UNIT-I

QUALITY CONCEPTS

UNIT-1(Quality Concepts)
Evolution of Quality Control – Concept Change –TQM Modern Concept –Quality Concept in Design –Review of Design –Evolution of Prototype

Total Quality:

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

Total Quality Management:

Total - Made up of the whole

      Quality - Degree of excellence a product or service provides

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

Why TQM:

1. A question of survival in the intense competitive environment

2. Increasing customer consciousness

Quality:

      ✓ Quality = Performance x Expectations

Dimensions of Quality:

- **Performance** — such as acceleration of a vehicle;
- **Reliability** — that the product will function as expected without failure;
- **Features** — the extras that are included beyond the basic characteristics;
- **Durability** — expected operational life of the product; and
- **Serviceability** — how readily a product can be repaired.

Basic Concepts of TQM:

1. Top management commitment

2. Focus on the customer – Both internal and external

3. Effective involvement and utilization of entire work force

4. Continuous improvement

5. Treating suppliers as partners

6. Establishing performance measures for the processes

Principles of TQM:

1. Customers' requirements - (both internal & external) must be met first time & every time
2. Everybody must be involved
3. Regular two way communication must be promoted
4. Identify the training needs and supply it to the employees
5. Top management commitment is must
6. Every job must add value
7. Eliminate waste & reduce total cost
8. Promote creativity
9. Focus on team work.

Characteristics:

1. Customer Oriented

2. Long term commitment for continuous improvement of all process

3. Team work

4. Continuous involvement of top management

5. Continuous improving at all levels and all areas of responsibility.

Definition:

1. TQM is the management approach of an organization, centered on quality, based on me participation of all its members and aiming at long-term success through customer satisfaction and benefits to all members of me organization and to society.

- ISO

2. TQM is an integrated organizational approach in delighting customers (both internal and external) by meeting their expectations on a continuous basis through everyone involved with the organization working on continuous improvement in all products, services, and processes along with proper problem solving methodology

- INDIAN STATISTICAL INSTITUTE (ISI)

3. TQM is a. people - focused management system that aims at continual increase in customer satisfaction at continually lower cost. TQM is a total system approach (not a separate area of

program), and an integral part of high level strategy. It works horizontally across functions and departments, involving all employees, top to bottom, and exceeds backwards and forward to include the supply chain and the customer chain

– TOTAL QUALITY FORUM OF USA

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. Staffing

4. Directing.

5. Controlling

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 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.

CHANGE CONCEPT:

While all changes do not lead to improvement, all improvement requires change. The ability to develop, test, and implement changes is essential for any individual, group, or organization that wants to continuously improve. There are many kinds of changes that will lead to improvement, but these specific changes are developed from a limited number of change concepts.

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 summarized 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: The accomplishment of a given task measured against preset known standards of accuracy, completeness, cost, and speed.

2. Features: a product feature is one of the distinguishing characteristics of a product or service that helps boost its appeal to potential buyers, and might be used to formulate a product marketing strategy that highlights the usefulness of the product to targeted potential consumers.

3. Durability: The ability to withstand wear, pressure, or damage.

4. Reliability: The quality of being trustworthy or of performing consistently well.

5. Serviceability: Degree to which the servicing of an item can be accomplished with given resources and within a specified timeframe.

6. Appearance: the way that someone or something looks.

7. Uniformity: the quality or state of being uniform.

8. Consistency and conformance: *Consistency* is the quality or condition of being *consistent*

9. Safety: The condition of being protected from or unlikely to cause danger, risk, or injury.

10. Time: A lead time is the latency between the initiation and execution of a process.

11. Customer service: The assistance and advice provided by a company to those people who buy or use its products or services.

12. Comparability: Capable of being compared; having features in common with something else to permit or suggest comparison

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

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.

QUALITY CONCEPTIN 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

REVIEW OFDESIGN:

Design review is a tool that can be used to help companies improve the quality of the products they produce, reduce the time to market for a product and reduce the development and scrap/rework costs of the project. It is a general activity that can be applied readily to any industry, and can be used to improve the quality of services as well as products. Design review consists of bringing the designers of a project together with unbiased, external reviewers to analyze the design of the project before any production is started. This allows for a project team to effectively identify problems that may occur with the product early in the design process to help reduce the potential for costly errors later.

Stage1 – Specification and architecture review

At this stage, designers should be reviewing customer requirements and creating preliminary drawings, schematics and broad functionality requirements to ensure that the rest of the design process will not be wasted on a product no one will purchase.

   Tools available: (Quality Functional Deployment) QFD, marketing analysis.

Stage 2 – Manufacturability, serviceability and reliability review

Designers need to communicate with manufacturing to ensure the product will be easy to manufacture. Special emphasis should be placed on trying to utilize existing company processes and products to reduce the impact the new design might have on the production process. Tools available: Failure mode and effects analysis (FMEA), Enterprise Resource Planning (ERP).

Stage 3 – Feature and expected performance review

Project team should focus on quantitative measures to determine how the product will function. Special emphasis should also be placed on market information for customer requirements to ensure the designers have applied as many features as possible to the product, and that customer needs have not changed since stage 1.

   Tools available: marketing analysis, focus groups, QFD.

     Raytheon uses a design review process at the system engineering level specifically to ensure that design changes will not ripple through the project. For example, if 2000 changes will need to be made to a project because of 1 change in the architectural design, that could cause serious problems. The thorough design review process employed at Raytheon allows the designers of the various parts to focus on adding features or improving the function of the parts without worrying about the additions working in relation to the rest of the project.

EVOLUTION OF PROTOTYPE

The idea behind this is that an initial prototype is presented to the user. They provide feedback and suggestions for improvements. These are actioned by the developer who then presents a more refined prototype. The user once more provides feedback. The process is repeated. So at each stage the prototype 'evolves' towards the final system. Hence the term 'evolutionary prototyping'.

You can view prototypes in two ways: what they explore; and how they evolve or what is their outcome.

In the context of the first view - what they explore - there are two main kinds of prototypes:

- A Behavioural prototype, which focuses on exploring specific behaviour of the system.
- A Structural prototype, which explores some architectural or technological concerns.

In the context of the second view - their outcome - there are also two kinds of prototypes:

- An Exploratory prototype, which is thrown away when done, also called a throw-away prototype.
- An Evolutionary prototype, which gradually evolves to become the real system.

Types of Prototyping:

1. Throwaway prototyping

Throwaway or rapid prototyping refers to the creation of a model that will eventually be discarded rather than becoming part of the final delivered software.

2. Evolutionary prototyping

Evolutionary prototyping (also known as breadboard prototyping) is quite different from throwaway prototyping. The main goal when using evolutionary prototyping is to build a very robust prototype in a structured manner and constantly refine it.

3. Incremental prototyping
The final product is built as separate prototypes. At the end, the separate prototypes are merged in an overall design. By the help of incremental prototyping the time gap between user and software developer is reduced.

4. Extreme prototyping
Extreme prototyping as a development process is used especially for developing web applications. Basically, it breaks down web development into three phases, each one based on the preceding one.

Prototyping Process:

The process of prototyping involves the following steps:

Identify basic requirements

⇩

Determine basic requirements including the input and output information desired. Details, such as security, can typically be ignored.

⇩

Develop initial prototype

The initial prototype is developed that includes only user interfaces. (See Horizontal Prototype, below)

⇩

Review

The customers, including end-users, examine the prototype and provide feedback on potential additions or changes.

⇩

Revise and enhance the prototype

Using the feedback both the specifications and the prototype can be improved. Negotiation about what is within the scope of the contract/product may be necessary. If changes are introduced then a repeat of steps 3 and 4 may be needed.

Evolutionary Prototyping:

Evolution prototyping is quite different from Throwaway prototyping. The main goal using Evolutionary prototyping is to build a very robust prototype in a structured manner and constantly refine it. When developing a system using evolutionary prototyping, the system is continually refined and rebuilt on the previously built prototype. The previous prototype is not thrown away just like for Throwaway prototyping model.
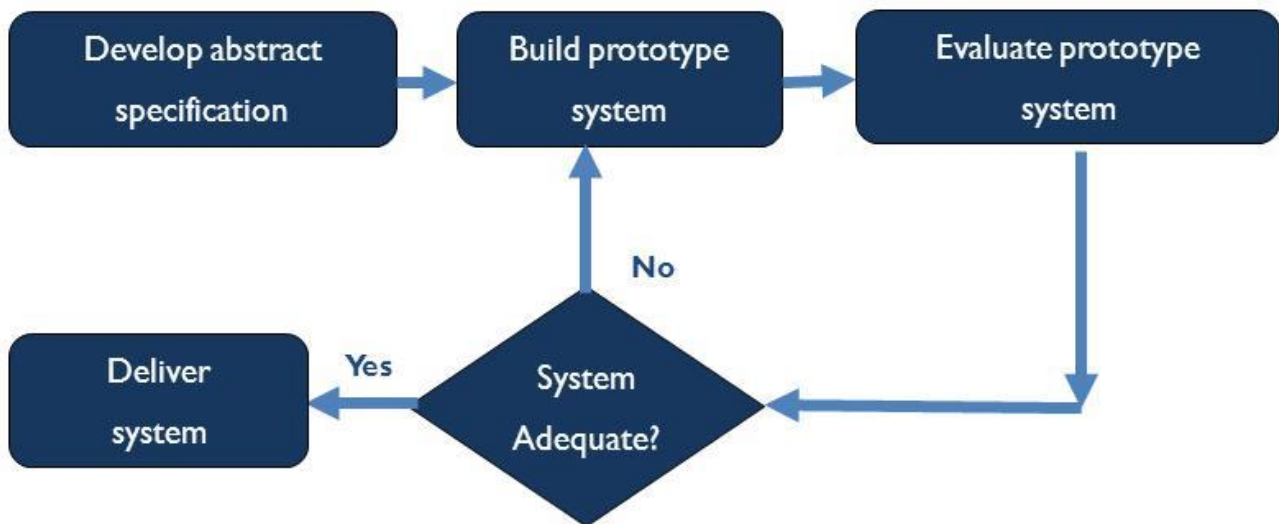
Advantages:

- Effort of prototype is not wasted.
- Faster than the waterfall model.
- High level of user involvement from the start
- Technical or other problems discovered early – risk reduced.
- Mainly suitable for projects with vague and unstable requirements.

Disadvantages:

- Prototype usually evolve so quickly that it is not cost – effective to produce great deal of documentation
- Continual change tends to corrupt the structure of the prototype system. Maintenance is therefore likely to be difficult and costly.
- It is not clear how to range of skills which is normal in software engineering teams can be used effectively for this mode of development.