- e. To create an organization whereby everyone is working towards making their organization the best business, and to capitalize on the sense of achievement and working in a world-class organization.

**An Integrated TQM Model**



**QUALITY BY DESIGN**

Product quality is created by design. There should be consideration of quality in design of a product which meets customers need at a price acceptable to him.

**GENERAL CONSIDERATION FOR A GOOD DESIGN**

1. Appearance
2. Functional Efficiency
3. Safety
4. Reliability
5. Maintainability
6. Ease of Production
7. Standardization
8. Review of Design

**EVALUATION OF THE PROTOTYPE**

1. Manufacturing Drawing
2. Product Specification
3. Design Changes during Production

**CONTROL ON PURCHASED PRODUCT**

An organization needs to purchase a variety of raw materials and products for further processing or consumption. The quality of product is important and given due consideration at the time of purchase because it can affect the quality of the end product. While deciding the quantity that is to be purchased, consideration is also given to the economy. Many times, it is more economical to get some of the components as per their own design manufactured by ancillary companies.

**PROCUREMENT PROCESS**

- Procurement process is known as purchasing through the purchasing department.
- It starts with a requisition from an employee and ends with the payment of supplier.

**EVALUATION OF SUPPLIERS**

- It is the process of evaluating and approving potential suppliers by factual and measurable assessment.
- It ensures a portfolio of best-in class suppliers is available for use.
- It is a process to measure and monitor the performance of suppliers for reducing cost, reducing risk and for continuous improvement.

Evaluation Process	Management Responsibilities
<p>It is the pre-qualification step within the purchasing process on the basis of which a supplier is approved or not approved. It is also known as <i>Supplier Performance Management</i>. This includes approval of various aspects of the supplier business including:</p> <ul style="list-style-type: none"> <li>▪ Capacity</li> <li>▪ Financials</li> <li>▪ Organization Structure, and</li> <li>▪ Performance</li> </ul> <p><b>Benefits</b></p> <ul style="list-style-type: none"> <li>▪ Suppliers provide high standard of products and services</li> <li>▪ Suppliers offer sufficient capacity and business stability</li> <li>▪ Identification and removal of hidden cost in supply chain</li> </ul> <p><b>Drawbacks</b></p> <ul style="list-style-type: none"> <li>▪ Include resources and cost commitments in establishing and maintaining an effective system</li> <li>▪ Without going through the root cause of supplier's problem or inconsistent scoring may result in inaccurate assessment.</li> </ul> <p><b>CAPACITY VERIFICATION</b></p> <p>For capacity verification, following points need to be verified:</p> <p><b>General Requirement</b></p> <ol style="list-style-type: none"> <li>1. Whether the organisation has established, documented, implemented, maintained and continually improves a quality management system (QMS) in accordance with the requirements of ISO 9000-2000?</li> <li>2. Whether the organisation has identified the processes needed for the quality management system, determined the sequence and interaction of these processes, criteria and methods required to ensure the effective operation and control of these processes, ensure the availability of information necessary to support the operation and monitoring of these processes, measures, monitors and analyses these processes and implements action necessary to achieve planned results and continual improvement.</li> </ol>	<ol style="list-style-type: none"> <li>1. <b>Management Commitment:</b> Whether the top management is committed to the development of the quality management system.</li> <li>2. <b>Customer Focus:</b> Whether the top management ensures that customer needs and expectations are determined considering obligations related to product including regulatory and legal requirements, converted into requirements and fulfilled with the aim of achieving customer satisfaction.</li> <li>3. <b>Quality Policy:</b> Has the top management defined its Quality policy? Is it appropriate to the purpose of the organisation, committed to meeting requirements of customers and to continual improvement, provides a framework for establishing and reviewing quality objectives, communicated and understood at appropriate levels in the organisation, reviewed for continuing suitability and controlled?</li> <li>4. <b>Provision of Resources:</b> Has the organisation determined and provided in a timely manner the resources needed to implement and improve the processes of the quality management system and to address customer satisfaction?</li> <li>5. <b>Assignment of Personnel:</b> Whether the Personnel assigned responsibilities defined in the quality management system are competent on the basis of applicable education, training, skills and experience.</li> <li>6. <b>Training, Awareness and Competency:</b> Whether the organisation has established a system for identifying competency needs of personnel and provides training. Evaluate the effectiveness of the training provided, and maintains appropriate records of education, experience, training and qualifications of its personnel?</li> <li>7. <b>Facilities:</b> Has the organisation identified, provided and maintained facilities such as Workspace, Equipment, hardware and software and supporting services it needed to achieve the conformity of product?</li> <li>8. <b>Work Environment:</b> Whether the organisation has a system for identification and management of human and physical factors of the work environment needed to achieve conformity of product.</li> <li>9. <b>Planning of Realization Processes:</b> Whether the organisation has determined Quality objectives for the product, project or contract, processes and documentation, resources and facilities specific to the product verification and validation activities, the criteria for acceptability, and records that are necessary to provide confidence of conformity in the process planning for product realization.</li> </ol>

Total Quality Management TQM is composed of three paradigms:

- Total: Organization wide
- Quality: With its usual Definitions, with all its complexities (External Definition)
- Management: The system of managing with steps like Plan, Organize, Control, Lead, Staff, etc.



Definition: As defined by the International Organization for Standardization (ISO): "TQM is a management approach for an organization, centered on quality, based on the participation of all its members and aiming at long-term success through customer satisfaction, and benefits to all members of the organization and to society."

### **Basic Concepts:**

TQM requires six basic concepts

1. A committed and involved management: TQM is a continual long term activity that must be imbibed in the culture of the organization. Everything begins with the long-term-top-to-bottom-organization support. Management must participate in the quality program, establish a council to develop clear vision, set goals and direct the programs
2. An unwavering focus on the customer: Customers are the very purpose of any organization. Key to an effective TQM is orienting all activities towards the need of the customer, both internally and externally.
3. Effective involvement and achievement of the entire work force: Implementing TQM is everyone's responsibility. Employees are the future of any organization. All personnel must be trained in TQM, its tools. They must be empowered to perform processes in an optimal manner.
4. Continuous improvement of the business and production processes: All employees must continually strive to improve all business and production systems.
5. Treating Suppliers as Partners: 40 to 60 % of the product cost is outsourced. So all supplier organizations have to be treated as extension of one's organisations.
6. Establish Performance measures: Measure and prosper. Measures should be available to note downtimes, nonconformities and satisfaction of customers, absenteeism etc.

### **Principles of Total Quality Management:**

The eight principles are:

1. Customer-Focused Organisation
2. Leadership
3. Involvement of People
4. Process Approach
5. System Approach to Management
6. Continual Improvement
7. Factual Approach to Decision Making and
8. Mutually Beneficial Supplier Relationships.

**Principle 1 - Customer-Focused Organisation** "Organisations depend on their customers and therefore should understand current and future needs of the customer, meet customer requirements and strive to exceed customer expectations".

Steps in application of this principle are:

1. Understand customer needs and expectations for products, delivery, price, dependability, etc.
2. Ensure a balanced approach among customers and other stake holders (owners, people, suppliers, local communities and society at large) needs and expectations.
3. Communicate these needs and expectations throughout the organisation.
4. Measure customer satisfaction & act on results, and
5. Manage customer relationships.

**Principle 2 - Leadership** "Leaders establish unity of purpose and direction of the organisation. They should create and maintain the internal environment in which people can become fully involved in achieving the organisation's objectives." Steps in application of this principle are:

1. Be proactive and lead by example.
2. Understand and respond to changes in the external environment.
3. Consider the needs of all stake holders including customers, owners, people, suppliers, local communities and society at large.
4. Establish a clear vision of the organisation's future.
5. Establish shared values and ethical role models at all levels of the organisation.
6. Build trust and eliminate fear.
7. Provide people with the required resources and freedom to act with responsibility and accountability.
8. Inspire, encourage and recognise people's contributions.
9. Promote open and honest communication.
10. Educate, train and coach people.
11. Set challenging goals and targets, and
12. Implement a strategy to achieve these goals and targets.

**Principle 3 - Involvement of People** "People at all levels are the essence of an organisation and their full involvement enables their abilities to be used for the organisation's benefit". Steps in application of this principle are:

1. Accept ownership and responsibility to solve problems.
2. Actively seek opportunities to make improvements, and enhance competencies, knowledge and experience.
3. Freely share knowledge & experience in teams
4. Focus on the creation of value for customers.
5. Be innovative in furthering the organisation's objectives.
6. Improve the way of representing the organisation to customers, local communities and society at large.
7. Help people derive satisfaction from their work, and
8. Make people enthusiastic and proud to be part of the organisation.

**Principle 4 - Process Approach** "A desired result is achieved more efficiently when related resources and activities are managed as a process." Steps in application of this principle are:

1. Define the process to achieve the desired result.
2. Identify and measure the inputs and outputs of the process.

3. Identify the interfaces of the process with the functions of the organisation.
4. Evaluate possible risks, consequences and impacts of processes on customers, suppliers and other stake holders of the process.
5. Establish clear responsibility, authority, and accountability for managing the process.
6. Identify internal and external customers, suppliers and other stake holders of the process,
7. When designing processes, consider process steps, activities, flows, control measures, training needs, equipment, methods, information, materials and other resources to achieve the desired result.

**Principle 5 - System Approach to Management** "Identifying, understanding and managing a system of interrelated processes for a given objective improve the organisation's effectiveness and efficiency." Page 13 of 23 Steps in application of this principle are:

1. Define the system by identifying or developing the processes that affect a given objective.
2. Structure the system to achieve the objective in the most efficient way.
3. Understand the interdependencies among the processes of the system.
4. Continually improve the system through measurement and evaluation, and
5. Estimate the resource requirements and establish resource constraints prior to action.

**Principle 6 - Continual Improvement** "Continual improvement should be a permanent objective of the organisation." Steps in application of this principle are:

1. Make continual improvement of products, processes and systems an objective for every individual in the organization.
2. Apply the basic improvement concepts of incremental improvement and breakthrough improvement.
3. Use periodic assessments against established criteria of excellence to identify areas for potential improvement.
4. Continually improve the efficiency and effectiveness of all processes.
5. Promote prevention based activities.
6. Provide every member of the organisation with appropriate education and training, on the methods and tools of continual improvement such as the Plan-Do-Check-Act cycle, problem solving, process re-engineering, and process innovation
7. Establish measures and goals to guide and track improvements, and
8. Recognise improvements.

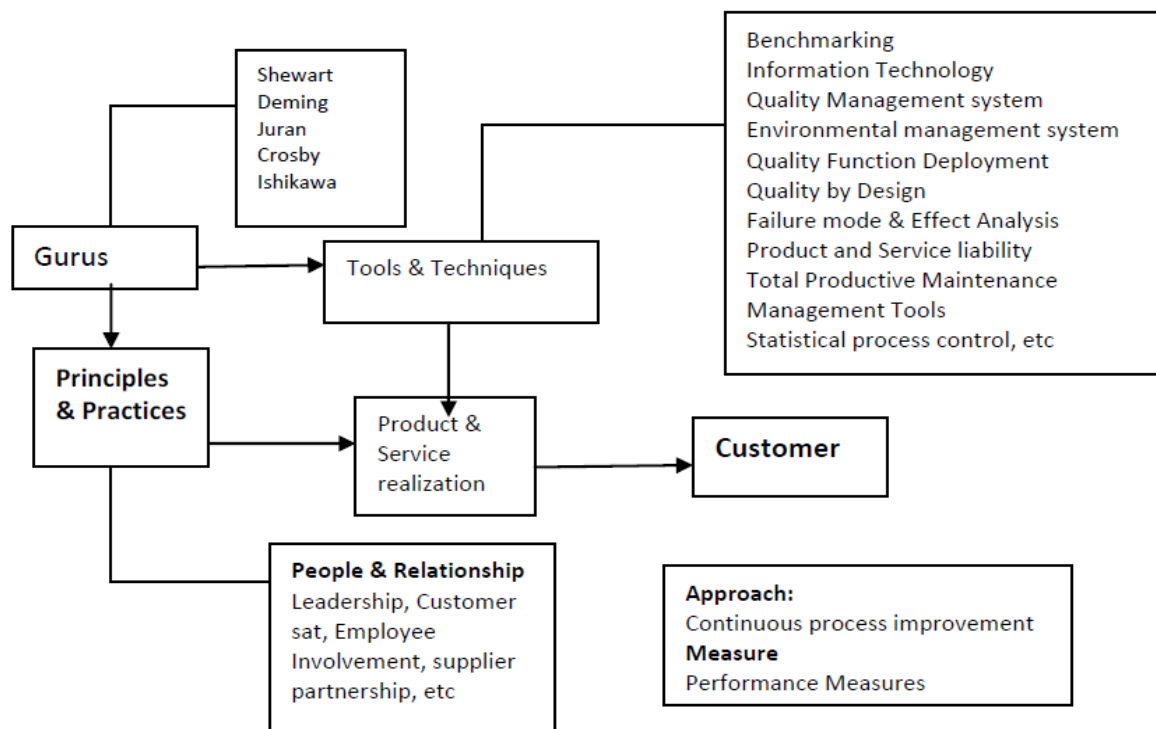
**Principle 7 - Factual Approach to Decision Making** "Effective decisions are based on the analysis of data and information." Steps in application of this principle are:

1. Take measurements and collect data and information relevant to the objective.
2. Ensure that the data and information are sufficiently accurate, reliable and accessible.
3. Analyse the data and information using valid methods.
4. Understand the value of appropriate statistical techniques, and
5. Make decisions and take action based on the results of logical analysis balanced with experience and intuition.

**Principle 8 - Mutually Beneficial Supplier Relationships** "An organisation and its suppliers are interdependent, and a mutually beneficial relationship enhances the ability of both to create value." Steps in application of this principle are:

1. Identify and select key suppliers.
2. Establish supplier relationships that balance short-term gains with long-term considerations for the organisation and society at large.
3. Create clear and open communications.
4. Initiate joint development and improvement of products and processes.
5. Jointly establish a clear understanding of customers' needs.
6. Share information and future plans, and
7. Recognise supplier improvements and achievements

### TQM Framework



TQM has evolved over a period of time through practice and the contribution of principles by various gurus. The whole system is focused towards the customer, who is the basic purpose for which the Organization exists. The products and services are realized by the combination of various principles and practices based on people and relationships, and Tools and Techniques, as shown above. The approach to product realization is by continuously identifying activities and process for incremental and breakthrough improvement so as to provide the best to the customer. This happens when at every stage all activities and process have progressive performance measures which channelize the performance in the direction of the set goal.

#### **Benefits of TQM:**

- Improved quality
- Employee participation

- Team work
- Working relationship
- Customer satisfaction
- Employee satisfaction.
- Increased productivity
- Communication]
- Profitability
- Increased market share

### DEVELOPMENT OF SOURCES

- The main thing is to ensure that the potential suppliers who show interest in the product, has the minimum essential plant equipment and skilled manpower.
- Quality engineers can set up necessary controls to ensure the quality of product to be maintained at acceptable level.
- Condition of supply should be put down in writing that clearly explains the vendor the submission of preproduction sample or a particular type of packaging etc.
- The following details should be considered:
  - Any national or international standard specification should be clearly mentioned
  - Materials to be approved by the purchaser before taken into use
  - Size of the sample, mode of dispatch and test to be conducted on the sample should be known to the vendor
  - Deviations from drawing and specifications or concessions on certain quality requirements should be clearly defined
  - Method of acceptance should be clarified to the vendors
  - Product nomenclature, part number and other details should be specified
  - Warranty clauses and procedure for claims should be clarified in details

### MANUFACTURING

Manufacturing involves making products from raw material by various processes or operations. It is a complex activity, involving people having broad range of disciplines and skills and a wide variety of machinery, equipments etc.

#### Considerations in Manufacturing

- i. Design must fully meet requirements and specifications of the product
- ii. Manufacturing must be by the most economical methods in order to minimize cost
- iii. Quality must be built into the product at each stage from design to assembly
- iv. Production methods must be flexible to changing demands, types of product, production rates, production quantities and on-time delivery to customer
- v. Strive for higher productivity by optimum use of the resources (material, machine, energy, capital, labour and technology)

### MANUFACTURING STEPS

#### 1. Pre-production Activity

- a. Selection of supplier
- b. Develop pilot-run plan
- c. Develop manufacturing strategy

#### 2. Pilot run

- a. Validate manufacturing process against:
  - i. Objectives in product specification
  - ii. Cost
  - iii. Quality
  - iv. Documentation
  - v. Tooling
  - vi. Training
  - vii. Process control
  - viii. Supplier plan and contract
  - ix. Internal failure analysis

#### 3. Production run

- a. Produce high quality product on time
- b. Continue to tune the process
- c. First order manufacture
- d. Verification of product cost

#### 4. Delivery to customer

- a. Deliver first production unit to the customer
- b. Refine manufacturing process based on:
  - i. First built
  - ii. Monitor field unit performance

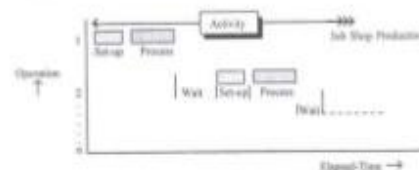
### METHODS OF MANUFACTURING

There is a variation in the production system as per the need of the product. Generally, production volume is the most important issue. There are three methods of the manufacturing:

1. Job Shop Production,
2. Batch Production, and
3. Mass Production.

#### Characteristics of Job Shop Production

- i. To meet a particular customer's needs
- ii. Lot size is small
- iii. Variety is high
- iv. Equipments used are general purpose and flexible to meet specific customer needs
- v. Labour should be highly skilled
- vi. Eg., grinding, gear manufacturing, fabrication etc.

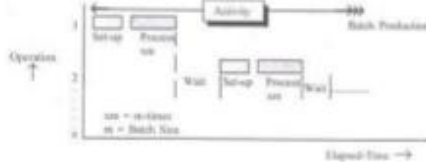


#### Characteristics of Batch Production

- i. For repeated customer orders
- ii. Lot size is medium and in batches
- iii. For moderate variety
- iv. Machines and equipments are general purpose

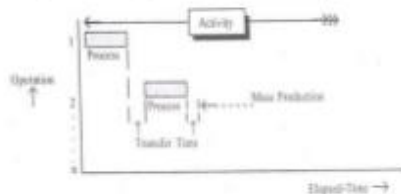
Group of Institutions

- v. Labour should be high skilled
- vi. Eg., bakery items, sports shoes, t-shirts etc.



**Characteristics of Mass Production**

- i. For high demand items
- ii. Lot size is very large
- iii. Variety may be one of its kind
- iv. Special machines, tools and equipments are used
- v. Labour skill level is moderate
- vi. Entire plant is designed to cater a few special varieties of products
- vii. Eg., oil refinery, chemical processing unit etc.



**TECHNIQUES OF MANUFACTURING**

1. **Just-in-Time (JIT) Manufacturers**
  - a. To keep the process moving and schedule supplies to arrive at the factory just-in-time for them to be used in production
2. **Kanban**
  - a. An automatic request for new supplies to the suppliers when supplies are running short
3. **Just-in-Sequence (JIS)**
  - a. Supplies arrive at the factory at the exact moment they are needed within the manufacturing sequence
4. **Total Productivity Maintenance (TPM)**
  - a. To repair minor issues with the machines to avoid stopping production
5. **Quick Response Manufacturing (QRM)**
  - a. To short the time period elapsed between customer's request for a product and its delivery
6. **Cellular Manufacturing**
  - a. Factory floor is divided into different sections or cells
  - b. Machines are placed in the order that facilitate the material flow to the completion of the product

7. **Single-minute Exchange of Die (SMED)**
  - a. Reduce waste time when there is some change in the process from old product to new product
8. **DMADV Methodology**
  - a. Design, Measure, Analyze, Design and Verify methodology based on the analysis of customer demand
  - b. Manufacturers plan ahead and try to design ways to avoid defects in the first place
9. **SIPOC Methodology**
  - a. Suppliers, Inputs, Process, Outputs, Customers methodology to allow manufacturers to trace the life cycle of the products from supplier to customer and identify problem areas
10. **Accelerate production**
  - a. Computer-aided-Design (CAD)
  - b. Computer-aided Manufacturing (CAM)
  - c. Computer-controlled Machines (CCM)
  - d. Computer-integrated Manufacturing (CIM)

**STEPS FOR QUALITY MANUFACTURING**

1. **Actual Process**
  - a. Name of the process
  - b. Starting and ending points
  - c. Inputs and outputs
  - d. Customers and suppliers
2. **Areas of Improvements**
  - a. Durability
  - b. Material
  - c. Toxicity
  - d. Disintegration of parts
3. **Solution for the problems**
  - a. Brainstorming
  - b. Consultation through specialists
  - c. Feedback from those who work on the process regularly
4. **Detailed Solution**
  - a. The personnel necessary for making improvements
  - b. Project cost analysis
  - c. Time frame for completing the overall improvements
  - d. How the improvement will affect rest of the plant
5. **Put Plan into Action**
  - a. Involve everyone who utilize the process in implementing the action plan
6. **Evaluate**
  - a. The process should have desired effect
  - b. The problem is fixed
  - c. Waste eliminated
  - d. Improvement within budget and time frame

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## INSPECTION AND CONTROL OF PRODUCT

Product Quality Inspections will help to protect the brand and the company's reputation by minimizing defective merchandise, customer complaints, non-compliant products, and late shipments. Quality Inspections can help manufacturers:

- Ensure product safety prior to shipping
- Minimize the amount of defective merchandise
- Reduce customer complaints due to inferior products
- Detect merchandise containing non-standard or non-compliant components
- Eliminate late shipments

Based on your specific needs throughout the manufacturing process, there are a wide variety of quality inspection services.

### Pre-Production Inspections

- Inspection of raw materials and components before production begins.
- After product samples are provided, verify that the factory has ordered the correct materials, components, and accessories.
- Also randomly select and inspect a sample of partially produced products for potential defects, then report findings.
- The technical advice necessary to improve product quality and to minimize the chance of defects during production.

### During Production Inspections

- They are ideal for:
  - Shipments of substantial quantities;
  - Product lines with continuous production;
  - Strict requirements for on-time shipments; and
  - As a follow-up if poor results were found during Pre-Production Inspection.
  - Normally, it is carried out when 10-15% of the merchandise is completed.
- At this point deviations are identified.
- If any, take advice on corrective measures that will ensure uniformity of product and quality.

- Re-check any defects discovered during Pre-Production Inspection and confirm that they have been rectified.

### Final Random Inspections

- It can begin only after production has been completed and all merchandise is ready and packed for shipment.
- Through a statistical method set by industry standards, sample products to verify product safety, quantity, workmanship, function, colour, size, packing, and more.
- This ensures that the product is consistent and compliant with all country, industry, or otherwise-specified requirements and that no critical major or minor defects appear.

### Loading Supervision

- Closely monitor the loading process
- Verify product quantity, and
- Ensure proper handling of the cargo.
- Seal the container(s) tape as proof of compliance.
- This significantly reduces the risk associated with importing cargo.

## QUALITY IN SALES AND SERVICES

- Customer's relationship with the company may have begun with the sale, but it's the service experience that really cements the deal.
- Customers begin to see value in the product only after they have tasted the entire pie of service.
- An efficiently managed and utilized team of after sales field technicians can positively impact the.
- They have the potential to systematically nurture customer loyalty, since service quality has a direct relationship with customer intent to repurchase.
- Successful cross sell and up sell of related products is also easier if existing customers are satisfied with the support they have received.
- Team of after sales field technicians have the potential to directly contribute to organization's revenue stream.
- Methods for establishing a quality reputation:



- Only those product should be sold which fully meet the customer's requirement
- Adjustments of warranty claims
- Effective after sales service

#### **GUARANTEE**

- A promise or assurance, especially in writing, that something is of specified quality, content, benefit, etc., or that it will perform satisfactorily for a given length of time.
- An undertaking by the selling company that it will replace the product free of cost or refund the money if the defect is due to improper material or faulty manufacture.
- It convinces the customer about the quality of the product.
- It is a powerful sales tool.
- Following information included in guarantee card:
  - Validity period
  - Manufacturer's liability
  - Claim procedure
  - Invalidation conditions

#### **ANALYSIS OF CLAIMS**

- Claims analysis is a technique for examining the positive and negative consequences of design features that are described in current or future scenarios of use.
- A "claim" is a statement of the consequences of a specific design feature or artifact on users and other stakeholders.
- Investigation of claims involves thorough technical knowledge of the product.
- Guarantee claims may be investigated by quality control department.
- The minor claims can be settled by regional service centres and the major ones may be referred to the company.
- Procedure for claim should be simple.