UNIT-IV

TQM TOOLS AND TECHNIQUES

QFD-QUALITY FUNCTION DEPLOYMENT

Introduction:

- Quality Function Deployment (QFD) is a planning tool used to fulfill customer expectations.
- It is a disciplined approach to product design, engineering and production and provides in-depth evaluation of a product.
- QFD focuses on customer expectations or requirements often referred to as the voice of the customer.
- It is employed to translate customer expectations in terms of specific requirements, in two directions and actions, in terms of engineering or technical characteristics that can be deployed through
    - Product planning
    - Part development
    - Process Planning
    - Production Planning
    - Service Industries

QFD Team:

- When an organization decides to implement QFD, the project manager and team members need to be able to commit a significant amount of time to it, especially in the early stages.
- Teams compose of members from marketing, design, quality, finance and production.
- One of the most important tools in the QFD process is communication.
- Team meetings are very important in the QFD process.
- The team leader needs to ensure that the meetings run in the most efficient manner and that the members are kept informed.
- The meeting format should have some way of measuring how well the QFD process is working at each meeting and should be flexible depending on certain situations.

Voice of the Customer:

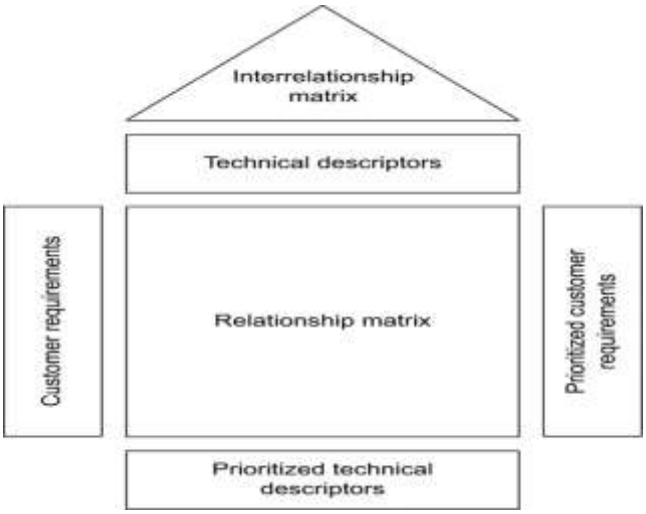
- Words used by the customer to describe their expectations are often referred to as the voice of the customer.
- Customer satisfaction like quality is defined as meeting or exceeding customer expectations.
- QFD begins with marketing to determine what exactly the customer desires from a product.
- During the collection of information, the QFD team must continually ask and answer numerous questions such as
    a) What does the customer really want?
    b) What are the customers' expectations?
    c) Are the customers' expectations used to drive the design process?
    d) What can the design team to do achieve customer satisfaction?

Organization of Information

House of Quality:

The primary planning tool used in QFD is the house of quality. The house of quality translates the voice of the customer in to design requirements that meet specific target values and matches those against how an organization will meet those requirements.

Many managers and engineers consider the house of quality to be primary chart in quality planning.



Building a House of Quality:

Step1: List Customer Requirements (WHATs)

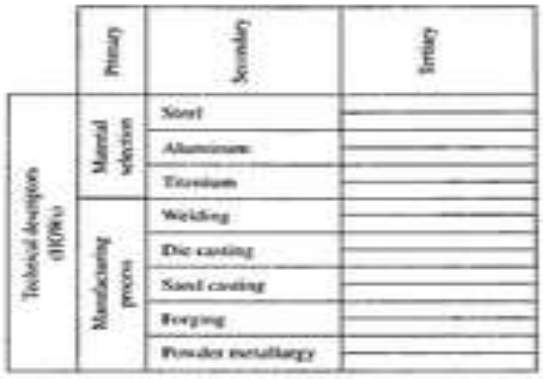
QFD starts with a list of goals and objectives.

- This list is often referred as the WHATs that a customer needs or expects in a particular product.
- This list of primary customer requirements is usually vague and very general in nature.
- Further a most detailed list of secondary customer requirements is needed to support the primary customer requirements.

Step 2: List Technical Descriptors (HOWs)

- The goal of the house of quality is to design or change the design of a product in away that meets or exceeds the customer expectations.
- Here the customer needs and expectations are expressed in terms of customer requirements; it is the duty of the QFD team to convert these requirements in to engineering characteristics or technical descriptors.
- Implementation of the customer requirements is difficult until they are translated in to counterpart characteristics.
- Counterpart characteristics are an expression of the voice of the customer in technical language.
- The list of technical descriptors is divided in two primary, secondary and tertiary technical descriptors.

- Determine their respective relationships.
- One way to reduce the confusion associated with determining the relationships between customer requirements and technical descriptors is to use an L-Shaped matrix.
- The L-Shaped matrix makes interpreting the complex relations very easy and does not require a significant amount of experience.



Step 3: Relationship Matrix

- The inside of the house of quality is called as the relationship matrix and it is usually filled by the QFD team.
- It is common to use symbols to represent the relationship between the customer requirements and descriptors.

Example:

A solid circle represents a strong relationship
A single circle represents a medium relationship
A triangle represents a weak relationship.

An empty column indicates that a particular technical descriptor does not affect any of the customer requirements and after careful scrutiny may be removed from the house of quality.

Step 4: Develop an interrelationship Matrix between HOWs

- The roof of the house of the quality called the correlation matrix is used to identify any interrelationships between each of the technical descriptors.

Symbols:

- ✓ A solid circle represents a strong positive relationship
- ✓ A circle represents a positive relationship

- ✓ An X represents a negative relationship
- ✓ An asterisk represents a strong negative relationship.

Step 5: Competitive Assessments

- ➢ The competitive assessments are a pair of weighted tables that depict item for item how competitive products are compared with current organization products.
- ➢ The competitive assessment tables are separated in to two categories customer assessment and technical assessment.
- ➢ The numbers 1 through 5 are listed in the competitive evaluation column to indicate a rating of 1 for worst and 5 for best.
- ➢ The customer competitive assessment is a good way to determine is the customer requirements has been met and identifies areas to concentrate in on the next design.

Technical Competitive Assessment:

- ➢ Customer requirements and technical descriptors that are strongly related should also exhibit a strong relationship in their competitive assessments.
- ➢ If an organization technical assessment shows its products to be superior to the competition, then the customer assessment should show a superior assessment.
- ➢ If the customer disagrees, then a mistake in engineering judgement has occurred and should be corrected.

Step 6: Develop Prioritized customer requirements

- ➢ Importance to customer
- ➢ Target value
- ➢ Scale-up factor
- ➢ Sales point
- ➢ An absolute weight

Step 7: Develop Prioritized technical descriptors

- ➢ Degree of technical difficulty
- ➢ Target value
- ➢ Absolute weights
- ➢ Relative weights

TOTAL PRODUCTIVE MAINTENANCE

Definition:

TPM (Total Productive Maintenance) is a maintenance philosophy designed to integrate equipment maintenance into the manufacturing process. The goal of any TPM program is to eliminate losses tied to equipment maintenance or, in other words, keep equipment producing only good product, as fast as possible with no unplanned downtime.

Meaning:

Total- All encompassing by maintenance and production individuals working together.

Productive-Production of goods and services that meet or exceed customers expectations

Maintenance-Keeping equipment and plant in as good as or better than the original condition at all times.

Steps:

- ❖ Management learns the new philosophy
- ❖ Management promotes the new philosophy
- ❖ Training is funded and developed for everyone in the organization
- ❖ Areas of needed improvement are identified
- ❖ Performance goals are formulated
- ❖ An implementation plan is developed
- ❖ Autonomous work groups are established.

1. Learning the new philosophy:

- ✓ TPM is merely trying to tap in to an unused resource, the brain power and problem solving ability of all the organizations employees.
- ✓ Thus it is necessary to allow people to make decisions.
- ✓ Many organizations have had the flavor-of-the-mouth approach to changing management techniques.
- ✓ This approach has led to credibility problems with employees.
- ✓ Management is changed and the new manger does not build on past accomplishments but develops a new system that will presumably solve all of the organizations problems.
- ✓ Lack of ownership seems to cause low cause morale and dissatisfaction with management.
- ✓ Ownership should be based on what is good for the customer and for the employees that serve the customer.

2. Promoting the new philosophy:

- ✓ Senior management must spend more time in promoting the system.
- ✓ They must sell the idea and let the employees know that they are totally committed to its success.
- ✓ If the belief in the new philosophy and commitment are not there, then positive results will not happen.
- ✓ Too often lip service is given to a "new idea".
- ✓ This can be solved by a belief that the new system will solve some immediate problems and lead to an immediate return on investment.
- ✓ A long term commitment to the new philosophy is required.
- ✓ One of the best ways to implement the new philosophy is just to start doing it.
- ✓ In other words start giving the maintenance and production personnel more autonomy.
- ✓ Once the employees realize that management is serious about taking the organization in a new, more positive direction, employees will usually respond.

3. Training:

- ✓ Teach the new philosophy to mangers at all levels.
- ✓ Begin with senior management and work down to first line supervisors.
- ✓ Don't teach the **HOW** also teach the **WHY**

- ✓ Senior management must spend time learning about and understanding the ramifications of this philosophy to their organization.
- ✓ Some managers are needed to be replaced because they don't accept change and also identify managers who readily respond to new philosophy.
- ✓ First line supervisors need to learn their role in what most likely will be a new environment.
- ✓ There needs to be some instruction in the areas of jobs that maintenance people do and jobs that production people do.
- ✓ A great benefit of TPM is the cross-pollination of ideas between maintenance technicians and production operators.

4. Improvement Needs:

- ✓ There are usually some machines that seem to be on the verge of breaking down or require an excessive amount of maintenance.
- ✓ Employees who work with the equipment on a daily basis are better able to identify those conditions than anyone else in the organization.
- ✓ A good first step is to let the operators and maintenance technicians tell management which machines and systems need the most attention.
- ✓ An implementation team of operators and technicians to coordinate this process is essential.

Six Losses:

Downtime Losses:

- ❖ **Planned**
  - ✓ Start ups
  - ✓ Shift Changes
  - ✓ Coffee and lunch breaks
- ❖ **Unplanned:**
  - ✓ Equipment breakdown
  - ✓ Change over's
  - ✓ Lack of material
- ❖ Idling and minor stoppages
- ❖ Slow downs and poor quality losses
- ❖ Process nonconformities
- ❖ Scrap

5. Goal:

- ✓ Goal should be set after the improvement needs are identified.
- ✓ The first goal is to establish the time frame for fixing the prioritized problem.
- ✓ Technicians and operators will probably want it done faster than management because it causes them more problems on a daily basis.
- ✓ Identifying needs and setting goals begins the process of getting the organization to work as a team.

6. Developing Plans:

- ✓ First, develop and implement an overall plan of action for training all employees.
- ✓ Plans for developing the autonomous work groups should take place during the training phase.

- ✓ Plan to use, team of maintenance technicians and operators to work on particularly troublesome problems.
- ✓ Priorities can be set and management can make a commitment with resources to correct some of the basic problems.

7. Autonomous Work Groups:

- ✓ Autonomous work groups are established based on the natural flow of activity.
- ✓ First make the operator responsible for the equipment and the level of maintenance that he is capable of performing.
- ✓ Next, identify the maintenance personnel who work in certain areas or have certain skill levels.
- ✓ Operators and maintenance personnel are brought together resulting in an autonomous work group.
- ✓ These groups must have the authority to make decisions about keeping the equipment in first class running order.

COST OF QUALITY

Quality costs are defined are those costs associated with the non-achievement of product or service quality as defined by the requirements established by the organization and its contracts with customers and society.
Simply stated, quality cost is the cost of poor products or services.

CATEGORIES & ELEMENTS OF QUALITY COST

I. Preventive Cost Category

1. Marketing/Consumer/User:

Costs are incurred in the accumulation and continued evaluation of customer and user quality needs and perceptions affecting user satisfaction with the organizations product or service.

2. Product/Service/Design Development:

Costs are incurred to translate customer and user needs in to reliable quality standards and requirements and to manage the quality of new product or service.

3. Purchasing:

Costs are incurred to assure conformance requirements of supplier parts, materials or processes and to minimize the impact of supplier non conformance on the quality of delivered products or services.

4. Operations (Manufacturing or service):

Costs are incurred in assuring the capability and readiness of operations to meet quality standards and requirements and to impart quality education to operating personnel.

5. Quality Administration:

Costs are incurred in the overall administration of the quality management function.

II. Appraisal Cost Category

1. Purchasing Appraisal Costs:

Purchasing appraisal costs can generally be considered the costs incurred for the inspection and test of purchased supplies or service to determine acceptability to use.

2. Operations (Manufacturing or service) Appraisal Costs:

Operations appraisal costs can generally be considered the costs incurred for the test or audit required to determine and assure the acceptability of product or service.

3. External Appraisal Costs:

External appraisal costs are incurred for field set up or installation and check out for the acceptance of customers.

4. Review of Test & Inspection:

Costs are incurred for regular reviewing inspection and test data, prior to release of the product for shipment.

5. Miscellaneous Quality Evaluations:

Costs involved in quality audits to assure continued ability to provide acceptable support to the production process.

III. Internal Failure Cost Category

1. Product or Service Design Failure Costs (Internal):

Design failure costs are the unplanned costs that are incurred because of inherent design inadequacies.

2. Purchasing Failure Costs:

Costs which are incurred due to the rejects of purchased items.

3. Operations (Product or Service) Failure Costs:

The costs associated with nonconforming product or service discovered during the operations process**.** It is categorized in to three distinct areas: material review and corrective action, rework or repair costs and scrap costs.

IV. External Failure Cost Category

1. Complaint Investigations of Customer or User Service:

It includes the total cost of investigating, resolving and responding to individual customer and user complaints.

2. Returned Goods:

Costs incurred in evaluating, repairing and replacing goods.

3. Retrofit and Recall costs

Retrofit and recall costs are those costs required to modify or update products or field service facilities to a new design change level, based on major redesign due to design deficiencies.

4. Warranty Claims

Warranty costs include the total costs of claims paid to the customer or user after acceptance to cover expenses, including repair costs, such as removing defective hardware from a system, or cleaning costs, due to food or chemical service accident.

5. Liability Costs

Liability costs are organization-paid costs due to liability claims, including the cost of product or service liability insurance.

6. Penalties

Penalty costs are those costs incurred because less than full product or service performance is achieved as required by contracts with customers or by government rules and regulations.

7. Customer or user good will

This category involves costs incurred that customers are not satisfied with quality of delivered product or service because the customer's quality expectations were greater than the quality they received.

8. Lost Sales

Lost sales comprise the value of the contribution to profit that is lost due to sales reduction because of quality problems**.**