# TOTAL QUALITY MANAGEMENT

## PRINCIPLES, METHODS AND APPLICATIONS

ANSH JOSHI

# Total Quality Management: Principles, Methods and Applications

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Ansh Joshi
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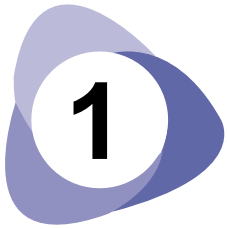


# INTRODUCTION

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## 1.1 Need for quality

One of the important issues that business has focused on the last two decades is “quality”. The other issues are cost and delivery. Consumers only buy the goods which meet their requirements and expectations with good quality and accepted price.

Quality has been widely considered as a key element for success in business in the present competitive market. A Quality refers to meeting the needs and expectations of customers. It is important to understand that the quality is about more than a product simply working properly.

The Quality refers to certain standards and the ways and means by which those standards are maintained, achieved and improved. Quality is not just confined to the products and services. It is the homogeneous element of any aspect of doing things with high degree of perfection. For example, the Business success depends on the quality decision making.

## 1.2 Evolution of quality

The history of total quality management (TQM) began initially as a term coined by Naval Air Systems Command to describe its Japanese-style management approach for quality improvement.

An umbrella methodology for continually improving the quality of all processes, it draws on knowledge of the principles and practices of:

- The analysis of quantitative and non-quantitative data

- The behavioral sciences

- Process analysis
- Economics theories


## Evolution of Quality

| | |
|---|---|
| 1920s | • Some of the first seeds of quality management were planted as the principles of scientific management swept through U.S. industry.<br>• Businesses clearly separated the processes of planning and carrying out the plan, and the union opposition arose as workers were deprived of a voice in the conditions and functions of their work.<br>• The Hawthorne experiments in late 1920s showed how the workers productivity could be impacted by participation. |
| 1930s | Walter Shewhart developed methods for statistical analysis and control of quality. |
| 1950s | • W. Edwards Deming taught methods for the statistical analysis and control of quality to Japanese engineers and executives. This can be considered the origin of TQM.<br>• Joseph M. Juran taught the concepts of controlling the quality and managerial breakthrough.<br>• Armand V. Feigenbaum's book Total Quality Control, a forerunner for the present understanding of TQM, was published.<br>• Philip B. Crosby's promotion of zero defects paved the way for quality improvement in many of the companies. |
| 1968 | • The Japanese named their approach to the total quality company wide quality control. It is around this time that the term quality management systems arises.<br>• Kaoru Ishikawa's synthesis of the philosophy contributed to the Japan's ascendancy as a quality leader. |

| | |
|---|---|
| Today | • TQM is the name for the philosophy of a broad and systemic approach to managing organizational quality.<br>• Quality standards such as ISO 9000 series and quality award programs such as the Deming Prize and the Malcolm Baldrige National Quality Award specify principles and processes that comprise TQM. |

## 1.3 Definition of quality

1. Predictable degree of uniformity and dependability at low cost and suited to the market -**Deming**

2. Fitness for use-**Juran.**

3. Conformance to requirements - **Crosby.**

4. A minimum loss imparted by a product to society from the time the product is shipped - **Taguchi.**

5. A way of managing tile organization -**Feigenbaum.**

6. Correcting and preventing loss, not living with loss – **Hosffin.**

7. Totality characteristics of an entity that bear on its ability to satisfy stated and implied needs – **ISO.**

**Quality**

Quality is quantified as

$$Q=\frac{P}{E},$$

Q - Quality

P - Performance

E - Expectations

If Q is greater than E, then the customer has a good feeling about the product or service.

**Quality planning:**

The quality planning is the strategy planning process in which the quality is embedded in each and every step. Quality planning can be applied for the following levels:

1. Supervisory and worker level

2. Multi levels

3. Functional levels

4. Major programming level.

## 1.4 Dimensions of manufacturing and service quality

**Dimensions View of Quality:**

Quality has nine different dimensions.They are as follows:

1. Features

2. Performance

3. Conformance

4. Reliability

5. Durability

6. Service

7. Response

8. Aesthetics

9. Reputation

Following table shows these nine dimensions of quality with their meanings and explanations in terms of a cell phone.

| S.No. | Dimension | Meaning and Example |
|---|---|---|
| **1.** | Features | Secondary characteristics such as added features like calculators and alarm clock features. |

| | | |
|---|---|---|
| **2.** | Performance | Primary operating characteristics of a product such as signal coverage, audio quality, display quality, etc. |
| **3.** | Conformance | Means meeting specifications or industry standards, workmanship (or) the degree to which a product's design or operating characteristics match pre-established standards. |
| **4.** | Reliability | The probability of a product's failing with a specified period of time. |
| **5.** | Durability | It is a measure of product's life having both economic and technical dimensions. |
| **6.** | Service | Resolution of problem and complaints, ease of repair. |
| **7.** | Response | Human to Human interface. |
| **8.** | Aesthetics | Sensory characteristics like exterior finish. |
| **9.** | Reputation | Past performance and other intangibles. |

These dimensions are almost independent. Therefore the product can be excellent in one dimension and average or poor in another. Rarely very few products excel in all the nine dimensions.

For example, the famous Japanese high quality cars, in the 1970s are based only on the dimensions of reliability, conformance and aesthetics. Therefore, quality products can be determined by using a few of the dimension of quality.

**Service Quality:** It is the set of activities an organization uses to satisfy the customers and their needs.

**Dimensions of Service Quality:**

**1. Reliability:** It refers to the dependability of the service providers and their ability to keep their promises.

**2. Responsiveness:** This refers to the reaction time of the service. It is the willingness to help the customer promptly in case of special and unforeseen requirements.

**3. Assurance:** This refers to the level of certainty a customer has regarding the quality of the service provided. It is the extent to which the service provider and the staff is able to inspire the trust and confidence.

**4. Empathy:** It is being able to understand the needs of the customer as an individual and meet the special requirements of the customer.

**5. Tangible:** It refers to services look or feel. It is similar to the physical characteristics of quality of product. This refers to the physical characteristics of facilities, equipments, consumable goods and personnel used in or associated with service provided.

**6. Other Dimensions:**

• Time

• Consistency

• Completeness.

## 1.5 Basic concepts of TQM

**Basic concepts of TQM:**

Total Quality Management is the management approach of an organization, that is centered on good 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.

TQM is the management philosophy that seeks to integrate all the organizational functions (engineering, marketing, design and production, customer service, finance, etc.) to focus on meeting the customer needs and organizational objectives.

TQM views an organization as a collection of processes. It maintains that organizations must strive to continuously improve the processes by incorporating the knowledge and experiences of workers. The simple objective of TQM is “Do the right things, right the first time, every time.” TQM is infinitely variable and adaptable. Although originally applied to the manufacturing operations and for a number of years only used in that area, the TQM is now becoming recognized as a generic management tool, just as applicable in service and public sector organizations. There are number of evolutionary strands, with different sectors creating their own versions from the common ancestor. TQM is the foundation for activities, which include:

• Just in time/demand flow manufacturing

• Meeting customer requirements

- Reducing development cycle times
- Improvement teams
- Reducing product and service costs
- Line management ownership
- Systems to facilitate improvement
- Employee involvement and empowerment
- Challenging quantified goals and benchmarking
- Recognition and celebration
- Specific incorporation in strategic planning
- Focus on processes / improvement plans
- Commitment by senior management and all employees

**1. Focus on the customer:**

Achieving customer satisfaction is the heart of TQM. Customers include both internal and external customers. So, focus on the customer is the key for any TQM programme.

**2. Top management commitment:**

Top management should participate completely.

**3. Continuous improvement:**

TQM is based on the quest for progress and improvements in TQM believes that there is always a better way of doing things, way to make better use of the company's total quality resources and a way to be more productive. For this purpose, various quality tools and techniques may be used.

**4. Effective involvement and utilization of the entire work force:**

This concept is sometimes referred as 'principle of employee's involvement' or 'respect for people'. TQM is a team work. Total quality recognizes that each person is responsible for the quality of his work and for the work of the group.

All persons must be trained in TQM, Statistical Process Control (SPC) and other appropriate quality improvement skills so that they can effectively participate on quality teams.

**5. Establishing performance measures for the process:**

Quantitative data are necessary to measure the continuous quality improvement activity. Therefore, performance measures such as up time, productivity, sales turnover, absenteeism, percent nonconforming, customer satisfaction, *etc.*, should be determined for each functional area. These results can be used for further improvement activities.

**6. Treating suppliers as partners:** Since the suppliers influence the company's quality, therefore a partnering relationship should be developed between the all management and the suppliers.

**Elements of TQM:**

**I. TQM principle and practices:**

1. Leadership

2. Customer focus

3. Employee involvement

4. Supplier partnership

5. Continuous process improvement

6. Performance measures

**II. TQM tools and techniques:**

1. Seven Tools of quality

2. Six signs

3. Bench marking

4. FMEA

5. QFD

6. TPM

The TQM is mainly concerned with continuous improvement in all work, from the high level strategic planning and decision-making, to detailed execution of work elements on the shop floor. It stems from the belief that mistakes can be avoided and defects can be prevented. It leads to the continuous improving results, in all the aspects of work, as a result of continuously improving capabilities, processes, people, technology and machine capabilities.

Continuous improvement must deal not only with the improving results, but more importantly with improving the capabilities to produce better results in the future. The five major areas of focus for

the capability improvement are demand generation, technology, supply generation, operations and people capability.

A central principle of TQM is that mistakes may be made by people, but most of them are caused, or at least permitted, by faulty systems and processes. This means that the root cause of such mistakes can be identified and eliminated and the repetition can be prevented by changing the process.

There are three major mechanisms of prevention:

1. Preventing mistakes from occurring .

2. Where the mistakes can't be absolutely prevented, detecting them early to prevent them being passed down the value-added chain.

3. Where the mistakes recure, stop the production until the process can be corrected, to prevent the production of more defects.

**Benefits of TQM:**

- Improve product quality.
- Improve productivity.
- Reduce quality costs.
- Increased profitability.

## 1.6 Definition of TQM

Total Quality Management (TQM) may be a comprehensive and structured approach to organizational management that seeks to improve the quality of products and services through ongoing refinements in response to continuous feedback.

TQM requirements may be defined separately for a selected organization or may be in adherence to established standards, such as the International Organization for Standardization's ISO 9000 series.

TQM can be applied to any type of organization; it originated in the manufacturing sector and has since been adapted for use in almost every type of organization imaginable, including schools, road maintenance, building management and churches.

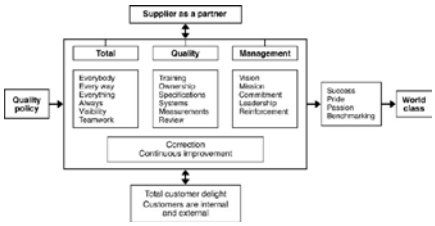

TQM

As the current focus of e-business, TQM is predicated based on the quality management from the customer's point of view.

## 1.7 TQM Framework

The various factors which constitute the frame work of TQM are:

- The philosophical elements
- The generic tools
- Tools of the QC department




TQM Framework

**The Eight Elements Of TQM**

Total Quality Management is a management approach that is originated in the 1950's and has steadily become more popular since the early 1980's. The total Quality is a description of the culture, attitude and organization of a company that strives to provide the customers with products and services that satisfy their needs. The culture requires the quality in all aspects of the company's operations, with the processes being done right the first time and defects and waste eradicated from operations.

To be successful implementing TQM, an organization must concentrate on the eight key elements:

1. Ethics

2. Integrity

3. Trust

4. Training

5. Teamwork

6. Leadership

7. Recognition

8.Communication

**Key Elements**

TQM has been coined to describe the philosophy that makes quality the driving force behind leadership, design, planning, and improvement initiatives. For this, the TQM requires the help of those eight key elements. These elements can be divided into four groups according to their function. The groups are:

I. Foundation - It includes: Ethics, Integrity and Trust.

II. Building Bricks - It includes: Training, Teamwork and Leadership.

III. Binding Mortar - It includes: Communication.IV. Roof - It includes: Recognition.

**I. Foundation**

TQM is built on the foundation of ethics, integrity and trust. It fosters the openness, fairness and sincerity and allows involvement by everyone. This is the key to unlocking the ultimate potential of TQM. These three elements move together, however, the each element offers something different to the TQM concept.

**1. Ethics :** Ethics is the discipline concerned with good and bad in any situation. It is a two-faceted subject that is represented by the organizational and individual ethics. Organizational ethics establish the business code of ethics that outlines the guidelines that all employees are to adhere to in the performance of their work. Individual ethics include personal rights or wrongs.

**2. Integrity :** Integrity implies the honesty, morals, fairness, values and adherence to the facts and sincerity. The characteristic is what customers expect and deserve to receive. People see the opposite of integrity as duplicity. TQM will not work in an atmosphere of duplicity.

**3. Trust :** Trust is a by-product of integrity and ethical conduct. Without trust, the framework of TQM cannot be built. Trust fosters full participation of all members. It allows empowerment that encourages pride ownership and it encourages commitment. It allows the decision making at appropriate levels in the organization, fosters individual risk-taking for continuous improvement and helps to ensure that measurements focus on improvement of process and are not used to contend people. Trust is essential to ensure the customer satisfaction. So, trust builds the cooperative environment essential for TQM.

**II. Bricks**

Basing on the strong foundation of trust, ethics and integrity, the bricks are placed to reach the roof of recognition. It includes:

**4. Training :** Training is very important for the employees to be highly productive. Supervisors are solely responsible for implementing TQM within their departments, and teaching their employees the philosophies of TQM. Training that employees require are interpersonal skills, the ability to function within teams, problem solving, decision making, job management performance analysis and improvement, business economics and technical skills. During the creation and formation of TQM, the employees are trained so that they can become effective employees for the company.

**5. Teamwork :** To become successful in the business, teamwork is also a key element of the TQM. With the use of teams, the business will receive quicker and better solutions to problems. Teams also provide a more permanent improvements in the processes and operations. In teams, the people feel more comfortable bringing up the problems that may occur and can get help from other

workers to find a solution and put into place. There are mainly three types of teams that TQM organizations adopt:

**A. Quality Improvement Teams or Excellence Teams (QITS) :** These are temporary teams witht he purpose of dealing with specific problems that often re-occur. These teams are set up for period of three to twelve months.

**B. Problem Solving Teams (PSTs) :** These are the temporary teams to solve certain problems and also to identify and overcome causes of problems. They generally last from one week to three months.

**C. Natural Work Teams (NWTs) :** These teams consist of a small groups of skilled workers who share tasks and responsibilities. These teams uses the concepts such as employee involvement teams, self-managing teams and quality circles. These teams generally work for one to two hours a week.

**6. Leadership :** It is possibly the most important element in TQM. It appears everywhere inorganization. Leadership in the TQM requires the manager to provide an inspiring vision, make the strategic directions that are understood by all and to instill the values that guide the subordinates. For a TQM to be successful in the business, the supervisor must be committed in leading his employees. A supervisor must understand TQM, believe in it and then demonstrate their belief and commitment through their daily practices of TQM. The supervisor makes sure that strategies, philosophies, values and goals are transmitted down through out the organization to provide focus, clarity and direction. A key point is that TQM has to be introduced and to led by top management. Commitment and personal involvement is required from the top management in creating and deploying clear quality values and goals consistent with the objectives of the company and in creating and deploying the well defined systems, methods and performance measures for achieving those goals.

**III. Binding Mortar**

**7. Communication :** It binds everything together. Starting from the foundation to roof of the TQM house, everything is bound by a strong mortar of communication. It acts as a vital link between all elements of TQM. The communication means a common understanding of ideas between the sender and receiver. The success of the TQM demands communication with and among all the organization members, suppliers and customers. Supervisors must keep open the airways where employees can send and receive the information about the TQM process. Communication coupled with the sharing of the correct information is vital. For the communication to be credible the message must be clear and receiver must interpret in the way the sender intended.

There are different ways of communication such as:

**A. Downward communication :** This is the dominant form of communication in an organization. The presentations and discussions basically do it. By this the supervisors are able to make the employees clear about the TQM.

**B. Upward communication** : By this the lower level of the employees are able to provide suggestions to the upper management of the affects of TQM. As the employees provide insight and constructive criticism, supervisors must listen effectively to correct the situation that comes about through the use of TQM. This forms a level of trust between supervisors and employees. This is also similar to empowering the communication, where supervisors keep open ears and listen to others.

**C. Sideways communication :** This type of communication is important because it breaks down the barriers between the departments. It also allows dealing with customers and suppliers in a more professional manner.

**IV. Roof**

**8. Recognition:** Recognition is the last and final element in the entire system. It should be provided for both the suggestions and achievements for teams as well as individuals. Employees strive to receive recognition for themselves and their teams. Detecting and recognizing contributors is the most important job of a supervisor. As the people are recognized, there can be huge changes in self-esteem, productivity, quality and the amount of effort exhorted to the task at hand. Recognition comes in its best form when it is immediately following an action that an employee has performed. Recognition comes in different ways, places and time such as,

Ways - It can be by way of personal letter from top management. Also by award banquets, plaques, trophies etc.

Places - Good performers can be recognized in front of departments, on performance boards and also in front of top management.

Time - Recognition can given at any time like in staff meeting, annual award banquets, etc.

## 1.8 Contributions of Deming

**Deming's Philosophy on TQM:**

To plan, Deming counsels that business should design quality products and services that customers want, develop the processes and systems that reduce waste and increase quality and decrease the cost of production. Deming wanted to revolutionize the way Beefy's Burgers produces burgers.

To gain a better understanding of the customer preferences, he surveyed everyone involved in the operation, from the customers to the employees. He even called his suppliers in to get their opinions. He called his employees in and showed them how to properly grill the burgers. He called

his supplier in to discuss alternatives to the current beef he uses. Finally, the managers take action. Management may make changes.

Deming tweaked a few things to speed up the process by placing more people on the line. Customers received their burgers on time and they were tasty, too.

**Juran's Approach to Quality Planning, Control and Improvement:**

Joseph Juran shared the connection with Deming. Juran's approach to quality control also had Japanese roots. While the Japan was price-competitive with the rest of the world, the quality of product did not measure up.

Like Deming, Juran stressed the importance of total quality management. However, he summed it up by saying that the total quality management begins at the top of an organization and works its way down. He developed 10 steps to quality improvement.

**Crosby's Ideology of Conformance to Quality Standards:**

Philip B. Crosby was a contemporary leader in TQM. He didn't implement the engineering principles or steps. He simply made the TQM easier for the layman to implement by breaking it down to an understandable ideology that organizations should adopt.

Crosby re-defined quality to mean conformity to standards set by the industry or organization that must align with customer needs.

**Deming's 14 Points on Route to Quality:**

**1. Create constancy of purpose towards 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 should awaken to the challenge, must learn their responsibilities and take on leadership for change.

**3. Cease dependence on inspection to achieve quality:** Eliminate the require 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, reduce total cost. Move towards 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 the quality and productivity and thus constantly decrease costs.

**6. Institute training** on the job.

**7. Institute leadership:** The aim of supervision must 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 works.

**8. Drive out fear,** so that everyone may work effectively for the company.

**9. Eliminate the slogans, exhortations and targets for the work force** which ask for zero defects and new levels of productivity. Such exhortations only create adversarial relationships, since the bulk of the causes of low quality and low productivity belong to the system and thus lie beyond the power of the workforce.

**10. 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.

**11. Eliminate work standards (quotas) on the factory floor.** Substitute leadership. **Eliminate management by objectives.** Eliminate management by numbers, numerical goals, substitute leadership.

**12. Remove barriers to pride of workmanship:** The responsibility of supervisors must be changed from sheer numbers to quality. Remove barriers which rob people in management and in engineering of their right to pride of workmanship. This means, for example, abolishment of annual or merit rating and of management by objectives.

**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 everyone's job.

## 1.9 Contributions of Juran and Crosby

Juran divides quality management into three parts. They are:

1) Quality planning

2) Quality control

3) Quality improvement

**(1) Quality Planning:**

A self-explanatory planning road map is shown below:


Quality planning road map

**Quality Control:**

At this stage, the control processes are designed to ensure the quality goals set in the planning to:

• Choose control subjects.

• Choose units of measurements.

• Establish the standards of performance.

• Measure the actual performance.

• Note the difference between the actual performance and standards.

• Take the action to close the performance gap.

**Quality Improvement:**

At this stage, there are ten steps to quality improvement.

**1)** Build awareness of the need and opportunity.

**2)** Set goals for improvement.

**3)** Organize to reach the goals.

**4)** Provide training.

**5)** Carry out projects to solve problems.

**6)** Report progress.

**7)** Give recognition.

**8)** Communicate results.

**9)** Keep score.

**10)** Maintain momentum by making annual improvement.

**Contributions of Crosby**

The four absolutes of quality observed by Crosby are

1. Performance

2. Features

3. Reliability

4. Conformance

One of Crosby's main contributions to quality is a set of four absolutes of quality management that provides insight into his quality philosophy. The following summary of his four absolutes is taken from the American Society for Quality:

**1. Quality has to be defined as conformance to requirements, not as goodness or elegance:** The management must establish requirements, supply the wherewithal and encourage and help employees to get the job done. The basis of this policy is "Do it right the first time".

**2. The system for assuring quality is prevention, not appraisal:** The first step to defect and error prevention is to understand the process* by that a product is produced. Once a defect occurs, discovery and elimination are top priorities. Prevention is a knowledge issue for quality-focused workers.

**3. The performance standard must be zero defects, not "that's good enough."** The only performance standard that makes sense for "do it right the first time" is zero defects. Zero defects needs to be a performance standard for everyone in the company, from top management to workers on the line.

**4. The measurement of quality is the price of non-conformance, not indices:** A dollar figure can be established for the cost of quality (COQ) by determining the difference between the price of non-conformance and the price of conformance.

The price of non-conformance is the expense of doing things the wrong way and can account for 20 to 35% of revenues. Price of conformance is the cost of doing things right — typically 3 to 4%. Managers should spend time identifying where cost of quality is occurring and address what makes it occur.

## 1.10 Barriers to TQM

**Barriers to TQM implementation and solution**

The various barriers in implementing TQM are:

1) Lack of management commitment.

2) Lack of faith in and support to TQM activities among management personnel.

3) Failure to appreciate TQM as a cultural revolution. In other words the inability to change the organizational culture.

4) Misunderstanding about the concept of TQM.

5) Improper planning.

6) Lack of employees commitment.

7) Lack of effective communication.

8) Lack of continuous training and education.

9) Lack of interest or incompetence of leaders.

10) Ineffective measurement techniques and lack of access to data and results.

11) Non-application of proper tools and techniques.

12) Inadequate use of empowerment and team work.

13) Inadequate attention to internal and external customers.

14) Delay or non-implementation of quality improvement team's recommendations.

2

# TQM PRINCIPLES

Leadership – Strategic quality planning, Quality statements - Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement – PDSA cycle, 5s, Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating.

## 2.1 Leadership

It is the process of influencing others towards the accomplishment of goals. A leader generates the will to do, show the direction and guides the group members towards the accomplishment of goals.


**Leadership Concepts**

The successful leader should understand the human nature-their basic needs and abilities. To be effective, the leader understands that:

1. People need security as well as independence at the same time.

2. Employees are very sensitive to external rewards and punishments and yet strongly motivated.

3. People prefer hearing a kind word of praise from the superior. The leader should, 'Catch them doing something right, so that he/she can pat them on the back.

4. People can process only a few facts at a time. Hence the leader should start with simple things.

5. People trust their gut reaction more than the statistical data.

6. People distrust their leaders, who are merely rhetoric, but do not follow any principles in actions.

**Role of leadership in TQM**

Leadership can act as a senior management's tool in implementing TQM in two fundamental ways. First, by modeling the TQM philosophy and its principles within its departmental operations, leadership can serve as a beachhead for TQM process throughout the company. Second, the leadership, with senior management's support, can take the TQM process company-wide by developing and delivering the long-term training and development necessary for the major organizational culture shift required by TQM.

Implementing the TQM requires a team effort headed by our organization's leadership team. Each person involved in the change management has their responsibilities, and it is important for the entire organization to understand the role of leadership in TQM to make delegating responsibility more effective.

**1) Involvement**

TQM of any kind of new company policy or program requires a participation from all of the departments that will be affected. A companies leadership needs to identify what those departments are and create an implementation team that consists of a representatives from each affected group. Management needs to create a structure that identifies various group leaders, the responsibilities of those group leaders and an accountability system that insures that the implementation team meets its timetable for getting the new program or policy in place.

**2) Interest**

Implementing the TQM within a company requires a feeling of urgency on the part of the entire company. It is the job of management to create that urgency by explaining to the staff why the implementation is necessary. Leadership needs to help the employees understand how the company benefits from the new implementation, but it also needs to get the organization to see the setbacks of not making a change.

**3) Monitoring**

TQM within a company is not an exact process. It is the dynamic procedure that needs to be monitored by management and altered to meet implementation goals. it is the responsibility of leadership to put the monitoring system in place, analyze the data that is being generated during the implementation and make any necessary changes to make the implementation more efficient.

**4) Next step**

Implementing TQM is often done in phases. The company leadership needs to be able to identify when all the phases of TQM is complete and be ready to transition the company to the next phase. For example, if a company is bringing in a new software program for customer management, then the first phase of the program may be to implement it in the sales department. Management needs to identify when the proper alterations to the software has been made that will allow it to be implemented in other parts of the company.

**Characteristics Of Quality Leaders**

The important characteristics of a successful leader are:

1. Customers first.

2. Value people.

3. Build supplier partnership.

4. Empower people.

5. Strive for excellence.

6. Demonstrate involvement/commitment.

7. Explain & deploy policy.

8. Improve communication.

9. Promote teamwork.

10. Benchmark continuously.

11. Establish system.

12. Encourage collaboration.

## 2.2 Strategic quality planning

**Strategic Planning:**

A systematic process of envisioning a desired future and translating this vision into broadly defined goals or objectives and a sequence of steps to achieve them.

**Seven Steps to Strategic Planning**

The process starts with the principle that quality and customer satisfaction are the center of organization future. It brings together all the buy stakeholders.

**1. Customer Needs**

The first step is to discover the future needs of the customers. What will they want? How will the organization meet and exceed expectations?

**2. Customer Positioning**

Next the planners find where the organizations want 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 must be targeted for break or eliminated. The organization needs to concentrate its efforts on area of excellence.

**3. Predict the Future**

Next, the planners should look into their crystal balls to predict future conditions which will affect their product or service. Demographics, economic forecasts and technical assessments or projections are tools that help in predicting the future. More than one organization, product or service has become obsolete because if 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 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 must 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 alignment, the plan will have little chance of success.

**7. Implementation**

This last step is frequently the most difficult. Resources has to be allocated for collecting the 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 must meet at least once a year to assess progress and take any corrective action. Strategic planning can be performed by any organization. It can be highly effective, allowing organizations to do the right thing at the right time, every time.

## 2.3 Quality statements

Quality statements declare the core values and concepts, vision and mission and quality policies of the organization. Once developed, they are reviewed and updated, some times. These statements form part of strategic planning. Each of the award winning organizations, invariably have a vision of and mission on, what quality is and how to achieve it.

Three element of quality statements are:

### (a) Vision statement

### (b) Mission statement

### (c) Quality policy statement

**(a) Vision Statement**

It is a brief declaration on the expectations of an organization. It is the ideal state which an organization strive continually to achieve. Visions are eternal, inspirational and shared fully within the organization, such as, for example:

Indian Overseas Bank We grow with people

IBM Service

Apple Computing for the masses

Disney theme park Happiest place on earth

Southern Railway We care

Successful visions provide a guidance for decision making. The desired goals revealed by the vision, provide the criterion for effective decision making. Some organizations strengthen the significance of vision statement by incorporating the same, in the uniforms or badges of the employees and official letter heads.

TI is a good company and one reason is that, we are am part of it -TI manual.

Example: Customers receive what they order, without nonconformities, on time, in the right quantity, booked and billed on time. People enjoy their work. The organization makes a profit

**(b) Mission Statement**

The mission statements explain the following : Who we are? Who are our customers? What we do? and How we do it? This may run to a paragraph and describe the activities of the organization. It provides a clear statement of the aim for the employees, projected customers and suppliers, as well.

**Example:** To meet customers' transport and distribution needs and by being the best at moving their goods, on time, safely and damage free. A Railway Company. We bring out and enlighten the hidden technical skills and abilities of youth, with high quality technical education and proper discipline - A Technical Institution.

**(c) Quality Policy Statement**

This provides a direction to all employees in the organization, as how they should provide products and service to the customers. It is drafted by the Chief Executive, upon the feed back from the employees and finally gets approved by the Quality council. Some of the characteristics of the policy statement may be highlighted as :

(a) Quality first, always.

(b) Fulfills the needs of the customers.

(c) Excel in the competition.

(d) Quality improvement, continually.

(e) Utilize the entire human resource.

A Quality policy declaration for an institution, is a must as per ISO 9000.

## 2.4 Customer focus

When we outline Total Quality Management, the term quality implies the customer and the product or service being delivered to the same. Here, we would attempt to understand the definition of a business enterprise in terms of its customers, it serves within the marketplace.

Alternatively, a company's business is outlined by what needs it is trying to satisfy, by which customer group it is targeting and by the technologies it will use and the functions it will perform in serving the target market.

One of the foremost important factors for the success of an enterprise is its customers. Without them, a business cannot exist however to capture customers, a business should try to find out what people want, how much and how often they will buy and how their post-purchase satisfaction are ensured.


Customer focus

**Relation of a method vs its customer:**

The process is outlined as a set of interconnected activities that results in a product or a service to be offered to a customer. Thus, their relation is of critical importance. The result of one activity directly affects the opposite entity.

For example, all the client complaints are unit analogous to method variation. If variation that is non-conformance to the quality standards occurs, it will ultimately affect the quality of the end product or service. Therefore, it is important to keep a strong check on.

## 2.5 Customer orientation

A customer-oriented organization places customer satisfaction at the core of each of its business decisions. Customer orientation is defined as an approach to sales and customer-relations where staff focus on helping customers to meet their long-term needs and wants.

Customer orientation is of ultimate importance to deliver value added products. There are 4 basic stages for customer orientation. They are:

**1) Develop:**

Development has to be done keeping customer requirements into mind.

Products has to be customer oriented.

The development cycle time should be minimal.

**2) Manufacture:**

As per the product, the manufacturing must be in such a way that it gives the best products to the customer.

Quality must not be compromised.

Manufacturing cycle time should be reduced.

**3) Market:**

Identifying and targeting the right customer.

Processing the demand as early as possible.

Customization of the products for the market.

**4) Deliver:**

Deliver to the target customer.

Reduce delivery time.

Value for money products.

## 2.6 Customer satisfaction

Customer satisfaction is not an objective statistics, but more of a feeling or attitude. If a customer is happy with a product or a service, it has hired or purchase they will pay their bills promptly, which greatly improves cash flow. Cash flow is the lifeblood of any organization.

The Customer is the King - Emphasized by Today's Buyer's Market. TQM's purpose is meeting or exceeding customer expectations, so that the customers are delighted. The customer satisfactions must be the primary goal of any organization.


Customer satisfaction

**Customer Satisfaction Model**

The Customers are,

- The most important people in the business.
- Not dependent on the organization, but the organization depends on them.
- Not an interruption to work, but are the purpose of it.
- Doing a favor when they seek business and not vice-versa.
- A part of business, not outsiders and they are life blood of the business.
- People who come with their needs and jobs.
- Deserve the most courteous and attentive treatment.

**Customer Satisfaction:**

The company should exceed the customer expectations and make him delighted. This means giving the customers more than TQM aims at satisfying customers requirements that never remain constant but keep on changing with the change in environment, circumstances, needs fashion standard of living etc. Customers satisfaction has several dimension such as :

1. Aesthetic look.

2. Reliability ( It should give efficient and consistent performance).

3. Safe and foolproof workability.

4. Suitability ( Fitness for use).

5. Variety in products and services .

6. Good packaging.

7. Durability the life aspect of quality.

8. Versatility ( It should serve number of purposes).

9. Affordability ( Economical )

10. Customers information and training demonstration / consulting.

11. Maintainability.

12. Speed of service ( quick response time).

13. Value for money spent by customer.

14. After sales service and support to customer.

15. Civility of service at all levels.

16. Good image of the company and customers confidence in the organization based on past experience.

Initially the organization should identify and define the customers in terms of internal/external short term/long term end users intermediate users product/ service user and their categories as industrial consumer their buying capabilities and locations.

After identifying the customers, their needs and requirements should be established and defined. Then, the organization must establish its quality policies, code of conduct, legislation, etc.

**Types Of Customers**

**Internal Customer**: The customer inside the company are known as internal customers.

**External Customers**: An external customer is the one who used the product or service or who purchase the products or service or who influences the sale of the product or service**.**

**Let us distinguish between internal and external customers.**

| Internal Customer | External Customer |
|---|---|
| The customers inside the company is called internal customer. | The customers outside the company is called external customer. |
| All of them depends upon each other. | Each customer were independent of each other. |
| Every person is considered as a customer of the preceding operation. | Every person, who uses the product or service. |
| These customer satisfaction will affect only the process inside the company. | This customer satisfaction will improve the sale of the product. |
| These customer will not depend upon the quality of the product. | They mostly concern about the products quality. |

**Questionnaire to evaluate the level of customer satisfaction:**

**(1) Mobile Service Provider:**

**1)** How long have you used our service?

**2)** How often do you use our service?

**3)** Overall, how satisfied were you with our service?

**4)** Please tell us why you feel that way.

**5)** Thinking of your most recent experience with our service, how much do you agree with worth of our service?

**6)** What do you like about our product/service?

**7)** Thinking of similar services offered by other companies, how would you compare our service offered to them?

**8)** Would you recommend our service to colleagues or contacts within your industry?

**9)** Why do you feel that way about recommending our service?

**10)** What suggestions do you have to improve our service?

**(2) A Sport Shoe Manufacturer:**

**1)** When did you buy our product?

**2)** How often do you use our product?

**3)** How satisfied are you with the product quality?

**4)** Compared to other similar products, how do you have used our product?

**5)** Compared to other similar products on the market, do you find the value for money of this product?

**6)** Would you buy this product again?

**7)** Would you recommend this product to others you know?

**8)** Is there anything else that you would like to share with us that would help us to improve our product?

## 2.7 Customer complaints

Complaints are a natural consequence of any service activity because "Mistakes are an unavoidable feature of all human endeavor and thus also of service delivery".

Service recovery is the process of putting the situation right though it has been defined more widely and more proactively as the action of seeking out and dealing with failures in the delivery of service.

The term "Complaint Management" is used to include settlement, service recovery, involves the receipt and investigation.

**Dealing with complaints:**

When the customer pays for a product or service, it is assumed that the product can work correctly or that the service received is as promised. Ideally, the customer will be satisfied and there will be no complaints.

If there is a problem and the customer complains about it, our company should quickly answer the complaint and solve the customer's problem. This is often done through our company's customer service activity. However also, we need to follow up and improve our business processes to rectify the problem.

**Solve the problem:**

We need to immediately answer the complaint and solve the problem. It may be to give money back, exchange a product or do some repair.

**Special bonus:**

To make sure the customer is completely satisfied, some companies can provide some special service or a reduced price on another product. This is done to assure the customer will come back for more business. Many retail stores have a generous return policy to satisfy dissatisfied customers.

**Dishonest customers:**

Unfortunately, there are dishonest customers who will make false claims to get some bonus. Some people will utilize a product or piece of clothing and then return it, saying they weren't satisfied.

High-end women's clothing stores often can have expensive gowns returned after some important event. The clothes have obviously been worn, but the customer says she is not satisfied or has changed her mind. Generally, the store will refund the money.

Since it is often difficult to say if the complaint is valid or not, the company can follow the adage, "The customer is always right." But since some dishonest people repeat their crimes, a better adage is "The customer is always right... once."

**Price in customer service:**

When a company sells a product or provides a service, part of the pricing should include the cost of servicing a certain percentage of defective products or complaints.

**Not dealing with complaints:**

Businesses that don't bother about satisfying their customers usually get more customer complaints. Answering them can of course, cost the company money. Some companies will try to mollify angry customers but many don't even bother.

**Rectify problem:**

The second thing a company must do upon receiving a complaint is to seek to rectify the problem.

Though a company hopes not to get complaints, often they can be blessing in disguise. Sometimes problems can be caught and fixed before they cause serious negative feedback or even legal problems.

It is in the company's best interest to solve any problems and try to make sure that they don't happen again. It is foolish for a company not to use customer complaints to initiate a corrective action.

**Making money off complaints :**

One software company holds weekly staff meetings in order to build morale and allow for status reports from each department. One part of their meetings is the report on how many customer problems they corrected the past week. If the number increased, the group was given praise. When asked why they praise increased problem calls, as opposed to working to fix those problems in the software or documentation, the owner said which they charge for each call, so it is a way to increase their income.

In other words, instead of making the customer completely satisfied with the product, they preferred some dissatisfaction, so they could fix the problem and make extra money from it.

This software package was a high-ticket, expensive application that was mainly sold to small companies. They also charged $50 for a user manual for the software.

Since the customers make a substantial investment in the software, they wanted to continue using it. However I wonder how much ill-will was created, even if the application normally performed well.

**Complaints that fall on deaf ears:**

Have we ever experienced poor service or purchased a defective product and complained about it, only to have our complaints fall on deaf ears? Many companies which have plenty of business feel they don't need to bother with complainers.

These businesses become very independent, especially if they have a product or service in demand. Some continue to succeed, even though they ignore customer complaints, however many will pay the price of lost business and degraded reputation in the long run.

**Apology mollifies customer:**

A company which responds and apologizes mollifies the complaining customer. But some of these companies never rectify the problem. The act of responding to the customer and apologizing is good business. Not fixing the problem is risky, though it may backfire on the company.

**Satisfied customer:**

First of all, it will help to satisfy the customer, so we will get repeat business or referrals. In fact, in some cases, effectively dealing with a customer complaint may lead to a more loyal customer than others who might not complain or have problems.

**Can rectify problems:**

Another benefit of dealing with complaints is that we can see weaknesses in our process or products that can be rectified. This can prevent possible future complaints or problems down the line. It is an effective form of customer feedback, although one we hope to eliminate.

**Major concern about complaints:**

For every formal complaint we receive, there may be 10 other customers who were dissatisfied and who felt to complain, however who never did. Instead, they change brands and tell their friends of the dissatisfaction. It is said that an unhappy customer can tell 13 people about his or her dissatisfaction. That is not the type of word-of-mouth advertising we want. The company goal should be to get no complaints at all.

## 2.8 Customer retention

Customer retention is the activity that a selling organization undertakes in order to reduce customer defections. Successful customer retention starts with the first contact an organization has with a customer and continues throughout the entire lifetime of a relationship.

Customer retention is the process of retaining the existing customers. The various tools used are:

1. Comment card

2. Customer questionnaire

3. Focus groups

4. Toll-free telephone numbers

5. Report cards

6. Internet and computer etc

**Importance of customer retention:**

1. Number of complaints received per month.

2. Increase in sales value.

3. Increase in profit.

4. Number of Warrants used.

## 2.9 Employee involvement

The importance of employee involvement in the success of any business. The shrinking global market has led to stiff competition in the business and industrial arena. The entry of a number of new companies in both local and global into various markets has given the customer a wide array of product choices.

Many of these new companies are able to produce the same or similar products at almost same or lower costs. Thus, customers today have a wide range of products to choose from. These products not only meet their specifications closely, however also their budgets. Competition has extended far beyond manufacturing or private sector. Today, the service, government and non-profit sectors also face stiff competition.

The need to grow and succeed in an increasingly competitive market has seen the implementation of various quality initiatives in different organizations. Issues-solving and process improvements are two vital aspects of quality initiatives and proactive actions are being taken in order to prevent problems.

Total Quality Management (TQM) is a continuous process that strives to increase customer satisfaction, lower costs and minimize defects and variations in every aspect and every process of the business. TQM involves a number of catchwords such as Just-In-Time, quality circles, employee involvement, continuous process improvement, empowerment, Kaizen, self-directed work groups and world-class quality.

Generally, the philosophy of TQM is to involve every employee in the organization along with its suppliers and distributors to improve product quality and enhance customer satisfaction. One of the important concepts of TQM is employee involvement. This is a relatively new method, which is a contrast to conventional management practices, wherein management takes all decisions and workers just follow them to accomplish their jobs.

This top-down management style is slow and inflexible with little room for competition. Survival in today's time-starved, customer driven market needs rapid response times from manufacturers and other businesses to the ever-changing customer needs. This focuses on the importance of employee involvement in any TQM initiative. Employee involvement is a system where the employees are encouraged to use their expertise and knowledge to suggest methods for improvements in their work areas.

These suggestions could pertain to improvements in the job, the product, the work atmosphere or the company as a whole. Many companies have ventured into a participative style of management by involving employees in the problem solving and decision making processes.

Once Ford faced a continuous threat of competition from Japanese car manufacturers, it ventured to study how the Japanese were excelling in their performance efficiency. It established a target force in order to study the Japanese manufacturing process. Results showed that the key to Japanese performance and efficiency was their empowered workforce and the teamwork involved. Employees were given the responsibility and authority to stop a process, if the quality failed to meet the standards specified.

Some of the most successful companies are those, which have achieved a close relationship between workers and the managers. The policies in these companies fostered teamwork, participation, continuous learning and flexibility. However, the change from conventional management practices to the new style was not achieved overnight. Learning and implementing

participative management needs a lot of effort and time. Implementation of employee involvement systems require many changes in the existing company practices.

The five obstacles that arise when companies try to shift from a traditional management style to a participative one are listed below:

• Resistance to change.

• Mistrust of the management's motives by the workers.

• Lack of clear expectations from the workers.

• Lack of participative skills among employees.

• Lack of executive commitment.

While change of any kind is difficult for the workers, when suddenly asked for inputs, they tend to doubt the motives of the management. Similarly, they are not sure of the extent of inputs needed and the importance placed by the management on these inputs.

Poor experience in participative activities is also a hindrance. Above all, it is vital for the management to remain continuously committed to the cause of TQM and employee involvement.

**Benefits of Employee Involvement:**

•It meets the organizational goals and objectives.

•It improves the quality.

•It improves the productivity.

•It improves the team activities.

## 2.10 Motivation

Over the evolution of total quality management (TQM), the emphasis upon people has increased. Any organization has to produce its outcomes through its people. Therefore, the key to quality performance is the organization's ability to motivate its people towards the desired actions and behaviour and increase their level of quality consciousness.

Motivation is based on emotions. It is the search for positive emotional experiences and the avoidance of negative emotional experiences. Motivation is involved in the performance of all learned responses. It is a behavior that will not occur unless it is triggered. In general, psychologists question whether motivation is a primary or secondary influence on behavior.Everyone has certain needs and goals. To obtain the goals and meet the needs that a person wants, they will have to agree to do work and provide services in exchange for what they want. One key to making those agreements satisfactory is how fair they are being treated.

People want to ensure that they will be consistently treated fairly. Perceived factors of being treated fairly from an employee perspective are salary, benefits, bonus, incentives if any, etc.

Salary and benefits are not seen as motivation, but as entitlement for the work that is being done. If the agreement is seen as being unfair, the person will be dissatisfied which will result in poor morale. However if the agreement is seen as being fair, it will play a role in whether the person is a "motivated" employee.

A company's learning environment can impact the motivation of an employee. Highly motivated employees possess high performance, high input, a desire to learn, innovate and grow with a company as long as the company provides desirable outcomes. In turn, the company will have seasoned staff that is skilled and motivated to advance the company through innovation and customer retention.

The first step in a company's plan to create a learning environment is realizing the value of employees and how they want and need, to be motivated.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**Motivation Techniques:**

**1. Management by Objective (MBO) and goal setting:** MBO is a process of collaborative goal-setting between a manager and a subordinate with the4 understanding that the degree of goal attainment by the subordinate will be a major factor in evaluating and rewarding the subordinate's performance. When the manager sits with the subordinates, jointly established goals for them and agree that the future rewards will be based on goal attainment then he or she is expected to be more motivated to work toward the goals that merit them.


Motivation Techniques

**2. Participation in management:** Subordinates are likely to be motivated the most when they are not only consulted but are also allowed to participate in decision-making. In fact the right kind of participation yields both motivation and knowledge valuable for enterprise success. Participation appeals to the need for affiliation and acceptance. It is a means of recognition and thus enhances subordinates eagerness to work harder.

**3. Monetary Incentives:** Money can never be overlooked as a motivator. It can also mean power or status.

In order to use money as a motivator, a manager has to remember the following:

• An enterprise can make its wages and salaries competitive within their industry and their geographic area to attract and hold people.

• People usually evaluate their compensation in the light of what their equals are receiving.

• Unless bonuses for mangers are based to a major extent on individual performance, an enterprise is not buying much motivation with them. In so far as possible, compensation has to be based on performance.

• Money can motivate only when the prospective payment is large relative to a person's income.

**4. Modified work week/flexible working hours:** There is considerable interest among employees in altering the work week to suit their convenience better. The primary motivational implications of the modified work week are that modification in their routine helps them satisfy their higher-level needs and provides them with an opportunity to fulfill several of their needs simultaneously.

By allowing employee more independence in terms of when they come to work and when they leave, mangers acknowledge and show "esteem" for the employees' ability to exercise self-control. It is hoped that employees will respond with higher levels of motivation.

Modified workweeks give employees the opportunity to fulfill a variety of needs. Using flexible working hours, a person can contribute to the organization and still have time. Say for example, to study for the MBA programmed for executives or to carry on business as a part-time occupation.

**5. Quality of working life (QWL):** This is an important motivational technique, use by managers in western societies. QWL is not only a very broad approach to job enrichment but also an interdisciplinary field of enquiry and action combining industrial relations, industrial engineering, industrial psychology and sociology organization theory and development, leadership theory and motivation, etc.

Managers have regarded QWL as a promising way of dealing with stagnation productivity. Workers and trade union leaders have also seen it as a way to improve working conditions and productivity and also as a means of justifying higher pay. It may also help minimizing labor disputes and ensuring industrial democracy.

**6. Effective criticism:** This can be a springboard for improving an employee's behavior and performance. Adopting a positive approach makes criticism less difficult as well as more effective. The manager must examine his or her own motives before criticizing. The manager should plan the presentation of his criticism in the best possible form with a view to motivating rather than rebuking him or her. Criticism should apply to the use of personal efforts for improvement now, not next week or next month. Specific time schedules for improvements are also to be set up.

**7. Job enrichment:** Making jobs challenging and meaningful is an accepted way of motivating employees greatly. In Job Enrichment, the attempt is to build into jobs a higher sense of challenge and achievement. Jobs may be enriched by variety. But they also may be enriched by the following:

Giving workers more freedom at workplace.

Giving subordinates a feeling of personal responsibility for their tasks.Encouraging participation of workers and interaction between them.Giving subordinates feedback on their job performance.

Involving workers in the analysis and change of physical aspects of the work environment, such as cleanliness, layout temperature, lighting, etc.

Several studies tend to prove that workers will work harder if their jobs are enriched and expanded so as to give them greater control over their work and more freedom from their supervisor.

Job enrichment has certain limitations also. Cost factor, very often, comes to hinder job enrichment. Jobs requiring hi-tech specialization, special machinery and technology may also suffer from being too meaningful to workers.

It merits mention that the limitations of job enrichment apply mainly to jobs requiring low skill levels. The jobs of managers, professionals or technicians already contain varying degrees of challenge and accomplishment.

## 2.11 Empowerment

Employee empowerment is a management concept, the basic theme of which is to give employees the means for making important decisions and making those decisions the "right" ones. When done right, the results are heightened productivity and a better quality of work life.

Whereas the actual practice of employee empowerment varies across organizations, empowerment is based on the fundamental concepts of job enlargement and job enrichment. Job enlargement involves changing the scope of the job to include a greater portion of the horizontal process. Job enrichment involves increasing the depth of the job to include responsibilities that have traditionally been carried out at higher levels of the organization.

**Benefits of Employee Involvement and Empowerment:**

While both employee involvement and employee empowerment are each distinct practices and are usually mutually exclusive to one another, the benefits of each can be similar. The main benefits of employee involvement and empowerment are enhanced morale, more productivity, healthier coworker relationships and creative thinking.

**1.Improved Morale:**

Involving employees in decisions and policy changes that directly affect their jobs while also empowering workers to be more autonomous, greatly improves company morale at large. When employees are treated as an asset and their input is given consideration, confidence increases among every team member and the organization sees significant gains in different facets like productivity and loyalty.

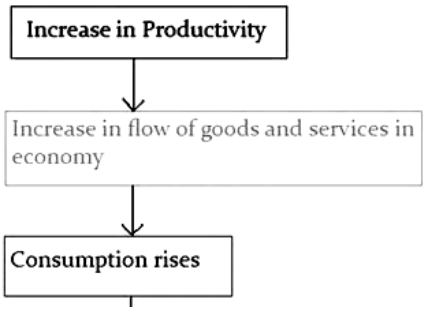
Improved morale will also increase employee longevity with the company, as longer an employee is associated with the company, the more experienced they become. This makes them mentors to new employees and therefore indispensable to managerial staff.

**2.Increased Productivity:**

Both employee empowerment in quality management quality management practices also translate into increased productivity. Employees with an investment in the best interest of the organization increase their role in the company and foster a stronger work ethic.

When employees are given independence and expected to be more self-sufficient, they eventually become more efficient as they learn to navigate their responsibilities with minimal interference and/or relying less on managerial staff for direction. This allows managerial staff more time to tend

to their own responsibilities other than giving assignments to subordinates and decreases micromanagement, that minimizes productivity.




Increased Productivity

**3.Team Cohesion:**

Employee empowerment fosters better relationships between the employees and with their managers, as employees that are given more independence tend to form better working relationships. Each sees the other as mutually benefiting from their working relationship.

In addition, more self-governance in the workplace lessens dependence on managers and supervisors and redirects that reliance laterally to coworkers.

**4. Innovation:**

Employee empowerment cultivates innovation, as employees which have a stake in company growth and sustainability will offer more ideas and problem-solving solutions when obstacles arise.

As the employee meets particular challenges or finds improvements in policies, procedures or products, it will foster growth and more critical and imaginative thinking. Employees will offer different perspectives than a managers and be able to offer a creative solution not otherwise considered by staff.

## 2.12 Team and Teamwork

**Team Work**

The employee involvement is put to optimum in using teams. Though the teams are very effective, they are not the solution for solving for all quality and productivity problems.

**Definition and Scope**

A Team is defined as a group of persons working together to achieve common objectives or goals. Teamwork is the cumulative sum of actions of the team, during which each person in the team subdues one's individual desires and opinions, to satisfy the objectives or goals of the group. The objectives are to be set clearly, targets to be specified, should have enabled the resources, and adopted a systematic approach. Members of the team have to be focused on how they are inter-related to each other, take note of the suggestions of colleagues, build on previous information, and resolve conflicts creatively. They will have to fix standards, maintain discipline, develop team spirit, and motivate mutually. They should ensure the completion of tasks and the needs of friendship, fulfillment of personal growth and self-esteem are also attained.

**Need of Team Work**

Why and how teams work, is explained in the following paragraphs:

(a) Team work succeeds because many heads are more knowledgeable than one. Abilities and expertise of each member of the team can be used effectively to solve problems. Many procedures are so complicated that one member cannot have thorough knowledge on entire process.

(b) According to the synergy principle, the whole is greater than the sum of its constituents. The interaction within the group gives results that exceed the contributions of each member.

(c) The team members develop mutual respect and appreciation with each other which enables them to do jobs better. The team spiritmotivates them to do better.

(d) Teams provide the effective medium for improved communication, enabling Successful solutions.

**Types of Teams**

The teams may be classified into four types bated on their characteristics.

**1. Process Improvement Team:** Each members of this team, represent on operation or the process. The activity of the team is limited to that shop or department. A team may consist of six to ten members from shop and departments an external or internal supplier or customer may be included in the team. The life cycle of this team is usually temporary and is disbanded, once the objective is realized.

**2. Cross Functional Team:** Six to ten persons representing different functional areas such as engineering, marketing, accounting, manufacture , quality, and human resources, form this team. The customer and supplier may also be the members. A typical example of a cross-functional team is a design review team. This type of team is normally temporary. A product support team, may function as permanent to serve a particular product line, service, or a particular group of customers. This type of team serves beyond functional area boundaries.

**3. Natural Work Team:** This team consists of all the members of the shop or depart-ment. It differs from quality circle, since a manager is part of the team and the schemes for improvement are

chosen by the management. The managers should anticipate reluctance of some employees to join this team and assist them in becoming comfortable in the team environment. Although 'team work' is possible, but without mutual understanding and unity of ideas and action, it can not be made a reality.

**4. Self-directed /Self managed Work Team:** They are similar to the natural work team, but without a manager or supervisor. Hence they are the crux, of the organization, as they are not only to execute the work but also to manage it. Usually a coordinator, by rotation, liaise with senior management. The team meets periodically to plan their activities, and decisions made by consensus. In addition, they are also responsible for recruitment, performance evaluation, customer relations, supplier relations, recognition and reward and training.

5. In a hydraulics unit, for example, the self directed team for assembly, deals with all aspects of the customer's order such as receiving the purchase order, manufacturing the components, assembly and testing the circuits, ship the valves, controls the inventory, and processes all information. In these cases, a gain sharing plan and a reward system for the team performance, instead of on the individual performance is relevant. Some overlap may occur between these types of teams and the organizations are at liberty to modify them, to suit their goals.

**Characteristics of successful Teams:**

1. Sponsor - To provide support to the organization.

2. Team Charter - Document defines the mission and union.

3. Team Composition - Size should not be more than ten members.

4. Training - Trained in problem solving technique.

5. Ground Rules - Separate ruler of operation and conduct.

6. Clear Objectives - Team should be stated clearly.

7. Accountability - Team performance is accountable.

8. Well-defined decision procedure - Right decision in right time.

9. Resource - Adequate information must be given.

10. Trust - Trust among the members and management.

11. Effective Problem Solving - It can be achieved using problem solving methods.

12. Open Communication - Everyone feels to speak in the team.

13. Appropriate Leadership - Leadership to motivate and guide the team.

14. Balanced Participation - Team involvement is necessary.

15. Cohesiveness - Members should be comfortable working with each other.

**Barriers to Team's program**

The barriers to a team's program are

• Insufficient training

• Incompatible rewards and compensation

• Lack of planning

• Lack of management support

• Project scope too large.

## 2.13 Recognition and Reward

**Recognition** is a process whereby management shows acknowledgment of an employee outstanding performance. Recognition is a form of employee positive motivation. Recognition of employees is highly essential as people find themselves in a accepted and winning role. To sustain employee's interest and to propel them towards continuous improvement, it is essential to recognize the people. This acknowledgment may be of financial, psychological or both in nature.

**Reward** is a tangible one, such as increase salaries, commissions, cash bonus, gain sharing, etc., to promote desirable behavior.

The employee's effort towards the improvement should be recognized for many reasons. Recognition is essential to:

• Improve employee's morale.

• Show the company's appreciation for better performance.

• Create satisfied workplace.

• Reinforce behavioral patterns.

• Stimulate creative efforts.

**Types of Rewards:** Broadly, one can classify the rewarding systems into two groups. They are,

**1. Intrinsic Rewards:** These are related to feelings of accomplishment or self-worth.

**2. Extrinsic Rewards:** These are related to pay or compensation issues.

Richard S. Allen and Ralph H. Kilmann have tabulated the different intrinsic and extrinsic rewards in Table.

| **Intrinsic Rewards** | **Extrinsic Rewards** |
|---|---|
| **1.** Non-monetary forms of recognition to acknowledge the achievement of quality improvement goals. | **1.** Profit sharing. |
| **2**. Celebrations to acknowledge the achievement of quality improvement goals. | **2.** Gain sharing. |
| **3.** Regular expressions of appreciation by managers and leaders to employees to acknowledge the achievement of quality improvement goals. | **3.** Employment security. |
| **4.** 360° performance appraisals-feedback from co-workers, subordinates or customers is incorporated into performance appraisals. | **4.** Compensation time. |
| **5.** Formal suggestion system available for individuals to make quality improvement suggestions. | **5.** Individual based performance systems. |
| **6.** Development based performance appraisals. | **6.** Quality based performance appraisals. |

## 2.14 Performance appraisal

The various steps that are involved in performance appraisal are,

- Establish performance standards.
- Communicate performance expectations to employees.
- Measure actual performance.
- Compare actual performance with standards.

• Discuss the appraisal with the employee.

• If necessary, initiate correction action.

Performance evaluation is often used as a tool to obtain salary adjustment as well as an opportunity to improve job performance. When inappropriately applied, performance evaluations may be perceived as being unfair, wasteful and demeaning.

In some organizations, there has been a trend to break down job functions to their most detailed level, weight each activity, judge it and then add up all the invalid numbers to achieve a more invalid judgment of a person's performance.

This non-Gestalt evaluation is an inspection philosophy that has not served manufacturing or health care very effectively.

Over the past four years, we have evolved a performance evaluation process at Minneapolis Children's Medical Center for physicians in both patient care and management roles.

## 2.15 Continuous process improvement

Continuous process improvement has the following approaches:

• Juran Trilogy

• PDCA Cycle

• 5002H Method

• 5S House Keeping

• Kaizen

**Concept of Continuous Process Improvement:**

Continuous improvement is based on a Japanese Concept known as Kaizen, that is the philosophy of frequently seeking ways to improve operations. It involves identifying benchmarks of excellent practices and instilling a sense of employee ownership of the process. The main target can be on:

• Reducing the length of time needed to process requests for loans in bank.

• The amount of scrap generated at a milling machine or the number of employee injuries.

Continuous improvement will also focus on problems with customers or suppliers like customers who request frequent changes in shipping quantities and suppliers that to maintain high quality.

The bases of the continuous improvement philosophy are the beliefs that virtually any aspect of an operation can be improved and which the people most closely associated with an operation are in the best position to identify the changes that should be made. Consequently, employee involvement plays a big role in continuous improvement programs.

**Getting Started with Continuous Improvement**

Instilling a philosophy of continuous improvement in an organization could be a lengthy process and several steps are essential to its eventual success.

• Train employees in the methods of statistical process control (SPC) and different tools for improvement quality.

• Make SPC methods a normal aspect of daily operations.

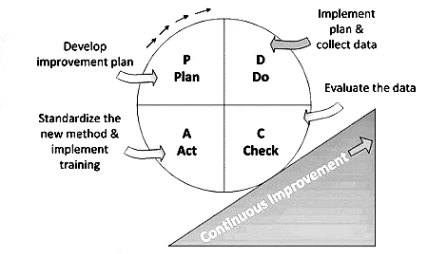
• Build work teams and employee involvement.

• Utilize problem-solving techniques in teamworks.

• Develop a sense of operator ownership of the process.

Here employee involvement is central to the philosophy of continuous improvement. But, the last two steps are crucial if the philosophy is to be the part of everyday operations. A sense of operator ownership emerges when employees feel as if they own the processes and methods, they use and take pride in the quality of product or service they produce.

It comes from participation on teamworks and in problem-solving activities, that instill in employees a feeling that they have some control over their workplace.




PDCA cycle

## 2.15.1 PDSA cycle


PLAN - What is needed?

DO - it

CHECK - That it works

ACT - To correct problems.

**1. Plan:**

• Define the problem.

• Define the performance indicators.

• Collect and analyze the process data.

• Generate possible solutions.

**2. Do:**

• Implement the plan on a limited scale or conduct an experiment to test the proposed improvement.

• Train all involved employees in the use of quality improvement methods and techniques.

**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 improvements are documented in standard procedures.

• Usually the cycle will be repeated under the different circumstances.

### 2.15.2 5s

**The concept of 5S:**

5S Philosophy focuses on effective work place organization and standardized work procedures. 5S simplifies our work environment, reduces waste and non-value activity whereas improving quality efficiency and safety.

**Sort:** (Seiri) the first S focuses on eliminating unnecessary items from the workplace.

**Set In Order:** (Seiton) is the second of the 5Ss and focuses on efficient and effective storage methods.

**Shine:** (Seiso) Once we have eliminated the clutter and junk that has been clogging our work areas and identified and located the necessary items, the next step are to thoroughly clean the work area.

**Standardize:** (Seiketsu) Once the first three 5S's have been implemented, we should concentrate on standardizing best practice in our work area.

**Sustain:** (Shitsuke) this is by far the most difficult S to implement and achieve. Once fully implemented, the 5S process can increase morale, create positive impressions on customers and increase efficiency and organization.

**Benefits of 5S:**

• Work place becomes clean and better organized.

• Results in good company image.

• Shop flux and office operations become easier.

• People become disciplined.

• Better quality awareness.

• Contribute to productivity quality.

### 2.15.3 Kaizen

**Kaizen:** It is the process of continuous improvement in small increments to make the process more efficient, effective, controllable and adequate.

• It is achieved through convention know-how and PDCA.

• It requires little investment but great effort to maintain.

• It requires recognition of effort before results.

• It is employee oriented.

• It involves everybody in the company.

**Two activities of Kaizen:**

1. Maintenance – involves activities directed at maintaining current technological, managerial and operating standards.

2. Improvement – aims at revising the current standards.

**Three Basic Principles of Kaizen:**

1. Work place effectiveness – the kaizen toolbox includes the 5S for improving workplace effectiveness.

2. Elimination of waste, strain and discrepancy - 3MUs in Japanese word.

**MUDA** – Waste

**MURI**- Strain

**MURA**- Discrepancy

3. Standardization – in terms of processes, materials and machinery.

**Goals of Kaizen:**

1. Kaizen is implemented not for profit but for quality.

2. The success of kaizen should be measurable through its impact on the customer satisfaction.

3. Kaizen will be successful only when it is process oriented.

Kaizen is a low cost approach to improvement, available to every organization that has the determination to improve its process or delighting customers. Kaizen brings out improvements, which results in improved productivity, efficiency, profitability and above all better quality of life of employees and satisfied customers.

**Two ways for Kaizen Implementation:**

1. Gradual Improvement of processes.

2. Kaizen Blitz – on the contrary, is a quick improvement methodology. A dramatic fashion of improvement which is normally completed in a single week. Its goal is to simply create better production line.

## 2.16 Supplier partnership

A commitment to continuous quality improvement cannot be translated into reality without treating supplier as a partner.

**Principles Of Customer / Supplier Relation**

• Both the customer and the supplier are fully responsible for the control quality.

• Both the customer and the supplier should be independent of each other and respect each others independence.

• The customer is responsible for providing the supplier with clear and sufficient needs so that the supplier will know what to produce precisely .

• Both the customer and the supplier should enter into an non adversarial contract with respect to quality, quantity, price, delivery method and terms of payments.

• The supplier is responsible for providing the quality that can satisfy the customer and submitting necessary data upon the customer's request.

• Both the customer and the supplier must decide the methods to evaluate the quality of the product or service to the satisfaction of both parties.

• Both the customer and the supplier should establish in the contract the method by that they can reach an amicable settlement of any disputes that may arise.

• Both the customer and the supplier must continually exchange information, sometimes using multi-functional teams, in order to improve the product or service quality.

• Both the customer and the supplier should perform business activities like procurement, production and inventory planning, clerical work and system so which an amicable and satisfactory relationship is maintained.

• When dealing with business transactions, both the customer and the supplier should always have the best interest of the end user in mind.

## 2.17 Partnering

It is defined as a continuing relationship between a buying firm and supplying firm involving a commitment over an extended time period, an exchange of information and acknowledgment of the risks and rewards of the relationship.

**Benefits Of Supplier Partnering**

• Improved Quality.

• Reduced cost.

• Increased Productivity.

• Increased efficiency.

• Increased market share.

• Increased opportunity for innovation.

• Continuous improvement of products/services.

## 2.18 Supplier selection

• **Sole sourcing** - Only one supplier for the entire organization. This may be forced to happen because of patent, technical specification, raw material location and monopolistic supplier.

• **Multiple sourcing** - For a single item having two or more supplier, resulting in better quality, better service at lower cost.

• **Single sourcing** - Use of one supplier to one item when several sources are available leading to long-term partnering relationship.

**Basis Of Supplier Selection**

1. Cost

2. Quality

3. Delivery

4. Reliability

5. Management

6. Compatibility

7. Goal congruence

8. Strategic direction of supplier firm

## 2.19 Supplier Rating

Additionally referred as score card system, it is used to obtain an overall rating of supplier performance based on quality, price, performance and production capability.

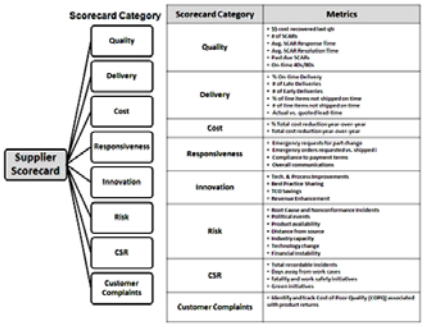
**Objectives Of Supplier Rating**

• Obtain an overall rating of supplier performance.

• Ensure complete communication with suppliers.

• Provide each supplier about the details of problems for corrective action.

• Maintain and improve the partnering relationship between the customer and the supplier.




Supplier rating

3

# TQM TOOLS & TECHNIQUES I

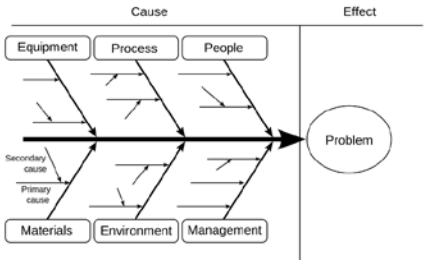
The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, Bench marking process – FMEA – Stages, Types.

## 3.1 The seven traditional tools of quality

The seven tools are:

- Cause-and-effect diagram (also known as the "Fish bone" or Ishikawa diagram)
- Check sheet
- Control chart
- Histogram
- Pareto chart
- Scatter diagram
- Stratification (alternately, flow chart or run chart)

**Cause-and-effect diagram (also known as Ishikawa or fishbone chart):**Identifies many possible causes for an effect or problem and sorts ideas into useful categories.




Cause and Effect diagram

**Check sheet:** A structured, prepared form for collecting and analyzing data; a generic tool that can be adapted for a wide variety of purposes.

The types of check sheets that are commonly used are

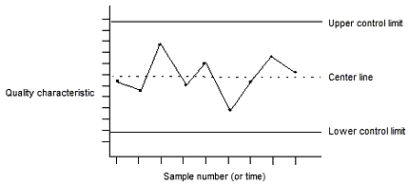
• Process distribution check sheet.

• Deflective item check sheet.

• Deflect location check sheet.

• Deflect factor check sheet.

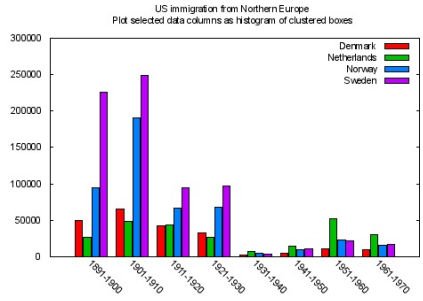
**Control charts:** Graphs used to study how a process changes over time.




Control chart

**Histograms**

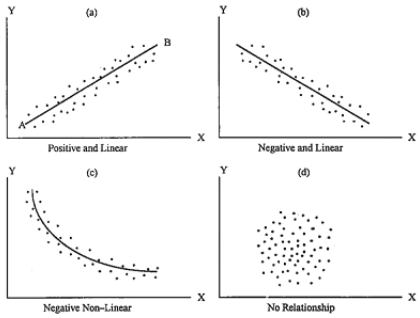
To illustrate and examine various data element in order to make decisions regarding them and effective when comparing statistical, survey or questionnaire results.




Histogram

**Scatter Diagram**

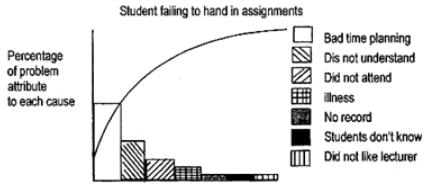
A scatter diagram is a tool for analyzing relationships between two variables. One variable is plotted on the horizontal axis while the other is plotted on the vertical axis. The pattern of their intersecting points may graphically show relationship patterns.




Scatter diagram

**Pareto chart:**

A Pareto chart is a special form of a bar graph and is used to display the relative importance of




Pareto Chart

**Applications of Pareto Chart:**

A. Focusing on critical issues by ranking them in terms of importance and frequency (Example: which course causes the most difficulty for students?; which problem with product X is most significant to our customers?)

B. Prioritizing problems or causes to efficiently initiate problem solving (Example: which discipline problems should be tackled first? or what is the most frequent complaint by parents, regarding the school? solution of what production problem will improve quality most?)

**Stratification:** A technique that separates data gathered from a variety of sources so that patterns may be seen (some lists replace “stratification” with “flowchart” or “run chart”).

**Run Chart** follows a process over a specific period of time like accrual rates, to track high and low points in its run and ultimately identify trends, shifts and patterns.

**Pareto Charts / Analysis**

Rates issues according to importance and frequency by prioritizing specific problems or causes in a manner that facilitates problem solving. Identify groupings of qualitative data, like most frequent complaint, most commonly purchased preservation aid, etc. in order to measure the one which

have priority. It can be scheduled over select periods of time to track changes. They can also be created in retrospect, as a before and after analysis of a process change.

**Flowcharts and Modeling Diagrams**

• Assist in the definition and analysis of each step in a process by illustrating it in a clear and comprehensive manner.

• Identify areas where workflow can be blocked or diverted and where workflow is fluid.

• Identify where steps are to be added or removed to improve efficiency and create standardized workflow.

## 3.2 New management tools

The seven management tools are:

- Relations diagram
- Tree diagram
- Arrow diagram
- Affinity diagram
- Matrix diagram
- Matrix data analyst diagram
- Process decision programme chart

**Relations diagram**

**Definition**

This tool displays all the interrelated cause-and-effect relationships and factors involved in a complex problem and describes desired outcomes. The process of creating an interrelationship diagraph helps a group analyze the natural links between different aspects of a complex situation.

**Process**

• Agree on the issue or question.

• Add a symbol to the diagram for each element involved in the issue.

• Compare each element to all others. Use an "influence" arrow to connect related elements.

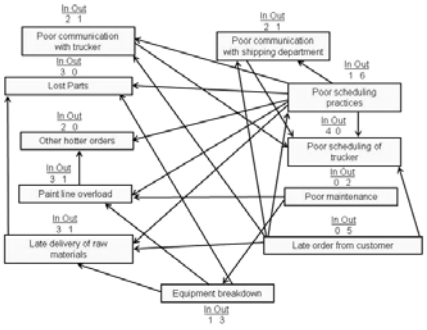
• The arrows must be drawn from the element that influences to the one influenced.

• If two elements influence each other, the arrow has to be drawn to reflect the stronger influence.

• Count the arrows.

The elements with the most outgoing arrows will be the root causes or drivers. The ones with the most incoming arrows will be key outcomes or results.

**Example:**




The inference is that Potential causes for late delivery are:

• 'Poor scheduling practices' (6 outgoing arrows).

• 'Late order from customer' (5 outgoing arrows).

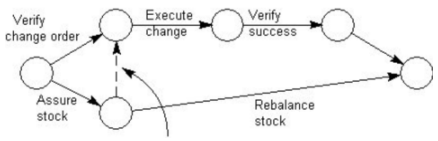
• 'Equipment breakdown' (3 outgoing arrows).

**Arrow diagram**

For years, construction planners used arrow diagrams to sequence and schedule the project tasks. Arrow diagramming has also been taught extensively in quantitative methods, operations

management and other business and engineering courses in the United States for a number of years.

Unfortunately, its use has generally been confined to technical experts. Adding arrow diagramming to the "quality toolbox" has made it more widely available to General Managers and other Non-Technical Personnel. Figure shows an example that time estimates can easily be added to every activity in order to schedule and control the project.




**Dotted line is dummy activity to ensure that execute change state only after verify change order and assume stock are completed Arrow Diagram**

**Affinity Diagram:**

**Purpose**

The purpose of an affinity diagram is to provide a visual representation of grouping of a large number of ideas or factors or requirements into logical sets of related items to help one organize action plans in a systematic manner.

**Procedure**

The steps in the procedure for preparing an affinity diagram are:

1. Decide the subject or the topic.

2. Generate large number of ideas through brainstorming.

3. Decide the number of groups and their titles. Create a card for every group. Enter the title of the group at the top of the card.

4. Distribute all the ideas among the cards. If necessary, create new cards for additional groups.

5. Arrange the cards according to the relationship between groups.

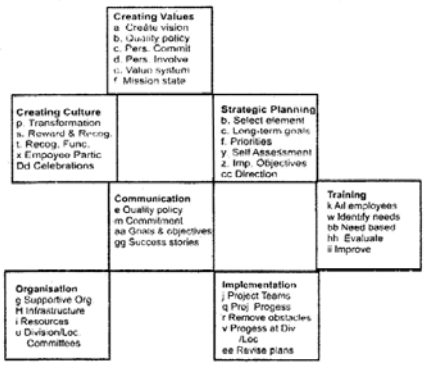
6. Give a name to the affinity diagram.

**Applications**

The structure and the procedure for affinity diagram shows simplicity of the tool. Its simplicity made it easy to combine it with other tools and put it to a wide variety of applications. For instance, it can

be combined with a cause and effect diagram or a relations diagram to identify and regroup causes for a problem or it will be combined with a tree diagram to categories possible solutions.

This will assist in problem solving. It can be used to group customer requirements in a complex product and can help one to design a product with characteristics and features that would satisfy and delight customers. It will be used to categories actions in an implementation plan leading to a rationalized distribution of responsibility.




Affinity Diagram

**Tree Diagram:**

**Purpose**

The purpose of the tree diagram is to explore ways and means to achieve an objective, develop a list of alternate ways to reach the desired situation in a linear sequential order and to present them in a visual form.

**Procedure**

This tool like any other tools the 'new seven' is a group tool. A brainstorming session is necessary to collect the large number of ideas by means of achieve the objective. The rules of brainstorming should be observed to get the best results from the tool. The steps and the procedure to develop a tree diagram is:

1. Identify a high priority problem which needs to be solved at the earliest. Prepare an objective statement explaining the desired situation or the target solution.

2. Decide the appropriate form of the diagram - cascade or tree as well as direction of flow after a brief discussion. Place the target solution in the dark rectangle.

3. Brainstorm to identify the primary means to achieve the objective. Arrange them in an appropriate order keeping in mind that the likely interrelations between them and place them in rectangles at the first level.

4. For every of the primary means, identify secondary means which would be necessary to attain those means. Arrange them in next level boxes.

5. Identify tertiary means needed to attain each of the secondary means and place them in a proper order in the next level boxes.

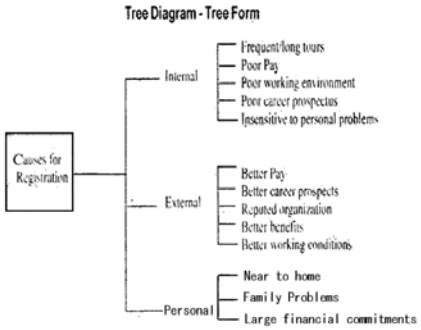
6. Continue the process till the group feels which the end of the line has been reached.

7. If a lower level means is needed to attain two higher level means, it could be connected to both. Rearrange the boxes if necessary to make this possible.

8. Brainstorm to reach a consensus on the relative, importance of the last level means to priorities action.

**Application**

The most important application of the tree diagram is for dividing solutions for problems. It helps one to develop a systematic step by step strategy to achieve an objective. It is also useful in monitoring the implements of solutions by taking care of accomplishment of means at various levels.

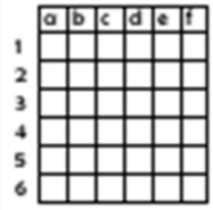



Tree Diagram

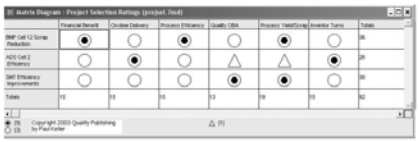
**Matrix diagram**

**Definition**

This tool shows the relationship between items. At every intersection, a relationship is either absent or present. Then, it gives information about the relationship such as its strength, the roles played by different individuals or measurements. Six differently shaped matrices are possible: L, T, Y, X, C, R and roof-shaped, depending on how many groups must be compared.




Matrix Diagram



A personnel department proposed to improve social activity within the company in order to increase loyalty levels. A theory puts forward that soft-skills training contributed significantly towards this in-house socializing. The personnel manager consequently decided to utilize a Matrix Diagram to investigate this.

**The steps taken were:**

**Objective:** Investigate effect of soft-skills training on social activity.

**Matrix:** T-matrix, with people on main stem, in-house training courses to left, attendance of social clubs to right, plus an extra column for years of service.

**Comparison:** In-house training - tick for attendance within last three years; social clubs - three bands corresponding to under 30%, 30% to 70% and over 70% attendance in the same period.

**Process decision program chart**

**Definition :**

A useful way of planning is to break down tasks into a hierarchy, using a Tree Diagram. The PDPC extends the tree diagram a couple of levels to identify risks and countermeasures for the bottom level tasks. Different shaped boxes are used to highlight risks and identify possible countermeasures. The PDPC is similar to the Failure Modes and Effects Analysis (FMEA) in that both identify risks, consequences of failure and contingency actions and the FMEA also rates relative risk levels for each potential failure point.

**Process:**

From the bottom level of some activity box, the PDPC adds levels for:

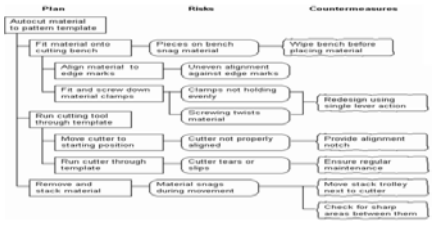
• Identifying what can go wrong (failure mode or risks)

• Consequences of that failure (effect or consequence)

• Possible countermeasures (risk mitigation action plan)

**Example**

A dress production team at a clothes manufacturer was improving the cutting-out process in order to minimize material wastage. They decided to utilize PDPC on the work breakdown structure to identify potential problems and ways of avoiding them.




As a result of this, the cutting was tested on cheaper material, resulting in the material clamp being redesigned to prevent drag, a start notch provided for the cutter and the general area being inspected for sharp corners to minimize snag problems. The cutting operator was involved in the PDPC process and the subsequent tests, resulting in her fully understanding the process. The final cutting process thereafter ran very smoothly with very little error.

**Matrix Data Analysis diagram**

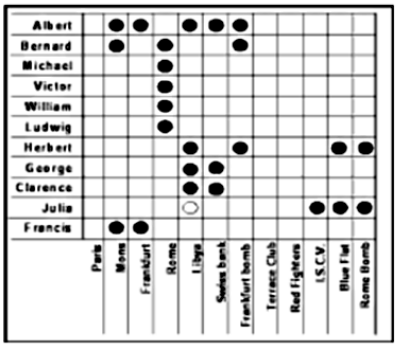
Matrix data analysis gives data and arranges them to display quantitative relationships among variables to made them more easily understood and analyzed. In its original form used in Japan, matrix data analysis is a rigorous, statistically based “factor analysis” technique.

Many feel that this method, while worthwhile for many applications, is too quantitative to be used on a daily basis and have developed alternative tools that are easier to understand and implement.

A small example of matrix data analysis is shown in Figure. In this example, MicroTech market researchers determined that the four most important consumer requirements are price, reliability, delivery and technical support. Through market research, an importance weighting was developed for each.

They also found numerical ratings for the company and their best competitor. Such an analysis provides information as to that actions the company should deploy to better meet the key customer requirements.

For example, in the below Figure, reliability is the highest in importance and MicroTech has a narrow lead over its best competitor. Thus, they should continue to strive for improving product reliability. Also, technical support is of relatively high importance, however MicroTech is perceived to be inferior to its best competitor in this category. Thus, improving the quality of support services should be a major objective.

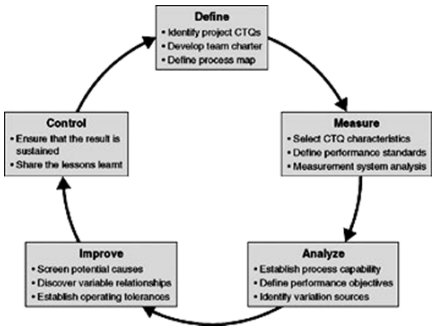



**Matrix Data Analysis Diagram**

## 3.3 Six-sigma: Concepts, methodology

Six sigma concept is a set of activities, an organization uses to win and retain customer's satisfaction. It may be provided either before, during or after the sale of the product.

Six sigma is described by acronym DMAIC. In DMAIC,




Six-sigma

**1. Define:**

Define is the first step of DMAIC, The definition step identifies activities and quality tools.

**Define Activities:**

• Identify project, champion and project owner

• Determine customer requirements and critical to quality (CTQs)

• Define problem, objective, goals and benefits

• Define stakeholder/resource analysis

• Develop project plan

**Define quality tools:**

• Project charter and plans

• Effort/impact analysis

• Process mapping

• Tree diagram

**2. Measure:**

It enables the benchmarking of process using actual data and quantify it.

**Measure Activities:**

- Define project scope
- Select output characteristic (Y's)
- Determine project critical Xs and Ys
- Assess performance specification
- Validate measurement systems
- Establish initial capability (Y's)
- Determine the process capability.

**Measure Quality tools:**

- Quality function deployment (QFD)
- Measurement system analysis (MSA)
- Check sheet

**3. Analyze:**

It's necessary to analyze the process applying statistical tools.

**Analyze activities:**

- Define performance objectives
- Analyze sources of variability
- Determine root causes using data

**Analyzing quality tools:**

- Statistical analysis of data
- Cause and effect or event diagram
- Histogram

- Pareto diagram
- Run chart
- Scatter diagram.

**4.Improve:**

**Improve activities:**

- Develop solution alternatives
- Screen potential causes
- Identify appropriate operating conditions
- Implement solution
- Determine solution effectiveness using data

**Improve quality tools:**

- Design of experiments (DOE)
- Brain storming
- FMEA (Failure Mode Effect Analysis)

**5. Control:** Success is the control step depends on previous steps. Tools are put in place to process improvement gains are maintained.

**Control activities:**

- Determine process capability (X's)
- Realize benefits of implementing solution
- Finish the project and communicate results

**Control quality tools:**

- Statistical process control (SPC)
- Out of control action plan (OCAP)
- Design changes for defects to be eliminated

**Capability Maturing Model:** Capability maturity Model (CMM) is a collection of instruction organization can follow with the purpose to gain better control over its software development process.

The CMM ranks software development organizations in a hierarchy of five levels each with a progressively greater capability of producing quality software. Each level is described as a level of maturity. These 5 levels are equipped with different number of instruction to follow.

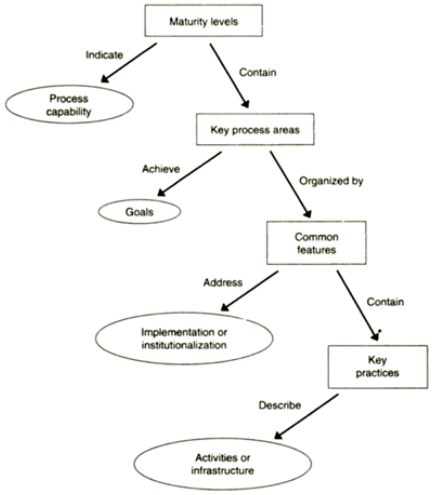
**Level 1-Initial :** At maturity level-1 processes are generally ad hoc and the organization normally does not provide a stable environment.

**Level 2-Repeatable:** At this maturity level-2, software development successes are repeatable. The organization can use some basic project management to track cost and schedule.

**Level 3-Defined:** A maturity level-3, processes are well characterized and understood and are explained in standards procedure, tools and methods.

**Level 4-Managed:** Using precise measurement, management may effectively control the software development effort. In particular, management identifies ways to adjust and adopt the process to particular projects without measurable losses of quality or deviations from specifications.

**Level5-Optimizing:** This maturity level focuses on continually improving process performance through both incremental and innovative technological improvement.




## 3.4 Applications to manufacturing, service sector including IT

**Manufacturing industries:**

The manufacturing industry is where Six Sigma got its start. Therefore, it might seem quite obvious that there are a slew of practical applications for Six Sigma Training within the industry.

This is often taken for granted, though leaving many companies to assume that it may just work for them, when in reality, the need for the process needs to be established just as it would be in any other industry before it may be used.

The goal of Six Sigma Projects, as we know, is to create a plan that results in a solution to improve a process or product to a ratio of 3.4 defects per million.

For the sake of example, consider the situation to be like this. we have a process that involves creating parts for a toy and a process that automates the construction of that toy once the parts are completed.

Currently, the time consumption is astronomical and we know that there has to be a better way to produce parts and complete toys in a manner that is more effective and productive. we are not sure of what the solution is, but we know that if we take time to examine our current data and figure out what our goals are, we can determine a process that achieves our goals.

This is the perfect setup for a Six Sigma Process to become involved in within the manufacturing industry, because it can prove to be very useful.

**IT industries:**

DMAIC (define, measure, analyze, improve, control) is applied the same way in the information technology (IT) services sector as it was in manufacturing. Some of the challenges facing Six Sigma in the IT sector are:

• Lengthy projects

• Data oriented tools

• Lack of knowledge in a knowledge-based industry

• Failure to properly use DMAIC in a software development project

• Six-Sigma as a Project Based Approach.

Initially, Six Sigma has been termed a project-based approach to improvements. Each project, however, could take between five weeks and six months. In the IT services sector, the length of the project is often too long to realize the benefits.

Projects are completed, resources are re-aligned and team members are transferred to other teams or sent to on site assignments. These changes affect the cohesiveness of improvement teams. Many Six Sigma projects are either delayed or canceled due to lack of participation.

## 3.5 Bench marking

A measurement of the quality of an organization's policies, products, programs, strategies and their comparison with the standard measurements or similar measurements of its peers.

It is a systematic method by which organization may measure themselves against the best industry practices.

**Example:**

Comparing a new product with standard product available in the market.

**Benchmarking Process**

Benchmarking Process usually involves the following steps:

1. Identify a critical process that needs improvement (For example: order entry, distribution, service after sale).

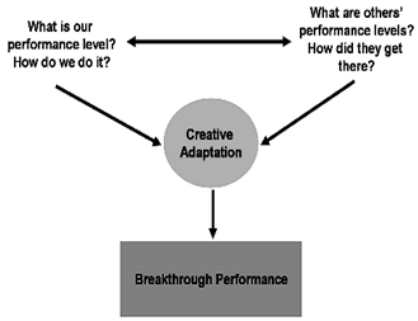
2. Identify an organization which excels in the process, preferably the best.

3. Contact the benchmark organization, visit and study the benchmarking activity.

4. Analyze the data.

5. Improve the critical process at our own organization.

6. Identify an organization that excels in the process, preferably the best.




Bench marking

**Classification based on the Organizations against whom one is Benchmarking:**

**1. Internal Benchmarking:** It refers to comparison of performance between departments, plants, subsidiaries and so on within the organization.

**2. Industry Benchmarking:** It refers to comparison of performance by the organizations producing the same class of products and services.

**3. Competitive Benchmarking:** It refers to comparison of performance against direct competitors.

**4. Best-in-class Benchmarking:** It refers to comparison of performance with best practices prevalent in an organization irrespective of products.

### 3.5.1 Reason to bench mark

**Objectives of Benchmarking**

• Benchmarking aims at a goal setting process to facilitate comparison with the best.

• Motivating stimulating employees for the goal of continuous quality improvement.

• Aims at external orientation of the organization.

• Identifying a technological break-through.

• Aims at searching for industry training.

**Reasons to Benchmark**

• Bench Marking is a powerful tool to achieve business and competitive objectives.

• Bench Marking is a SWOT tools to help organizations develop those strengths and reduce weakness.

• Bench Marking can notify the organization if it has fallen behind the competition.

• Bench Marking enhances innovation by requiring organization to constantly scan the external environment.

## 3.5.2 Bench marking process


Benchmarking Process

**Steps in Benchmarking Process:**

**Table: Step in benchmarking process**

| **Phases** | **Steps** | |
|---|---|---|
| Planning | 1. | Earmark what is to be benchmarked? |
| | 2. | Identify the best competitor. |
| | 3. | Determine data collector method and start collecting data. |
| Analysis | 4. | Determine current performance 'GAP'. |
| | 5. | Project the future performance levels. |
| Integration | 6. | Communicate the benchmark findings and gain acceptance. |
| | 7. | Establish the functional goals.<br>Establish functional goals.<br>Communicate data for analysis<br>Give acceptance for analysis |
| Action | 8. | Develop the action plans. |

| | | |
|---|---|---|
| | 9. | Implement specific actions and monitor the progress. |
| | 10. | Recalibrate the benchmarks. |
| Maturity | 11. | Attain leadership position. |
| | 12. | Integrate practices into process. |

**Phase I: Planning**

The planning phase involves these steps:

To identify

(i) What is to be benchmarked?

(ii) To whom or what shall we compare?

(iii) How will the data be collected?

**Step 1: What can be benchmarked? (i.e., deciding what to benchmark)**

Benchmarking can be applied to any business or production process. During this step, obtain which functions, tasks, processes or activities within the own organization will be subjected to benchmarking. Appoint a benchmarking team that will pilot the activity within the organization.

In this stage, formulate the project goals; find the data to be collected and prepare a tentative list of questions.

**Step 2: To whom or what shall we compare? (i.e., identifying benchmark partners)**

Identify the world-class or leading edge companies that have a similar product or process. Important criteria for the selection of benchmark partners are : The partners should be outstanding regarding the benchmark subject, competitiveness of activities and availability of reliable information about the partners.

**Step 3: Determine data collection method and collect data**

• Gather both qualitative and quantitative data about the process performances of partners based on interviews, surveys and consultation of contacts and technical magazines.

• Examine the process and underlying working methods of partners.

**Phase II: Analysis**

The analysis phase involves a careful understanding of current process practices as well as those of benchmarking partners. This phase consists of the following two steps:

**Step 4: Determine the current performance gap**

Determine the gap between the performance level of the organization and that of its benchmark partner. After the data is gathered, measured and analyzed, compare these to the data of the own organization. Based on this, determine the current performance gap between the own organization and that of the benchmark partners.

Document the differences in underlying working methods and the causes of the differences in performance.

**Step 5: Project future performance levels**

The gap is a projection of performance. Therefore, the performance will change as industry practices change. So keeping the future in mind, project the performance levels.

**Phase III: Integration**

Integration is the process of using benchmark findings to get operational targets for change. It involves careful planning to incorporate new practices in the operation and ensures that benchmarking findings are incorporated in all formal planning process. This phase consists of the following two steps:

**Step 6: Communicate benchmark findings and gain acceptance**

• Demonstrate the benchmark findings to the management for their acceptance.

• Communicate the benchmark findings to all organizational levels to get support, commitment and ownership.

**Step 7**: **Establish functional goals**. On the base of communicated data and acceptance of analysis, functional goals will be established.

**Phase IV: Action**

This consists of 3 steps.

**Step 8: Developing action plans.**

**Step 9: Implementing specifies actions and monitor the progress.**

**Step 10: Recalibrate benchmarks.**

**Phase V: Maternity**

This will be reached when best industry practices are incorporated in business processes. It consists of two steps:

**Step 11: Attain the leadership position.**

**Step 12: Integrate practices into the process.**

Benchmarking is based on learning from others, rather than developing new and improved approaches. It also leads to stagnation of idea strategies best industry practices, etc.

**Balance scorecard:**

It is a management system that enables organizations to clarify their vision and strategy and translate them into action. It provides feedback around both the internal business processes and external outcomes in order to continuously improve strategic performance and result. When full deployed, the balance scorecard transforms the strategic planning from an academic exercise into the nerve center of the enterprise.

## 3.6 FMEA

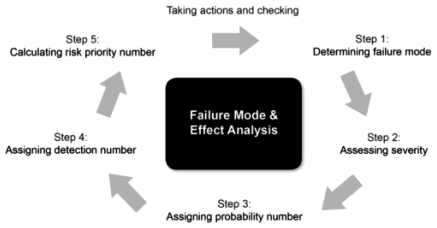
Failure mode and effect analysis (FMEA) is also known as risk analysis. It is a preventive measure to systematically display the causes, effects and possible actions regarding observed failure. The objective of FMEA is to anticipate failures and prevent them from occurring. FMEA prioritizes failures and attempts to eliminate their causes.

FMEA is a technique to identify and eliminate potential failures, problems, errors which occur in the system, design, process and service before they reach the customer.

### 3.6.1 Stages of FMEA

The DFMEA is deals with design activities .It involves the steps of breaking down the product into smaller parts like sub-assemblies, sub-systems or components and then identifying the potential failure modes and potential causes for each of the parts; determining the current controls to the causes; followed by the failure effects to the product assembly and end users; finally, the risks of the effects are assessed.

The PFMEA used to solve problems due to manufacturing processes. It starts with a process flow chart which shows each of the manufacturing steps of a product. The potential failure modes and potential causes for each of the process steps are identified, then the current controls are determined, followed by the effects of failures on the manufacturing line operators and product end users. The risks of these effects are then assessed accordingly.




Stage of FMEA

“Describe the system. A detailed description of the process is initially required so that it can be broken down into either a functional, hierarchical or reliability block diagram. The assessment team also needs a detailed description of the various actions performed by each section, including a description of their modes of success or failure.

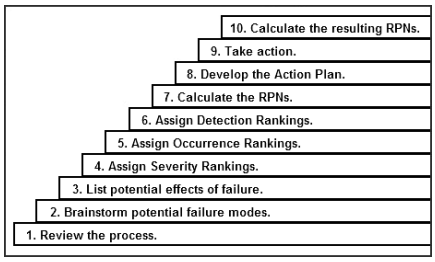
Establish the basic principles and purposes of the study. The purpose and scope of the assessment needs to be stated, along with how the results will be displayed and whether there will be any interaction between the results and any further studies to be performed.

Carry out the study. Initially all items must be identified in the various systems or subsystems produced by the graphical breakdown of the process.

All the possible failure modes of these items should then be collated. The most likely failures caused by the failure modes can then be identified and their effects on the process evaluated.

Report the results. The report should include the diagram produced in stage 1, a detailed record of the analysis a summary, recommendations indicating possible improvements, failures which have significant effect on the process, as well as those that produce none.

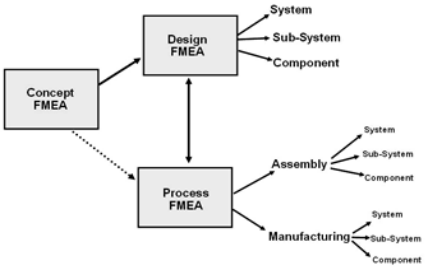
**Creating a FMEA**




After finishing the above mentioned steps, sort the RPN numbers and identify most critical issues. The team must decide where to focus first. Assign specific actions with responsible persons. Also, be sure to include the date for when this action is expected to be complete. Once actions have been completed, rescore the occurrence and detection. In most cases we will not change the severity score unless the customer decides this is not an important issue.

### 3.6.2 Types

Although the purpose, terminology and other details can vary according to type (e.g., Process FMEA - PFMEA, Design FMEA - DFMEA, System FMEA, Product FMEA, FMECA, etc.), the basic methodology is similar for all.




Types of FMEA

There are several different types of FMEA. Even though what is being analyzed is slightly different and the assessment criteria may change some, the step-by-step approach or technique still remains essentially the same. Some of the more common types of FMEA / FMECA are described below.

**Concept FMEA (CFMEA)**

The Concept FMEA is used to analyze concepts in the early stages before hardware is defined. It focuses on potential failure modes associated with the proposed functions of a concept proposal. This type of FMEA includes the interaction of multiple systems and interaction between the elements of a system at the concept stages.

**Design FMEA (DFMEA)**

The Design FMEA is used to analyze products before they are released to production. It focuses on potential failure modes of products caused by design deficiencies. Design FMEAs are normally done at three levels system, subsystem and component levels. This type of FMEA is used to analyze hardware, functions or a combination

**Process FMEA (PFMEA)**

The Process FMEA is normally used to analyze manufacturing and assembly processes at the system, subsystem or component levels. This type of FMEA focuses on potential failure modes of the process that are caused by manufacturing or assembly process deficiencies. Although Design FMEA's are used in analyzing medical equipment, Process FMEA is commonly used in regard to patient care, especially associated with certain types of surgery. This approach is also commonly used in many industries to access certain processes involved in providing customer care.

**Advantages of FMEA:**

i. Risk index/RPN enables prioritization of faults

ii. Explicitly documents modes of control/ mitigation

iii. Format useful for tracking action items

iv. Easily constructed using hand-written spreadsheets or computer-based software tools

**Disadvantages of FMEA:**

i. Failure and reliability rates are particularly difficult to estimate when human performance is involved; that could be considered as the major disadvantage.

ii. Difficult to assess combination of event/complex interactions

iii. Severity and occurrence ratings are often difficult for individuals or teams to estimate.

4

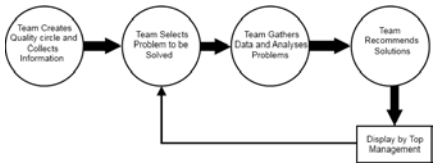
# TQM TOOLS & TECHNIQUES II

Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Cost of Quality – Performance measures.

## 4.1 Quality circles

The quality circles meet during the workweek to identify the problems and to work on solutions. They are empowered with the ability to collect the data and take surveys within the workplace to work towards resolution of the problems.

The reasoning behind these quality circles is that the people who actually do the job know what problems they encounter in their day to day functions and are the people who can make suggestions as to how to improve their production.




Quality circles

An organization may identify 4-5 different areas which require the continuous monitoring and improvement. Each area may be allocated to a group (forms from the members of the organization) which is called Quality Circle 1, 2, 3, 4 etc, depending on the number of areas identified.

The Quality Circles should have a common objective of working for the success of their project in the area being allocated to them. These areas may be referred as Kaizen activities. Membership of each QC is on a voluntary basis.

The following are suggested steps in forming the Quality Circle:

• Inform staff of the Kaizen activities.

• Explain the full concepts and the advantages of Kaizen activities.

• Divide the staff into small groups - Quality Circles.

- Discuss and analyze problems identified in each area by QCs.
- Recommend possible solutions by QCs.
- Prepare implementation plans.
- Write the proposal in implementing plans.

## 4.2 Quality Function Deployment (QFD)

**House of Quality:** The primary planning tool use of QFD in house of quality are it covers the voice of the customer into product design characteristics Uses a series matrix diagram, also known as quality tables that resembles connected houses.

The Steps in building a House of Quality are:

1. List the Customer Requirements (WHAT's).

2. List the 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 a Prioritized Customer Requirements.

7. Develop a Prioritized Technical Descriptors.

**Step 1: Customer Requirements - "Voice of the Customer"**

The first step in a QFD project is to find what market segments will be analyzed during the process and to identify who the customers are. The team then gathers the information from the customers on the requirements they have for the product or service.

In order to organize and evaluate this data, the team uses simple quality tools like Affinity Diagrams or Tree Diagrams.

**Step 2: Regulatory Requirements**

Not all the product or service requirements are known to the customer, so the team must document requirements that are dictated by management or regulatory standards that the product must adhere to.

**Step 3: Customer Importance Ratings**

On the scale from 1 - 5, customers then rate the importance of each requirement. Then this number will be used later in the relationship matrix.

**Step 4: Customer Rating of the Competition**

Understanding how the customers rate the competition can be a tremendous competitive advantage. In this step of the QFD process, it is also a good idea to ask customers how our product or service rates in relation to the competition.

There is remodeling that can take place in this part of the House of Quality. Additional rooms that identify the sales opportunities, customer complaints, goals for continuous improvement, etc., can be added.

**Step 5: Technical Descriptors - "Voice of the Engineer".**

The technical descriptors are attributes about the product or service that can be measured and benchmarked against the competition. Technical descriptors may exist that our organization is already using a determine product specification, however new measurements can be created to ensure that our product is meeting customer needs.

**Step 6: Direction of Improvement**

As the team defines the technical descriptors, a determination must be made as to the direction of movement for each descriptor.

**Step 7: Relationship Matrix**

This is a matrix where the team determines the relationship between the customer needs and the company's ability to meet those requirements.

The team asks the question, "What is the strength of the relationship between the technical descriptors and the customer’s needs?" Relationships can either be weak, moderate or strong or carry a numeric value of 1, 3 or 9.

**Step 8: Organizational Difficulty**

Rate the design attributes in terms of organizational difficulty. It is very possible that some attributes are in direct conflict. Increasing the number of sizes may be in conflict with the company’s stock holding policies.

**Step 9: Technical Analysis of Competitor Products**

To better understand the competition, engineering then conducts a comparison of competitor technical descriptors. This process involves a reverse engineering competitor products to determine the specific values for competitor technical descriptors.

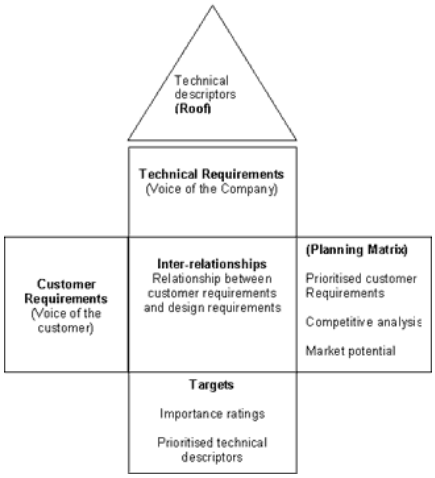
**Step 10: Target Values for Technical Descriptors**

At this stage in the process, the QFD team begins to establish the target values for each technical descriptor. Target values shows "how much" for the technical descriptors and can then act as a base-line to compare against.

**Step 11: Correlation Matrix**

This room in the matrix is where the term House of Quality comes from because it makes the matrix look like a house with a roof. The correlation matrix is probably the least used room in the House of Quality.

However, this room is a big help to the design engineers in the next phase of a comprehensive QFD project. Team members must examine has each of the technical descriptors impact each other. The team should document strong negative relationships between technical descriptors and work to eliminate physical contradictions.




House of quality

Devise a QFD methodology for design and development of cups used in vending machine for dispersing hot and cold beverages.

**Step 1:** List customer requirements (WHATs).

• To disperse hot beverages.

• To disperse cold beverages.

- To be recyclable.
- To be safe and Eco-friendly.
- Durable.
- Light weight.
- Strength.

**Step 2:** List technical descriptors (HOWs).

- Plastic cup.
- Paper cup.
- Plastic coated paper cup.
- Chemical free.
- No sharp edges.
- Low cost materials.
- Colorful.

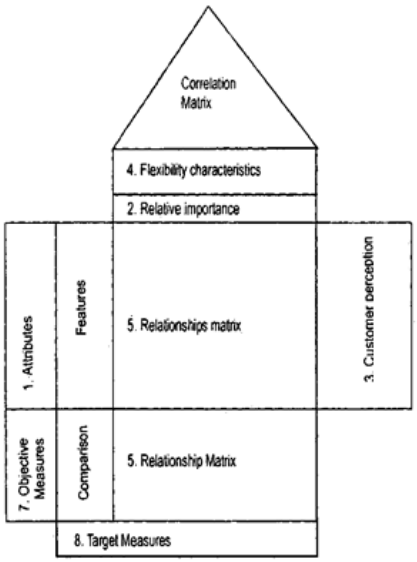
**Step 3:** Develop a Relationship Matrix between WHATs and HOWs by assigning scores.

**Step 4:** Develop an inter-relationship matrix between how.

**Step 5:** Competitive assessments.

**Step 6:** Develop prioritized customer requirements.

**Step 7:** Develop prioritized technical descriptors.




House of quality

**Benefits of QFD:**

The various benefits of quality function deployment are:

**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 lime**

• 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).

## 4.3 Taguchi quality loss function

**Taguchi's Approach vs Traditional Approach:** Consider two products and one is within the specified limits and the other is just outside of the specified limits. In the traditional approach, the product within the limits is considered as a good product, while the outside one is considered as bad product.

Taguchi disagrees with this traditional approach. He believes that when a product moves from its target value, that move causes a loss no matter if the move falls inside or outside the specified limits.

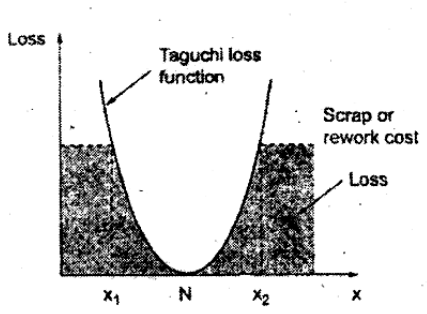
**Taguchi Method:**

**Illustration**: Suppose the manufacturing specifications for a widget is 20 ±3 mm; Under the traditional manufacturing perspective, if the widget actually produced is less than 17 mm or greater than 23 mm, then it must be discarded. For any widget within the 17 mm to 23 mm range, the traditional manufacturing perspective recognizes no quality loss cost. This traditional perspective is illustrated by the box shape in figure.

Under the Taguchi perspective, a **quality loss** is incurred whenever the actual widget does not reach the exact target value 20 mm. Variations from this target value (even 19 mm of 21 mm value) will produce the quality loss cost. The area of customer dissatisfaction is illustrated by the U shape curve in figure.

**Taguchi's Quadratic Quality Loss Function:**

Quality loss occurs when a product's specifications deviate from target or nominal value. No matter how small the deviation, there is some loss in quality. If the deviation grows, then the loss increases. The Taguchi's U-shaped loss function curve is shown in figure.




**Quadratic quality loss function**

Taguchi uses a quadratic equation to determine this curve.

$L(x) = k(x - N)^2$

Where,

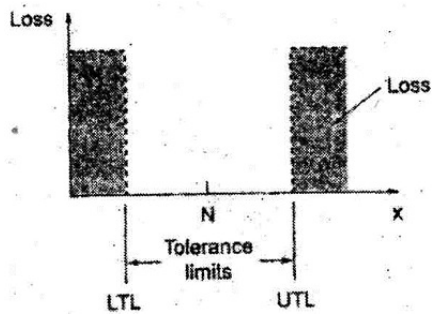
*L(x)* = Loss function,

*k* = Constant of proportionality,

*x* = Quality characteristic of selected product,

*N*= Nominal value of the chosen product and

*(x - N)* = Tolerance.




**Loss function implicit in traditional tolerance specification**

Figure shows the loss function in a traditional approach. In contrast, the smooth curve illustrates the Taguchi's approach. Cross-hatching in both the figure indicates the losses.

## 4.4 TPM – Concepts

**Total productive maintenance** (**TPM**) is a system of maintaining and improving the integrity of production and quality systems through the machines, equipment, processes and employees that add business value to the organization.

TPM focuses on keeping all equipment in top working condition to avoid breakdowns and delays in the manufacturing process.

The various benefits of TPM are,

• Increased equipment productivity.

• Improved equipment reliability.

• Reduced equipment downtime.

• Improved return on investment.

**Objectives of TPM:**

• To improve equipment effectiveness

• To achieve autonomous maintenance

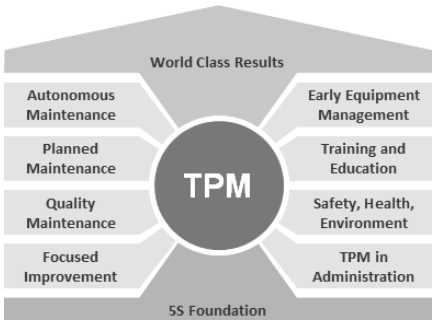
• To plan maintenance

• To train all staff in relevant maintenance skills

• To achieve early equipment management.

**THE TRADITIONAL TPM MODEL:**

The traditional approach to TPM was developed in the 1960s and consists of 5S as a foundation and eight supporting activities (sometimes referred to as pillars).




Traditional TPM model consists of a 5S foundation

**The 5S Foundation**

The goal of 5S is to create the work environment that is clean and is well-organized. It consists of five elements:

• Sort (i.e., eliminate anything that is not truly needed in work area)

• Set in Order (i.e., organize the remaining items)

• Shine (i.e., clean and inspect the work area)

• Standardize (i.e., create standards for performing the above three activities)

• Sustain (i.e., ensure the standards are regularly applied).

This creates a foundation for well-running equipment. For example, in a clean and well-organized work environment, tools and parts are much easier to find and it is much easier to spot emerging issues such as fluid leaks, metal shavings from unexpected wear, material spills, hairline cracks in mechanisms, etc.

**Types of maintenance:**

**1. Breakdown maintenance**

It means that people will wait until the equipment fails and repair it. Such a thing may be used when the equipment failure does not significantly affect the operation or production or generate any significant loss other than repair cost.

**2. Preventive maintenance**

It is a daily maintenance (oiling, cleaning, inspection and re-tightening) design to retain the healthy condition of equipment and prevent failure through the prevention of deterioration, periodic inspection or equipment condition diagnosis to measure deterioration.

It is further divided into predictive maintenance and periodic maintenance. Just like human life is extended by preventive medicine, the equipment service life will be prolonged by doing the preventive maintenance.

**2a. Periodic maintenance (Time based maintenance - TBM):**

Time based maintenance consists of periodically inspecting, servicing and cleaning equipment and replacing parts to prevent sudden failure and process problems.

**2b. Predictive maintenance:**

This is a method in which the service life of important part is predicted based on the inspection or diagnosis, in order to use the parts to the limit of their service life.

Compared to the periodic maintenance, predictive maintenance is condition based maintenance. It manages the trend values by measuring and analyzing information about deterioration and employs a surveillance system, designed to monitor the conditions through an on-line system.

**3. Corrective maintenance:**

It improves the equipment and its components so that preventive maintenance can be carried out reliably. Equipment with the design weakness must be redesigned to improve the reliability or improving maintainability.

**4. Maintenance prevention:**

This indicates the design of new equipment. Weakness of current machines are sufficiently studied and are incorporated before commissioning a new equipment.

### *4.4.1 Improvement needs of TPM*

**Companies that have been successful usually follow an implementation plan that includes the following 12 steps:**

**Step 1: Announcement of TPM.**

Top management needs to create an environment that will support the introduction of TPM. Without the support of management, skepticism and resistance will kill the initiative.

**Step 2: Launch a formal education program.**

This program will inform and educate everyone in the organization about the TPM activities, benefits and the importance of contribution from everyone.

**Step 3: Create an organizational support structure.**

This group will promote and sustain the TPM activities once they begin. Team-based activities are essential to a TPM effort. This group needs to include the members from every level of the organization from management to the shop floor. This structure will promote communication and will guarantee everyone is working toward the same goals.

**Step 4: Establish basic TPM policies and quantifiable goals**.

Analyze the existing conditions and set the goals that are SMART: Specific, Measurable, Attainable, Realistic and Time-based.

**Step 5: Outline a detailed master deployment plan.**

This plan will identify what resources will be needed and when needed for training, equipment restoration and improvements, maintenance management systems and new technologies.

**Step 6: TPM kick-off.**

Implementation will begin at this stage.

**Step 7: Improve the effectiveness of each piece of equipment.**

Project teams will analyze each piece of equipment and make the necessary improvements.

**Step 8 : Develop an autonomous maintenance program for operators.**

Operators routine cleaning and inspection will help to stabilize conditions and stop accelerated deterioration.

**Step 9: Develop a planned or preventive maintenance program.**

Create a schedule for preventive maintenance on each piece of equipment.

**Step 10: Conduct training to improve operation and maintenance skills.**

The maintenance department will take on the role of teachers and guides to provide the training, advice and equipment information to the teams.

**Step 11: Develop an early equipment management program.**

Apply preventive maintenance principles during the design process of equipment.

**Step 12: Continuous improvement.**

As in any lean initiative, the organization needs to develop a continuous improvement mind-set.

Maintenance and reliability as a core business strategy is key to a successful TPM implementation. Without the support of top management, the TPM will be just another “flavor of the month.” Implementing TPM using the above 12 steps will start us on the road to “zero breakdowns” and “zero defects.”

**Needs of TPM:**

- Development of the best world class organisation.
- Reduce the cost continuously.

## 4.5 Cost of Quality

As defined by Philip B. Crosby in his book "Quality Is Free", the cost of quality has two main components:

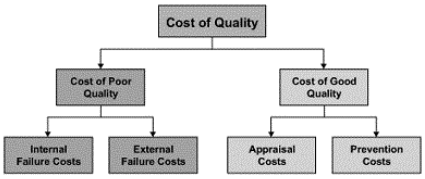
1. The cost of good quality (also referred as cost of conformance).

2. The cost of poor quality (also referred as cost of non-conformance).

As figure shows:

1. The cost of poor quality affects the internal and external costs resulting from failing to meet requirements.

2. The cost of good quality affects the costs for investing in the prevention of non-conformance to requirements. Costs for appraising a product or service for conformance to requirements.




Cost of quality

**Types of Quality Cost:**

1. Prevention cost.

2. Appraisal cost.

3. Internal failure cost.

4. External failure cost.

**1. Prevention Cost:** The costs that occur when a company is performing activities designed to prevent the quality problems from arising in product or services.

**Prevention cost includes:**

• Cost of quality planning

• Cost of documenting

• Process control cost

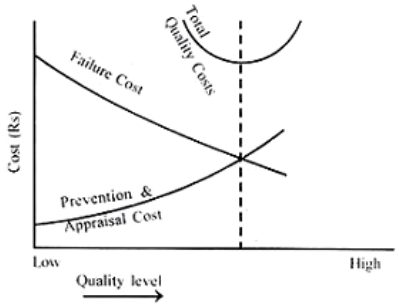
• Cost of training

• Cost associated with preventing recurring defects.

**2. Appraisal Cost:** The cost associated with measuring, evaluating a auditing products or services to ensure that they conform to the specifications or requirements. Appraisal costs relate to testing, execution and examination to assess whether the specified quality is being maintained.

**3. Cost of Internal Failure:** They arise due to internal failures. There costs are linked to correct the mistakes before delivering the products such as scrap, re-inspection, rework, retesting and sales discounts for inferior products.

**4. Cost of External Failure:** They arise from the rejection of the products, services by the customers due to poor quality. These costs are associated with the adjustment of malfunctions after delivery of the product such as travel, repair cost and lodging expenses, replacement cost, stock space parts, lost goodwill of customer, guarantee and warranty costs and dispatchment costs.




Cost of Quality

**The Categories of Quality Cost:** Many companies summarize the quality costs into four broad categories. They are:

**a) Internal failure costs** - The cost associated with defects that are found prior to transfer of the product to the customer.

**b) External failure costs** - The cost associated with defects that are found after product is slipped to the customer.

**c) Appraisal costs** - The cost incurred in determining the degree of conformance to quality requirement.

**d) Prevention costs** - The cost incurred in keeping the failure and appraisal costs to a minimum. Sometimes we can also include the hidden costs i.e., the implicit costs.

## 4.6 Performance measures

Performance measures are recognized because of the important element of all the Total Quality Management programs. Managers and supervisors directing the efforts of an organization or a group have the responsibility to know how, when and where to institute the wide range of changes. These changes cannot be sensibly implemented without the knowledge of appropriate information upon which they are based.

Performance measures quantitatively tell us something important about our services, products and the processes which produce them. They are the tool that help us to manage, understand and improve what our organizations do. Performance measures let us know:

• How well we are doing?

• If we are meeting our goals?

• If our customers are satisfied?

• If our processes are in statistical control?

• If and where improvements are necessary?

Most of the performance measures will be grouped into one of the following six general categories. However, certain organizations may develop their own categories as appropriate depending on the organization's mission:

**1. Effectiveness**: A process characteristic indicating the degree to which the process output (work product) conforms to requirements.(Are we doing the right things?)

**2. Efficiency**: A process characteristic indicating the degree to which the process produces the required output at minimum resource cost. (Are we doing things right?)

**3. Quality**: The degree to which a product or service meets customer requirements and expectations.

**4. Timeliness**: Measures whether a unit of work was done correctly and on time. Criteria should be established to define what constitutes timeliness for a given unit of work. The criterion is usually based on customer requirements.

**5. Productivity**: The value added by the process divided by the value of the labour and capital consumed.

**6. Safety**: Measures the overall health of the organization and the working environment of its employees.

5

# QUALITY SYSTEMS

Need for ISO 9000- ISO 9000-2000 Quality System – Elements, Documentation, Quality auditing- QS 9000 – ISO 14000 – Concepts, Requirements and Benefits – Case studies of TQM implementation in manufacturing and service sectors including IT.

## 5.1 Need for ISO 9000

**Need for Standards**

Standards are generally defined in terms of the model of best practice, against which all others may be compared. Thus, the role of standards is not to build the proverbial better mousetrap, but to ensure the conformance to a standard.

The standards available for software quality management establishes the model to be employed and then the accreditation body, e.g. BSIQA in the UK for the ISO9000 series, is called in to ensure that the implementation meets the required standard and indeed continues to meet the required standard over time.

In practice, three levels of accreditation are encountered, they are summarized in the below table.

| **Accreditation type** | **Description** |
|---|---|
| First party | Internal monitoring only |
| Second party | External monitoring by a customer |
| Third party | External monitoring by an independent standards body |

It is obviously more effective to have the quality management system accredited externally. The advantage of the third party accreditation over second party accreditation is that the supplier only has to satisfy one accreditor.

Clearly to have to justify one's quality practices to six different customers is undesirable, in terms of cost and time expended. In the past, certain key customers have assumed almost third party status.

It is vital that all the parties understand that a standard neither improves quality directly, nor ensures the perfection. It should however ensure that the correct procedures are in place and being carried out. The standard provides a model and the accreditation procedure the incentive to ensure that things are done correctly. The accreditation process provides a number of potential benefits to the supplier:

• It provides an external validation to see whether the investment made in the QMS is being effective.

• It gives the supplier and their quality system external credibility.

• It allows the supplier to sell to those customers who insist on accreditation as a condition of tender.

• It qualifies the supplier to be included in buyers guides compiled by the accreditation bodies and circulated to potential customers.

The cost of accrediting a satisfactory QMS to one of the ISO9000 series standards is small in relation to the cost of setting up the QMS in the first place. The ISO9000 series is a generic quality management standard. The ISO9000 series of standards are the international standards defined for the quality management systems.

The three main standards are ISO9001, 9002 and 9003. IS09001 is intended applications where there is a significant design element. Since most of the software application requires significant design input, ISO9001 is generally the standard applied within software development.

ISO9002 is intended for many manufacturing situations where the product is produced to a predefined specification and ISO9003 for easy applications where the quality can be determined by a simple final inspection and testing procedure.

ISO9000 provides guidance on which standard to adopt and ISO9004 assistance on how to establish a QMS which meets the requirements of the ISO9000 series.

**Series of Standards**

i. A ISO 9000, "Quality Management and Quality Assurance Standards Guidelines for Selection and Use".

ii. A ISO 9001, "Quality Systems - Model for Quality Assurance in Design, Development, Production, Installation & Servicing".

iii. A ISO 9002, "Quality Systems - Model for Quality Assurance in production, Installation & Servicing".

iv. A ISO 9003, "Quality Systems- Model for Quality Assurance in Final Inspection and Test".

v. A ISO 9004-1, "Quality Management and Quality System Elements - Guidelines".

## 5.2 ISO 9000-2000 Quality System

**ISO 9000**

The ISO 9000 series of documents was created by International Organization for Standardization (ISO) to set the international requirements for quality management systems. Now adopted by over 80 countries, use of the series of standards has become a common place in the business world. The ISO 9000 standards are a set of international quality management system with standards and guidelines. The term of the ISO 9000 refers to a group of quality management standards.

The ISO 9000 currently includes the three quality standards: ISO 9000:2000, ISO 9001:2008 and ISO 9004:2000. ISO 9001:2008 presents the requirements, while the ISO 9000:2000 and ISO 9004:2000 presents the Quality guidelines. All of these are the process standards (not the product standards).

This ISO 9000 was published in 1987, then revised in the year 1994 and 2000. "ISO 9000:2000 is used to describe the whole family of standards beginning with 900x.

It is important to have standard operating procedures in the global market. With millions of ISO 9000 users worldwide, it is imperative that the introduction of these standards be as seamless as possible. In pursuit of these goals, ISO/TC 176/SC 2, which handled the revision of the ISO 9001 and ISO 9004 standards, has developed an introduction plan to facilitate the successful launch of the new standards.

**ISO 9000 Series**

The ISO 9000:2000 series consist of only one Specification Standard ISO 9001:2008 that is compared to the older series ISO 9000:1994 which was comprised of three specification standards - ISO 9001, ISO 9002, ISO 9003 and its relevant guidelines. ISO 9001:1994 Series was designed to remain in effect until December 15, 2003 when the first surveillance audits for ISO 9001:2008 would be completed.

The series itself is generic and is designed to be applicable to any manufacturing or service process. The series is revised and controlled by the Technical Committee (TC) 176, made up of international members from many of the industries and backgrounds.

**ISO 9000:2000 is applicable to:**

• Organizations seeking a greater supplier confidence that product requirements will be satisfied;

• Organizations seeking a competitive advantage through the implementation of a quality management system;

• Those concerned with a mutual understanding of the terminology used in quality management (e.g. customers, suppliers, regulators);

• Those internal or external to the organization who assess the quality management system or audit it for conformity with the requirements of ISO 9001 (e.g. regulators, auditors, certification/registration bodies);

• Developers of related standards.

There are many different ways of applying the ISO 9000:2000 quality management principles. The nature of the organization and the specific challenges it faces will determine how to implement them.

**Background to ISO 9000 standards**

ISO 9000 has revolutionized the quality domain. It controls the quality, saves money, customers expect it, and savvy suppliers use it. The ISO 9000 can be applied to all the kinds of organizations. It helps both the product and service oriented institutions attain the unprecedented improvements in quality. It can be implemented in small, medium and large-scale organizations and it is applicable to the organizations in the industrial, software and service sectors.

The needs of the modern businesses are numerous and manifold. The ISO 9000 standards are applicable to all the areas of the international business, because they are international in scope. Furthermore, the ISO 9001:2008's new focus on the customer satisfaction ensures that supplier product precisely meets the needs of the customer. The revised standards will be of specific help to the organizations wishing to go beyond simple compliance with Quality Management System requirements for the sake of certification.

The present day business-wide needs, whether quality-related or not, are exacting. Keeping in line with this trend of reasoning, the ISO members thought it essential to introduce structural changes to the standards, while maintaining the basic requirements of the original standards.

**Essential Changes to the ISO 9000 Series**

In order to reflect the modern management approaches and to improve the organizational practices, structural changes were necessary. The ISO has taken care to maintain the essential requirements of the past ISO 9000 standards.

The ISO 9000 family contained more than 20 standards and documents. This proliferation of the standards was a particular concern of ISO 9000 users and customers. To respond to this concern, the ISO 9000:2000 family was narrowed down to four primary standards supported by a considerably reduced number of supporting documents. To the extent possible, the key points in the past documents were integrated into four primary standards and the sector needs addressed while maintaining the generic nature of the standards. The four primary standards are:

ISO 9000: Quality management systems - Fundamentals and vocabulary

ISO 9001: Quality management systems - Requirements

ISO 9004: Quality management systems - Guidance for performance improvement

ISO 19011: Guidelines on quality and/or environmental management systems auditing.

The revised ISO 9001 and ISO 9004 standards were developed as a "consistent pair" of standards. The revised ISO 9001 clearly addresses the quality management system requirements for an organization, to demonstrate its capability to meet the customer requirements and enhance customer satisfaction. The revised ISO 9004 is intended to go beyond the ISO 9001 and examine satisfaction for interested parties.

Both the ISO 9001 and ISO 9004 use a common vocabulary as defined in the ISO 9000, which also describes the underlying fundamentals. A logical, systematic approach has been adopted in formulating the definitions used in the ISO 9000, with the intention of generating a more consistent terminology that is "user-friendly".

ISO 9001: 2008 specifies the requirements for a quality management system where an organization needs to demonstrate its ability to consistently provide product that meets the customer and applicable statutory and regulatory requirements and aims to enhance the customer satisfaction through the effective application of the system including processes for continual improvement of the system and the assurance of conformity to customer and applicable statutory and regulatory requirements.

All the requirements of this International Standard are generic and are intended to be applicable to all the organizations regardless of size, type and product provided where any requirement(s) of this International Standard cannot be applied due to the nature of an organization and its product, this can be considered for exclusion.

When exclusions are made, claims of conformity to this International Standard are not acceptable unless these exclusions are limited to requirements within the clause 7 and such exclusions do not affect the organization's ability or responsibility to provide product that meets customer and applicable regulatory requirements.

## 5.3 Elements

**The elements of ISO 9000 quality system.**

| | Title | Description |
|---|---|---|
| 1. | Scope | The purpose of the standard is for the organization to demonstrate its ability to provide a product that meets customer requirements. |
| 2. | Normative reference | They are other standards which, by being listed constitute provisions of the ISO 9000 standard. |
| 3.. | Quality management system | Provider general requirements for the QMS and defines documentation requirements. |
| 4. | Terms and conditions | To describe the supply chain supplier—> Organization—> customer. |
| 5. | Management responsibility | Defines the requirements top managers must perform to ensure the effectiveness of the QMS. |
| 6. | Resource Managements | Defines the requirements companies must meet to provide adequate re- sources to implement and maintain the QMS and to continually improve its effectiveness. , |
| 7. | Product realization | Defines requirements for processes related to product realization. |
| 8. | Measuring, analysis and improvement | Define requirements for maintaining, measuring analysis and improvement processes needed to demonstrate conformity of the product ensure conformity of the QMS. |

**Elements of ISO 9000:**

• Management Responsibility

• Contract Review

- Quality System
- Document and Data Control
- Design Control
- Control of Customer Supplied Product
- Purchasing
- Process Control
- Product Availability and Traceability
- Inspection and Testing
- Control of Inspection, Measuring and Test Equipment
- Inspection and Test Status
- Corrective and Preventive Action
- Control of Nonconforming Product
- Handling, Packaging, Storage, Preservation and Delivery
- Control of Quality Records
- Internal Quality Audits
- Servicing
- Training
- Statistical Techniques.

## 5.4 Documentation

The documents required by most organization are:

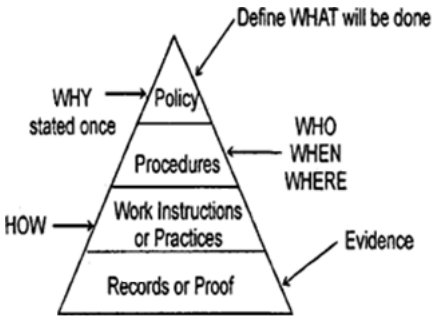
### 1. Quality Policy Manual

### 2. Quality System Procedures (QSPs)

### 3. Work Instructions (WIs)

### 4. Record/ Formats/ Forms

The below system documentation can be viewed as a hierarchy containing four levels as shown in figure.




Documentation pyramid

**1. Quality Policy Manual**

Quality policy manual is the first level of documentation. This is the document that defines 'what will be done' and 'why'. The 'why' can be stated just once as a quality policy statement. This statement should be short and simple definition of the organization quality intentions.

The remainder of the policy manual addresses what will be done to comply with the standard being used. The policy manual communicates the quality policy and objectives of an organization. This manual is a living document. Because it reflects the current system being followed in the organization.

**2. Quality System Procedures (QSPS)**

The second level of documentation is the quality procedures. These procedures describe the methods that will be and to implement and perform the gated policies. These procedures define who should perform the specific tasks, when the task should be done and where documentation will be made. These documents collectively define the organization's operations from receiving an enquiry to delivering a completed product or service.

The procedures are confidential documents of the organization and therefore need not be revealed to outsiders.

**3. Work Instructions (WI's)**

This third level of documentation is generally company specific. It gives us details of how individual work processes (for example: welding, machining, casting, etc.) are carded out within a company.

Work instructions should also specify how the work should be done; who should undertake the work and what records are to be maintained. The work instructions may be in the form of a detailed drawing, recipe, photograph, routing sheet specific job function, video or simply a sample for comparison of conformity. The work instructions should be written by the employee who performs the task.

**4. Records/Formats/Forms**

These provide evidence of activity having been performed in compliance with the quality system procedure. Records may be forms that are filled-out, a stamp of approval on a product or a signature and date on some type of document. Records are used to provide trace ability of actions taken on a specific product or batch of products.

**BENEFITS OF DOCUMENTATION**

The documentation of quality systems serves the following benefits:

1. Documentation regularizes the method of performing the day-to-day activities.

2. It provides formats for standardizing practices.

3. It provides reference for assessing degree of enforcement in practice.

4. It facilitates trouble shooting for tracing back on the processes.

5. It demonstrates the ISO quality system certification.

## 5.5 Quality auditing

**Quality Auditing**

Quality auditing should be carried out in order to verify whether a quality system is effective and suitable.

**Definition:** A quality system audit is defined as "a systematic and independent examination to determine whether quality activities and related results comply with planned arrangements, whether these arrangements are implemented effectively and whether these are suitable to achieve objectives."

**Features of Quality Audits:** Some salient features about quality audits are:

• The quality audit typically applies to quality systems or to the elements such as products, processes or services. Such audits are often referred as 'quality system audits', 'process quality audits', 'product quality audits' and 'service quality audit' respectively.

• Quality audits are carried by staff who are not directly responsible in the areas being audited. But preferably auditors should work in co-operation with relevant personnel.

• Quality audit is an information gathering activity. It is not a 'policy' kind of activity.

• Quality audits may be conducted for internal or external purposes. They need not cover whole quality system at once, but may cover the elements of it.

**Types of Audits:** The general classification of audits is given below:

**(i) First party audit: (or Internal audit):** This refers to an internal audit where the auditee is its own client, i.e., the audit is done by an organization, working on itself.

**(ii) Second party audit**: This refers to audit by one organization on another organization. This type of audit is normally done on a supplier by a customer.

**(iii) Third party audit:** This refers to audit by an independent organization on a supplier, for accreditation assessment purposes.

**Objectives of Quality Audits (Need for Quality Audits):** The objectives of quality audit programs are:

• To determine the conformity or non-conformity of the quality system elements with regard to specified requirements.

• To determine the effectiveness of the implemented quality system in meeting specified quality objectives.

• To meet regulatory requirements, if applicable.

• To permit the listing of the audited organization's quality system in a register for third party certification.

• To evaluate an organization's own quality system against a quality system standard.

**Stages of an Audit:** The four stages of the auditing are:

1. Audit planning

2. Audit performance

3. Audit reporting

4. Audit follow-up

**Uses of Quality AUDIT**

Quality Audits examine the elements of a quality management system in order to evaluate how well these elements comply with quality system requirements.

The objectives of the external audit:

a) Determine the actual performance conforms to the documented quality systems.

b) Initiate the corrective action activities in response to deficiencies.

c) Follow up on noncompliance items of previous audits.

d) Provide continued improvement in the system through feedback to management.

e) Cause the auditee to think about the process, thereby creating possible improvements.

The objectives of the internal audit:

a) Determine the actual performance conforms to the documented quality systems.

b) Initiate the corrective action activities in response to deficiencies.

c) Follow up on noncompliance items of previous audits.

d) Provide continued improvement in the system through feedback to management.

e) Cause the auditee to think about the process, thereby creating possible improvements.

**External and internal audits on quality**

| **Internal Audit** | **External Audit** |
|---|---|

| | |
|---|---|
| • Here auditee is its own client. | Here auditee is by another organization. |
| • This type of audit results to improve the internal quality. | This type of audit results to improve the overall product quality. |
| • Here the audit may be frequent. | Here the audit may be once a twice per year. |
| • They are planned activity. | They may be surprised audit. |
| • This gives informal reports. | This gives a formal report. |

## 5.6 QS9000- ISO 14000 – Concepts

QS-9000 is a set of Quality System requirements recently adopted by members of the automotive industry. In September 1994 Ford Chrysler and General Motors announced that QS-9000 would immediately replace all previous supplier quality programs. Several heavy truck manufacturer's also adopted the QS-9000 standard.

**Elements of QS 9000:**

QS 9000 standards can be divided into three sections. They are:

**Section 1: ISO 9000 based requirements**

The section 1 requirements include the exact text of ISO 9001 with the addition of automotive/heavy trucking requirements.

**Section 2: Automotive sector specific requirements**

This section includes common requirements for all automotive supplies agreed by the 'Big three' (i.e., Chrysler, Ford Motor and General Motors)

**The sector specific requirements are:**

1. Production part approval process (P-PAP).

2. Continuous improvement.

3. Manufacturing capabilities (such as facilities planning, mistake proofing and tooling management).

**Section 3: Customer specific requirements**

This section deals with the specific requirements of each customer over and above the requirements specified in section 2.

**ISO 14000 CONCEPTS**

Is a management standard, it is not performance or product standard.

The underlying purpose of ISO 1400 is that companies will improve their environmental performance by implementation but there are no standards for performance or level of improvement.

It is a process for managing company activities that impact the environment.

**CHARACTERISTICS OF ISO 14000**

1. COMPREHENSIVE- all members of the organization participate n environmental protection, the EMS considers stakeholders and there are processes to identify all environmental impacts.

2. PRO ACTIVE- it focuses on forward thinking and action instead of reacting to command and control policies.

3. SYSTEMS APPROACH- it stresses improving environmental protection by using single environmental management system.

**The Environmental System Management System contains the following elements**

1. An environmental policy supported by the top management.

2. Identification of environmental aspects and significant impacts.

3. Identification of legal and other requirements

4. Environmental goals, objectives and targets that support the policy.

5. An environmental management program

6. Definition of roles, responsibilities and authorities

7. Training and awareness procedures

8. Process of communication of the EMS to all interested parties.

9. Document operational procedures

10. Procedures for the emergency response

11. Procedures for monitoring and measuring operations that can have significant impacts on the environment.

12. Procedures of non-conformance

13. Record management procedures

14. A program for auditing and corrective action

15 . Procedures for management review.

### *5.6.1 Requirements and Benefits*

**Requirements of ISO 14001 are:**

a) Environmental aspects

b) Legal and other requirements

c) Objectives and targets

d) Environmental Management Programs.

Four elements for the checking and corrective action of ISO 14001 are:

a) Monitoring and measuring

b) Non-conformance and corrective and preventative action

c) Records

d) EMS audit.

**QS-9000 Quality System requirements**

The QS-9000 Quality System requirements are divided into three sections.

Section 1: Common requirements, includes the exact text of ISO 9001 with the addition of automotive / heavy trucking requirements.

Section 2: Additional Requirements, includes requirements beyond the scope of ISO 9001, common to all three manufacturers.

Section 3: Customer Specific Sections, contains requirements unique to either Ford, General Motors, or Chrysler.

**Benefits of ISO 9000 Standards:**

• Achievement of international standard of quality.

• Customer satisfaction.

• Value for money.

• Increased profitability.

• Higher productivity.

• Improved corporate image.

• Growth of the organization.

• Access to global market.

• Higher morale of employees.

**Organizational Benefits of QS14000**

• Assuming customers of a commitment to environmental management.

• Improve public relation.

• Meeting customer requirement.

• Market share increase.

• Increase investor satisfaction.

• Better industry/government relation.

• Conserving input material and energy.

• Low cost insurance, easy attainment of permits and authorization.

The major difference between the ISO 9000 and QS 14000 are:

• The ISO 9000 family concerned with management but quality QS 14000 family relates with environmental management.

• The ISO 9000 family focuses only on the management aspects in product quality whereas QS 14000 focuses only on environmental aspects and impacts of that product.

**Benefits of ISO 14000**

ISO 14000 standards are practical tools for organizations who are not satisfied with mere compliance with legislation - which may be perceived as a cost of doing business. They are the useful tools for proactive organizations who understand that implementing a strategic approach can bring return on investment in environment-related measures.

The systematic ISO 14001:2004 approach requires the organization to take a hard look at all areas where its activities have an environmental impact. A properly designed ISO 14001:2004 Environmental Management Systems allows efficient identification of opportunities for cost savings. It can trigger the procedural and/or technological changes that reduce the total cost of a product or improve its value.

Some of the benefits of implementing an ISO 14000 Environmental Management System in accordance with the ISO 14000 standards include:

**1. Operational Benefits**

• Greater employee involvement in business operations with a more motivated workforce.

• Efficiency, discipline and operational integration with ISO 9000.

• Assists in developing and transferring technology within the company.

• Easier to obtain operational permits and authorizations.

• Fewer operating costs.

• Helps reduce pollution.

• Savings from safer workplace conditions.

• Reduction of costs associated with discharges, emissions, waste handling, transport and disposal.

• Improvements in the product as a result of process changes.

• Safer products.

**2. Environmental Benefits**

• Minimizes the hazardous and non-hazardous waste.

• Conserves the natural resources - gas, electricity, space and water with resultant cost savings.

• Prevents pollution and reduces the wastage.

**3. Marketing Benefits**

• Demonstrates to customers that the firm has met environmental expectations.

• Meets the potential national and international government purchasing requirements.

• Delivers the profits from marketing "green" products.

• Provides a competitive marketing tool.

• Improves the international competitiveness.

**4. Financial Benefits**

• Improves the organization's relationship with insurance companies.

• Process cost savings by reduction of material and energy input.

• Elimination of costs associated with conformance to conflicting national standards.

• Helps to reduce the liability and risk.

• Satisfying investor / shareholder criteria.

• Improved access to capital.

**a. Global**

• Facilitate trade and remove trade barriers.

• Improve the environmental performance of planet earth.

• Build consensus that there is a need for environment management and a common terminology for EMS.

**b. Organizational**

• Assuring customers of a commitment to environmental management.

• Meeting the customer requirements.

• Maintaining a good public/community relations image.

• Satisfying investor criteria and improving access to capital.

• Reducing incidents that result in liability.

• Obtaining insurance at reasonable cost.

• Conserving input materials and energy.

• Improving defense posture in litigation.

• Improving industry/government relations.

• Facilitating the attainment of permits and authorization.

## 5.7 Case studies of TQM implementation in manufacturing and service sectors including IT.

**The implementation of TQM with case study from the manufacturing industry.**

**Step 1: Top Management Commitment**

• The top management must be willing to commit the resources necessary to achieve certification.

**Step 2: Appoint the Management Representative**

• The management representative is responsible for coordinating the implementation and maintenance of the quality system. Also he is the contact person for all parties involved in the process.

**Step 3: Awareness**

• The next step is to create awareness about the ISO 9000 quality management system.

• Since the implementation of the quality system requires involvement of all members in the organization, the members should understand the process and implications of ISO program.

**Step 4: Appoint an Implementation Team**

• Now the implementation team should be formed.

• This team should be drawn from all levels and areas of the organization.

• The team should identify the quality management system processes and their sequence and interaction.

**Step 5: Training**

• The implementation team, supervisors and internal audit team should be trained.

• This activity can be accomplished through in-house training programs, seminars, workshops, etc.

**Step 6: Time Schedule**

• This activity develops a time schedule for the implementation and registration of the system.

• This time frame will vary, depending on the size and type of organization.

**Step 7: Select Element Owners**

• The implementation team selects owners for each of the system elements. Many of these owners will be members of the implementation team.

• Each owner has the option of selecting a team to assist the process.

**Step 8: Review the Present System**

• A review of the present quality system should be performed.

• Copies of all the quality manuals, procedures, work instructions and forms presently in use are obtained.

• This activity is a gap analysis and can be performed by the element owners and their teams or by an external consultant.

**Step 9: Write the Documents**

• Written quality policy and procedure manuals should be prepared.

• This documentation of work instructions should be done by the employee who performs the job.

**Step 10: Install the New System**

• The policies, procedures and work instructions should be integrated into the day-do-day workings of the organization.

• Now the new system is installed.

**Step 11: Internal Audit**

• An internal audit of the quality system should be conducted.

• This step ensures that the system is working effectively and to provide management with information for the comprehensive management review.

**Step 12: Management Review**

• The management review should be conducted in order to determine the effectiveness of the system in achieving the stated quality goals.

**Step 13: Pre-assessment**

• The pre-assessment is an optional step. If a good job has been done on the previous steps, then pre-assessment is not necessary.

**Step 14: Registration**

• The registration activity include: choosing a register, submitting an application and conducting the register's system audit.

• While choosing a registrar, one should consider so many factors such as cost, lead time and customer’s acceptance of the registrar, the registrar's accreditation and familiarity with the industry.

• The application for registration should also include supplying the registrar with the policy and procedure manuals for their review.

• The time involved in the registrar's system audit will vary depending on the size and complexity of the organization and the number of auditors involved.

**Step 15: Award of ISO 9000 Certificate**

• After accepting the application and setting a time for registration, the registrar will review the quality system documentation.

• Based on the satisfactory report of the assessment team, license i.e.,ISO certificate will be granted to the organization by ISO/ BIS to use the certification mark in letter heads, quality certificates, etc.

• The certificate awarded is normally valid for 3 years. During the period of validity, surveillance audits are conducted to ensure that the document quality system is being effectively maintained.

• The surveillance audits will not be full audits, but random checks of some elements to ensure that the system continues to function.