CHAPTER 3  ISO 9000 & TQM

3.1 ISO 9000

As the industries started crossing the boundaries between the countries, now they were not to cater to the local or domestic need but to think globally. With this changed scenario in the entire world there was a need for having a single quality assurance model or standard and hence ISO came in to existence. Basically ISO aims at harmonization of standards at the international level with a view to minimize trade and technical barriers.

Till 1950s there were no formal quality systems. It was J.M Juran who conceptualized Quality Control as an element of quality management with the help of his Quality Control Handbook in 1951 after Second World War. Then in 1959 American Department of Defense issued the first national standard, Mil Std 9858 on quality program requirements. This standard worked as foundation of all subsequent quality system standards. Corrective and preventive actions, data analysis, improvement, removal of special cause variation, contract review, work instructions, record keeping, and document control were a part of this standard of 1950s.

With the growth of the arms race in 1960s, US Military came out with many such standards and in 1968 Mil-Q-9858 was used for the NATO Allied Quality Assurance Publications for application to all member countries engaged in joint defense programmes. Numbers of such standards were published by different countries, but almost all were related to defense industry. Canada was the first country to develop and publish quality system standards for commercial use in 1975 in the form of Canadian Standards Association’s Z299 series. BSI published BS 5750 in 1979. By 1983 many more countries did the same and came out with standards for quality with minor differences between them.

By 1984 drafted a revision to BS 5750 1979 and in view of the international interest encouraged International Organization of Standardization (ISO) to embark on an International Standard for Quality Systems. More than 26 countries got involved in
the development of the standard and set a new world standard for quality management.

ISO was published in 1987 as a set of six standards, ISO 8402, ISO 900-1, ISO 9001, ISO 9002, ISO 9003 and ISO 9004-1 all were having a strong resemblance to the BS 5750 family of standards.

In 1990s ISO 9000 became very popular in the manufacturing sector in the beginning and then gradually in the service sector as well. From 27,000 certifications by 1993 to 2,74,040 by 1999 is a proof of its acceptance globally. First review of ISO 9000 was done in 1992, which was superficial in nature. The second edition was published in 1994. By that time further 2,00,000 companies got certified.

ISO 9000:1994 emphasized quality assurance via preventive actions, instead of just checking final product, and continued to require evidence of compliance with documented procedures. As with the first edition, the down-side was that companies tended to implement its requirements by creating shelf-loads of procedure manuals, and becoming burdened with an ISO bureaucracy. In some companies, adapting and improving processes could actually be impeded by the quality system.

On December 15, 2000, the revised and improved ISO 9001:2000 was published which replaced the three 1994 versions of ISO 9001, 9002 and 9003. The main change was regarding the structure. It gave five elements instead of the 20 clauses which earlier ISO had. The new model proposed process based quality management system.


The following table (Table 3.1) throws some light on the major differences between ISO 9001:1994 and ISO 9001:2004 standard:
### Table 3.1 Key differences between 1994 and 2000 standard

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Aimed at quality assurance</td>
<td>Aimed at customer satisfaction</td>
</tr>
<tr>
<td>Required procedures to be established, documented and maintained</td>
<td>Required processes to achieve defined objectives</td>
</tr>
<tr>
<td>Focused on correcting errors</td>
<td>Focuses on continual improvement (improving effectiveness)</td>
</tr>
<tr>
<td>Management with executive responsibility to define its commitment to quality</td>
<td>Top management to demonstrate its commitment to developing, implementing and improving a system of interrelated processes to enable achieve objectives</td>
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</table>

The fourth edition of ISO 9001 was released in year 2008, which replaced the ISO 9001:2000. This revision basically was not for much of amendments, but to clarify the points in the text and also to enhance the compatibility with ISO 14001:2004, which is the environmental standard. ISO-survey2010 suggests that there were 11,09,905 certified companies, all over world (178 countries) in year 2010. India was on 8th place amongst top ten countries with 33,250 certifications. [15]


Following table (Table 3.2) indicates some of the minor changes from ISO 9001:2000 to ISO 9001:2008: [2]

### Table 3.2 Changes from ISO 9001:2000 to ISO 9001:2008

<table>
<thead>
<tr>
<th>Area</th>
<th>ISO 9001:2008</th>
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</thead>
<tbody>
<tr>
<td>Outsourced Processes</td>
<td>Process approach including outsourced processes</td>
</tr>
<tr>
<td>Management Representative</td>
<td>Must be a member of the organization</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>It has added information systems to Buildings, workspaces, equipment, software, utilities and support services like transportation and communication o the infrastructural requirements</td>
</tr>
<tr>
<td>Work environment</td>
<td>Clarified meaning of conducive working environment, it relates to working conditions which include physical and environmental conditions</td>
</tr>
<tr>
<td>Customer requirements</td>
<td>Clarifies the meaning of specific delivery and post delivery. It includes warranty provisions, contractual obligations and supplementary services</td>
</tr>
<tr>
<td>-----------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Design and development planning</td>
<td>Plan and perform product design and development review, verification and validation activities separately or in combination</td>
</tr>
<tr>
<td>Customer satisfaction</td>
<td>A note is added specifying that customer satisfaction can be monitored and measured with the help of customer satisfaction and opinion surveys</td>
</tr>
<tr>
<td>Internal Audit Records</td>
<td>Explicitly stating a requirement that a record of internal audit activities and results must be maintained</td>
</tr>
<tr>
<td>Process monitoring and measurement</td>
<td>An additional note to stipulate the impact of each process on the overall effectiveness of the quality management system and the impact it has on the ability to meet product requirements must be measured</td>
</tr>
<tr>
<td>Release of product</td>
<td>It is made clear that the products are released for delivery to customers and records must indicate who released the products for delivery to customers</td>
</tr>
<tr>
<td>Monitoring and measuring equipment</td>
<td>The term device is replaced by equipment to make it unambiguous.</td>
</tr>
</tbody>
</table>

Actually ISO is not an acronym of International Organization for Standardization. In fact, the term ‘ISO’ is derived from the Greek isos, meaning ‘equal’. The name ISO is used around the world to denote the organization, thus avoiding the plethora of acronyms resulting from the translation of ‘International Organization for Standardization’ into the different national languages of member countries, e.g. IOS in English, OIN in French (from Organization Internationale de Normalization). For all the countries, the short form of the Organization’s name is ISO. [16]

The aim of International Standardization is to facilitate trade, exchange and technology transfer through:

- Enhancement of product quality and reliability at a reasonable price
- Improvement of health, safety and environmental protection and reduction of waste
- Greater compatibility and inter-operability of goods and services
• Simplification for improved usability
• Reduction in the number of models and thereby reduction of costs
• Increased efficiency of distribution and ease of maintenance

It is but obvious that users have more confidence in the products and services that conform to International Standards. Assurance of conformity can be provided by manufacturers’ declarations, or by audits carried out by independent bodies.

3.1.3 Principles of ISO standards [16]

3.1.3.1 Equal footing

Every participating ISO member institution has the right to take part in the development of any standard which it judges to be important to its country’s economy. Irrespective of the size or strength of that economy, each participating member in ISO has one vote. The activities of ISO are carried out in a democratic framework where each country is on an equal footing to influence the direction of ISO’s work at the strategic level, as well as the technical content of its individual standards.

3.1.3.2 Voluntary

ISO standards are voluntary. As a non-governmental organization, ISO has no legal authority to enforce their implementation on any firm. However, while ISO standards are voluntary, they may become a market requirement, as has happened in the case of ISO 9000 quality management systems, or of dimensions of freight containers and bankcards.

3.1.3.3 Market-driven

ISO develops only those standards for which there is a market requirement. Experts on loan from the industrial, technical and business sections, which have asked for the standards, carry out the work and subsequently put them to use. Others with relevant knowledge, such as representatives of
government agencies, consumer organizations, academia and testing laboratories may join these experts.

3.1.3.4 **Consensus**

Even if ISO standards are voluntary – the fact that they are developed in response to market demands, and are based on consensus among the. ISO takes account of both evolving technology and evolving interests by requiring a review of its standards at least every five years to decide whether they should be maintained, updated or withdrawn. In this way, ISO standards retain their position as the state of the art, as agreed by an international cross section of experts in the field.

3.1.3.5 **Worldwide**

ISO standards are technical agreements, which provide the framework for compatible technology worldwide. Developing technical consensus on this international scale is a major operation carried out by number of ISO technical groups consisting of technical committees, subcommittees and working groups with thousands of experts who participate annually to develop ISO standards.

3.1.4 **How ISO standards benefit society [3] [16]**

ISO standards have played important role in providing benefits to the various strata of the society. The benefits, which can accrue to the different strata, are given in the following paragraphs:

For business, the widespread adoption of International Standards means that suppliers can base the development of their products and services can base the development of their sectors. This in turn, means that businesses using International Standards are increasingly free to compete on many markets around the world.

For customers, the worldwide compatibility of technology, which is achieved when products and services are based on International Standards, brings them an
increasingly wide choice of offers, and they also benefit from the effects of competition among suppliers.

For governments, International Standards provide the technological and scientific bases underpinning health, safety and environmental legislation.

For trade officials negotiating the emergence of regional and global markets, International Standards create “a level playing field” for all competitors on those markets. The existence of divergent national or regional standards can create technical barriers to trade, even when there is political agreement to do away with restrictive import quotas and the like. International Standards are the technical means by which political trade agreements can be put into practice.

For developing countries, International standards that represent International consensus on the state of the art constitute an important source of technological know-how. By defining the characteristics that product will be expected to meet on export markets, International Standards give developing countries a basis for making the right decisions when investing their scarce resources and thus avoid squandering them.

For consumers, conformity of products and services to International Standards provides assurance to quality, safety and reliability.

For everyone, International Standards can contribute to the quality of life in general by ensuring that the transport, machinery and tools we use are safe.

For the planet we inhabit, International Standards on air, water and soil quality, and on emissions of gases and radiation, can contribute to efforts to preserve the environment.

3.1.5 Role of ISO quality standards

The standard was primarily intended for situations where customers and suppliers were in a contractual relationship. It was not intended for use when there was no contractual relationship. Even in contractual situations, demonstration of capability is often only necessary when the customer cannot verify the quality of
the products or service after delivery. It is clear that customers need confidence in
the quality of products supplied and would require some evidence that addressed
the need. ISO 9000 was a neat solution to this problem as it embodied most of the
requirements needed to obtain an assurance of quality. Any additional
requirement could be put into contract.

ISO 9000:2000 is a series of three International Standards for Quality Management
Systems. They specify requirements and recommendations from the design and
assessment of management systems. ISO 9000 is not a product standard. The
purpose of the standards is to assist organizations of all types to implement and
operate effective quality management systems. It is not their purpose to fuel the
certification, consulting, training and publishing industries.

3.1.6 The ISO 9000 family of Standards [15]

3.1.6.1 ISO 9000 Quality Management Systems- Fundamentals and Vocabulary

The purpose of ISO 9000 is to provide an appreciation of the fundamental
principles of QMS and an explanation of terminology used in the standard.
Although they are not requirements, the context and interpretation of the
requirements will not be understood without the appreciation of the concepts that
underpin the requirements.

3.1.6.2 ISO 9001 Quality Management Systems- Requirements

The purpose of ISO 9001 is to provide requirements which if met will enable
organizations to demonstrate they have the capability to consistently provide the
product that meets customer and applicable regulatory requirements. These
standards can be used in contractual situations. The organizations can use ISO
9001 as a model to design their management system provided they also use ISO
9000 and ISO 9004.
3.1.6.3 ISO 9004 Quality Management Systems- Guidelines for performance improvements

The purpose is to provide guidance for improving the efficiency, effectiveness and overall performance of the organization. The standard should be used as guidance in designing, operating and improving a management system.

3.1.7 Model of a Process based Quality Management System

The ISO 9000:2000 family of standards is based on a process model—a model that is intended to represent a process-based QMS. As seen from the model, there are no processes or systems between the needs of the interested parties and satisfying them other than are shown in the ellipse i.e. the management system. There are no other systems shown like financial management system, environmental management system— in fact only one system. However to confuse matters it refers to this system as a quality management system rather than the management system.

3.1.8 CLAUSES OF ISO: Process based model [15]

3.1.8.1 Quality Management System

The cycle commences with the Organization’s purpose from which are developed objectives. In planning to meet these objectives the processes are identified and their sequence and interaction determined. Once the relationship between processes is known, the criteria and methods for effective operation and control can be developed and documented. The processes are described in terms that enable their effective communication and a suitable way of doing this would be compile the process descriptions into a quality manual that not only references the associated procedures and records but also shows how the processes interact. Before implementation the processes need to be resourced and the information necessary to operate and control them deployed and brought under document control. Once operational the processes need to be monitored to ensure they are functioning as planned. Measurements taken to verify that the processes are delivering the required output and actions taken to achieve the planned results.
The data obtained from monitoring and measurement that is captured on controlled records needs to be analyzed and opportunities for continual improvement identified and the agreed actions implemented.

The system should not be perceived as a set of documents but as a means to achieve the organization’s objectives.

3.1.8.2 Management Responsibility

The cycle commences with a Vision- a statement of what we want to be or do, and then a Focus on customers for it is the customer that will decide whether or not the organization survives. It is only when you know what your market is, who your customers will be and where they will be that you can define the Purpose or Mission of the organization. From the purpose or mission you can devise a Vision (where you want to get to- what you want to become) and from the mission come the Policies or Values that will guide you on your journey. These policies help frame the Objectives, the milestones on route towards your destination. The policies won’t work unless there is Commitment so that everyone pulls in the same direction. Plans have to be made to achieve the objectives and these plans need to identify and lay out the Processes that will be employed to deliver the results- for all work is a process and without work nothing will be achieved. The plans also need to identify the Responsibility and Authority of those who will be engaged in the endeavor. As a consequence, it is essential that effective channels of Internal Communication is established to ensure that everyone understands what they are required to achieve and how they are performing. No journey should be undertaken without a means of knowing where you are, how far you have to go, what obstacles are likely to lie in the path ahead or what forces will influence your success. It is therefore necessary to collate the facts on current performance and predictions of what lies ahead so that a Management Review can take place to determine what action is required to keep the organization on course or whether any changes are necessary to the course or the capability of the organization in order to fulfill the purpose and mission.
3.1.8.3 Resource Management

Whatever the resource, it firstly has to be planned, then acquired, deployed, maintained and eventually disposed of. The standard does not address financial resources specifically but clearly they are required to implement and maintain the management system.

Purchasing is not addressed under resource management but under product realization. Note that there are no clauses that address resource disposal. This is probably because the standard only focuses on intended product, whereas, ISO 14001 would address resource disposal and unintended product.

Although still a relatively short set of requirement in ISO 9001, they are among the most important, for without adequate resources no organization will fulfill its purpose and mission. We have discovered that we cannot exclude any of the organization’s resources at all either directly or indirectly affect our ability to satisfy the needs and expectations of the interested parties.

3.1.8.4 Product Realization

Product realization is also a series of processes that have interfaces with resource management processes and which embody measurement, analysis and improvement processes.

The cycle commences by scanning the environment to gain an understanding of customer needs and expectations. In doing so we need to communicate with customers and determine the requirements of customers, of regulators and of the organization relative to the product or service to be supplied. This will undoubtedly involve more customer communication and once requirements have been determined we need to review the requirements to ensure they are understood and confirm we have the capability to achieve them. If we have identified a need for new products and services, we would then need to plan product realization and in doing so use preventive action methods to ensure the success of the project and
take care of any customer property on loan to us. We would undertake product design and development and in doing so we would probably need to identify product, purchase materials, components and services, build prototypes using the process of production provision and validate new processes. After design validation we would release product information into the market to attract customers and undertake more customer-communication. As customers enquire about our offerings we would once more determine the requirements in order to match customer needs with product offerings and our ability to supply.

Now faced with real customers demanding our products, we would review the requirements and confirm we had the capability to supply a product that matched their needs before entering into a commitment to supply. We would then proceed to plan product realization once again and undertake production or service provision. During production or service delivery we would maintain traceability of the product if applicable, perform measurement and monitoring and control the measuring and monitoring devices. We would monitor and measure processes and monitor and measure products at each stage of the process. If we found variations we would undertake the control of non-conforming product and analyze data to facilitate corrective action.

Throughout production or service delivery we would seek the preservation of product and take care of customer property. Once we had undertaken all the product verification and preserved the product for delivery, we would ship the product to the customer or complete the service transactions. To complete the cycle customer communication would be initiated once more to obtain feedback on our performance.

3.1.8.5 Measurement, Analysis and Improvement

Measurement, analysis and improvement processes are vital to the achievement of quality. Until we measure using devices of known integrity, we know little about a process or its outcomes. But if we measure using instrument that are unfit for purpose, we will be misled by the results. With the results of valid measurement
we can make a judgment on the basis of facts. The facts will tell us whether we have met the target. Analysis of the facts will tell us whether the target can be met using the same methods or better methods or whether the target is the target to aim for. Measurements without a target value to compare results of measurement are measurements without a purpose. The target value is therefore vital but arbitrary values demotivate personnel. Targets should always be focused on purpose so that through the chain of measures from corporate objectives to component dimensions there is a soundly based relationship between targets, measures, objectives and the purpose of the organization, process or product.

Measurement is a key to performance, for without measurement it is difficult to know how we are performing and where we need to focus our effort to improve performance.

3.1.9 The Eight Principles of Quality Management [3] [17] [18]

Quality management is becoming increasingly important to the leadership and management of all organizations. It is necessary to identify Quality Management as a distinct discipline of management and lay down universally understood and accepted rules for this discipline.

The ISO technical committee working on the ISO 9000 standards had published a document detailing the quality management principles and application guidelines. (This article is based on the said document). The latest revision (version 2008) of ISO 9000 standards are based on these principles.

Definition of Quality Management Principle [17]

"A quality management principle is a comprehensive and fundamental rule / belief, for leading and operating an organization, aimed at continually improving performance over the long term by focusing on customers while addressing the needs of all other stake holders".
The eight principles are:

1. Customer-Focused Organization
2. Leadership
3. Involvement of People
4. Process Approach
5. System Approach to Management
6. Continual Improvement
7. Factual Approach to Decision Making and

Now let us examine the principles in detail.

3.1.9.1 Customer-Focused Organization

"Organizations depend on their customers and therefore should understand current and future customer needs, meet customer requirements and strive to exceed customer expectations".

Steps in application of this principle are:

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

- Increased revenue and market share obtained through flexible and fast responses to market opportunities.
- Increased effectiveness in the use of the organization’s resources to enhance customer satisfaction.
- Improved customer loyalty leading to repeat business

3.1.9.2 Leadership

"Leaders establish unity of purpose and direction of the organization. They should create and maintain the internal environment in which people can become fully involved in achieving the organization’s objectives."

Steps in application of this principle are:

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

12. Implement a strategy to achieve these goals and targets.

Benefits:

- People will understand and be motivated towards the organization’s goals and objectives.
- Activities are evaluated, aligned and implemented in a unified way.
- Miscommunication between levels of an organization will be minimized.

3.1.9.3 Involvement of People

"People at all levels are the essence of an organization and their full involvement enables their abilities to be used for the organization’s benefit".

Steps in application of this principle are:

1. Accept ownership and responsibility to solve problems.

2. Actively seek opportunities to make improvements, and enhance competencies, knowledge and experience.

3. Freely share knowledge & experience in teams.

4. Focus on the creation of value for customers.

5. Be innovative in furthering the organization’s objectives.

6. Improve the way of representing the organization to customers, local communities and society at large.

7. Help people derive satisfaction from their work, and

8. Make people enthusiastic and proud to be part of the organization.
Benefits:

- Motivated, committed and involved people within the organization.
- Innovation and creativity in furthering the organization’s objectives.
- People being accountable for their own performance.
- People eager to participate in and contribute to continual improvement.

3.1.9.4 Process Approach

"A desired result is achieved more efficiently when related resources and activities are managed as a process."

Steps in application of this principle are:

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

Benefits:

- Lower costs and shorter cycle times through effective use of resources.
• Improved, consistent and predictable results.

• Focused and prioritized improvement opportunities.

3.1.9.5 System Approach to Management

"Identifying, understanding and managing a system of interrelated processes for a given objective improves the organization’s effectiveness and efficiency."

Steps in application of this principle are:

1. Define the system by identifying or developing the processes that affect a given objective.

2. Structure the system to achieve the objective in the most efficient way.

3. Understand the interdependencies among the processes of the system.

4. Continually improve the system through measurement and evaluation, and

5. Estimate the resource requirements and establish resource constraints prior to action.

Benefits:

• Integration and alignment of the processes that will best achieve the desired results.

• Ability to focus effort on the key processes.

• Providing confidence to interested parties as to the consistency, effectiveness and efficiency of the organization.

3.1.9.6 Continual Improvement

"Continual improvement should be a permanent objective of the organization."

Steps in application of this principle are:
1. Make continual improvement of products, processes and systems an objective for every individual in the organization.

2. Apply the basic improvement concepts of incremental improvement and breakthrough improvement.

3. Use periodic assessments against established criteria of excellence to identify areas for potential improvement.

4. Continually improve the efficiency and effectiveness of all processes.

5. Promote prevention based activities.

6. Provide every member of the organization with appropriate education and training, on the methods and tools of continual improvement such as the Plan-Do-Check-Act cycle, problem solving, process re-engineering, and process innovation.

7. Establish measures and goals to guide and track improvements, and

8. Recognize improvements.

Benefits:

- Performance advantage through improved organizational capabilities.

- Alignment of improvement activities at all levels to an organization’s strategic intent.

- Flexibility to react quickly to opportunities.

3.1.9.7 Factual Approach to Decision Making

"Effective decisions are based on the analysis of data and information."

Steps in application of this principle are:

1. Take measurements and collect data and information relevant to the objective.
2. Ensure that the data and information are sufficiently accurate, reliable and accessible.

3. Analyze the data and information using valid methods.

4. Understand the value of appropriate statistical techniques, and

5. Make decisions and take action based on the results of logical analysis balanced with experience and intuition.

Benefits:

- Informed decisions.

- An increased ability to demonstrate the effectiveness of past decisions through reference to factual records.

- Increased ability to review, challenge and change opinions and decisions.

3.1.9.8 Mutually Beneficial Supplier Relationships

"An organization and its suppliers are interdependent, and a mutually beneficial relationship enhances the ability of both to create value."

Steps in application of this principle are:

1. Identify and select key suppliers.

2. Establish supplier relationships that balance short-term gains with long-term considerations for the organization and society at large.

3. Create clear and open communications.

4. Initiate joint development and improvement of products and processes.

5. Jointly establish a clear understanding of customers' needs.

6. Share information and future plans, and

7. Recognize supplier improvements and achievements.
Benefits:

- Increased ability to create value for both parties.
- Flexibility and speed of joint responses to changing market or customer needs and expectations.
- Optimization of costs and resources.

3.2 TQM: (TOTAL QUALITY MANAGEMENT)

TQM is the philosophy, which the organizations can think of in order to move further in the quality aspect. TQM is management approach of an organization centered on Quality, based on participation of all its members, aiming at long term success, through customer satisfaction and benefits to all members of the organization & to the society as a whole. As the principles of TQM suggest continuous improvement, the organizations will be striving for better and better product, process and environment. In order to do this effective leadership and top management commitment is very much essential. It is a companywide movement and not applicable to only few corners or areas of the factory. It also emphasizes on Quality chain i.e. concept of internal & external customers. All the benefits derived from the ISO can equally be achieved with TQM as well. Over and above due to involvement of employees from all the level of the organization, effective utilization of human resource would take place. Due to empowerment to the employees in terms of finding out the problems, analyzing the problems and giving suggestions thereby allowing them to become the part of decision making process the Human force will be highly motivated and hence there will be improvement in the productivity.

The problem with TQM is, one does not get overnight results and to some extent the results are intangible. It is also said that TQM is endless journey and hence lacks proper direction and motivation.

According to British Standard BS 7850, TQM is defined as, “Management philosophy and company practices that aim to harness the human and material resources of an
organization in the most effective way to achieve the objectives of the organization.” [2]

TQM is defined as both a philosophy and a set of guiding principles that represent the foundation of a continuously improving organization. It is the application of quantitative methods and human resources to improve all the processes within an organization and exceed customer needs now and in the future. TQM integrates fundamental management techniques, existing improvement efforts and technical tools under a disciplined approach. It encompasses all aspects of business. Its key concepts are emphasis on management commitment, customer focus, involvement of all, treating suppliers as partners, continuous improvement and performance measurement.

Sustained implementation of TQM can result in benefits such as improvement in quality of products and services, productivity, reliability, market share, revenue, profits which will lead to overall growth of an organization. [4]

3.2.1 Total Quality Management: (brief history) [3]

TQM means different things to different people. What first captured the attention of American managers was Japanese’ import’ called quality circles. The idea was to have workers meet occasionally to discuss work problems. As a result, workers developed ideas about how to solve problems pertaining to their work areas. In the period of 1962 to 1980, there were over 1,00,000 quality circles in operation in Japan. American corporations began to use quality circles in the mid-70. By 1986, quality circles were so common that Business Week listed them as the fad of the ‘80’s. (Business Week, Jan. 20, 1986, p.60).

W. Edwards Deming gained widespread attention in the 1980’s after being featured in a documentary titled “If Japan Can, Why Can’t We?”

Walter Shewhart had discovered that quality could be measured, and that there are measures of variability. Deming refined and improved on the ideas of Walter Shewhart. Deming improved on Shewhart’s work and invented what is popularly known as the Deming Cycle of Plan-Do-Check-Act or PDCA cycle.
3.2.2 Some definitions of TQM

- A management method relying on the cooperation of all members of an organization. A management method that centers on Quality and on the long term success of the organization through the satisfaction of the customers, as well as the benefit al all its members and society.

- A systematic customer focused approach to continuous performance improvement. A philosophy and set of guiding principles, which represent the foundation for continuously improving the organization through employee involvement. The application of quantitative methods and human resources to improve the materials and services supplied to and by an organization, and all the processes within the organization and the degree to which the needs of the customer are met. The integration of fundamental management techniques, existing improvement efforts, and technical tools, under a disciplined approach result in continuous improvement.

- An organizational undertaking is to improve the quality of manufacturing and service. It focuses on obtaining continuous feedback for making improvements and refining existing processes over the long term.

- Management approach of an organization centered on quality, based on participation of all members and aiming at long-term success through customer satisfaction, and benefits to all members of the organization and to society. Quality management has been defined in ISO 9000:2000 as ‘coordinated activities to direct and control an organization with regard to quality.’

- TQM is an organization wide effort for continuous improvement in the organization processes, products and services for attaining the goal of customer satisfaction.

- TQM is defined as Management method relying on the cooperation of all members of an organization. A management method that centers on Quality
and on the long-term success of the organization through the satisfaction of the customers, as well as the benefit of all its members and society.

- It is a philosophy that is designed to make an organization faster, flexible, focused and friendly. It leads to a structured system that focuses each employee on the customer. It creates an environment that allows organization-wide participation in planning and implementing a continuous improvement process to meet customer needs. [19]

- According to the British Standard BS 7850, TQM is defined as “Management philosophy and company practices that aim to harness the human and material resources of an organization in the most effective way to achieve the objectives of the organization.” This definition of TQM does not mention quality specifically: that quality is synonymous with the objectives of the organization is implicit. [20]

3.2.3 Traditional organization v/s TQM organization

The following table (Table 3.3) gives an idea regarding the differences between traditional organization and organizations following TQM principles:

<table>
<thead>
<tr>
<th>Traditional Organization</th>
<th>TQM Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company driven</td>
<td>Customer driven</td>
</tr>
<tr>
<td>Short-term orientation</td>
<td>Long-term orientation</td>
</tr>
<tr>
<td>Opinion driven</td>
<td>Data driven</td>
</tr>
<tr>
<td>Tolerance of waste</td>
<td>Elimination of waste</td>
</tr>
<tr>
<td>Fire fighting</td>
<td>Continuous improvement</td>
</tr>
<tr>
<td>Inspection</td>
<td>Prevention</td>
</tr>
<tr>
<td>Fortressed departments</td>
<td>Cross-functional teams</td>
</tr>
<tr>
<td>Top-down hierarchy</td>
<td>High employee participation</td>
</tr>
<tr>
<td>Blame</td>
<td>Problem solving</td>
</tr>
<tr>
<td>Isolation</td>
<td>Systems thinking</td>
</tr>
<tr>
<td>Management</td>
<td>Leadership</td>
</tr>
</tbody>
</table>
3.2.4 Basic Approaches of TQM [21]

It requires six basic concepts:

1. **A committed and involved management to provide long-term top-to-bottom organizational support:**

   Management must participate in the quality program. A quality council must be established to develop a clear vision, set long-term goals and direct the program. Managers participate on quality improvement teams and also as coaches to other teams. TQM is a continual activity that must be entrenched in the culture it is not just a one-shot program. TQM must be communicated to all people.

2. **An unwavering focus on the customer, both internally and externally:**

   The key to an effective TQM program is its focus on the customer. An excellent place to start is by satisfying internal customers. We must listen to the “Voice of the customer” and emphasize design quality and defect prevention.

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

   TQM is an organization-wide challenge that is everyone’s responsibility. All personnel must be trained in TQM, statistical process control (SPC) and other appropriate quality improvement skills so they can effectively participate on project teams. People must come to work not only to do their jobs, but also to think about how to improve their jobs, people must be empowered at the lowest possible level to perform processes in an optimum manner.

4. **Continuous improvement of the business and production process:**

   There must be a continue striving to improve all business and production processes. Quality improvement projects, such as on-time delivery, order-entry efficiency, billing error rate, customer satisfaction, cycle time, scrap reduction and supplier management are good places to begin.
5. **Treating suppliers as partners:**

On the average 40% of the sales is purchased product or service, therefore, the supplier quality must be outstanding. The focus should be on quality and life cycle costs rather than price. Suppliers should be few in number so that true partnering can occur.

6. **Establish performance measures for the processes:**

Performance measures such as uptime, percent non-conforming, absenteeism and customer satisfaction should be determined for each functional area. Quantitative data are necessary to measure the continuous quality improvement activity.

3.2.5 **Main Elements of TQM [20]**

3.2.5.1 **Quality Chain**

The customer-supplier relationships both within and without the organization are described as quality chains. All interactions within an organization can be viewed in a way with every one being both a customer and a supplier.

These customer-supplier chains operate throughout the organization and the quality of supply to the external customer will be dependent on all the links holding together. If there is a break in the chain it will have a knock-on effect.

3.2.5.2 **Process Management**

A process is a way in which inputs are converted to outputs. The inputs may be materials or information. The output will be the product that meets the needs of the customers of the process. In TQM the aim is to understand the processes that are involved in meeting the customers’ needs so that they can be managed to ensure that these needs are met consistently. All personnel will be involved with processes and process management, which is the method of establishing control over the processes. They will thus be concerned with assuring the quality of supply. The first stage in process
management is to identify and define the processes involved. For each supplier-customer link there will be a process. To define the process we must know what the process is required to achieve, i.e. the specification for the process, and what the inputs and the outputs for the process are. We can use this process definition to determine the controls that are required to allow the process to be managed.

The two most important aspects of process management are making sure that the output meets the customers’ requirements and that this happens consistently. Consistency is an important issue.

3.2.5.3 Continuous Improvement

The establishment of consistent process is not enough in the TQM environment, it requires that processes are continuously reviewed and improved. From the management point of view there should be a system for review and improvement, providing an opportunity to do something more effectively, to reduce the variability in a process, or to save money.

The key to continuous improvement are knowing that a change is required, making sure that any proscribed change will be effective, and ensuring that the most knowledgeable people are involved in the improvement process.

The following figure indicates the cycle of continuous improvement.

3.2.6 Some other concepts of TQM

There are certain misconceptions about TQM, which can be cleared with the following table (Table 3.4). The table indicates what TQM is and what it is not. [22]

<table>
<thead>
<tr>
<th>Is</th>
<th>Not</th>
</tr>
</thead>
<tbody>
<tr>
<td>A cultural change</td>
<td>An overnight cure</td>
</tr>
<tr>
<td>Responsibility of top management</td>
<td>QA manager is responsible</td>
</tr>
<tr>
<td>A systematic way to improve processes</td>
<td>A new program</td>
</tr>
<tr>
<td>Structured approach to solving problems</td>
<td>Fire fighting</td>
</tr>
<tr>
<td>Proactive organization</td>
<td>Reactive</td>
</tr>
<tr>
<td>Action speaks</td>
<td>Slogan speaks</td>
</tr>
<tr>
<td>Practiced by everyone</td>
<td>A specialized discipline</td>
</tr>
<tr>
<td>Team involved</td>
<td>Only one person or department involved</td>
</tr>
</tbody>
</table>
3.2.7 Differences between organizations following TQM and others

The differences between organization practicing TQM and others are given in following Table 3.5: [22]

*Table 3.5 TQM Company versus others*

<table>
<thead>
<tr>
<th></th>
<th>TQM Company</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training Investment</td>
<td>Expensive</td>
<td></td>
</tr>
<tr>
<td>Change Way of life</td>
<td>Resisted</td>
<td></td>
</tr>
<tr>
<td>Defects Zero</td>
<td>Inevitable</td>
<td></td>
</tr>
<tr>
<td>Effort Long-term</td>
<td>Short-term</td>
<td></td>
</tr>
<tr>
<td>Performance Customer requirements</td>
<td>Cost and schedule as agreed to</td>
<td></td>
</tr>
<tr>
<td>Communications Horizontal and Vertical</td>
<td>Vertical</td>
<td></td>
</tr>
<tr>
<td>Performance goals Better than yesterday</td>
<td>Organization standards</td>
<td></td>
</tr>
<tr>
<td>Management role Coach</td>
<td>Enforcer</td>
<td></td>
</tr>
</tbody>
</table>

3.2.8 Barriers to TQM implementation [2] [22]

- Lack of top management commitment
- Lack of employee involvement
- Non-cooperation of first line and middle level management
- Lack of clarity in vision
- Poor planning
- Losing track of business performance
- Not involving customers and suppliers
- Belief that training leads to employee attrition
- Failure to change organizational philosophy
- Resistance to change at all levels
- Ineffective TQM facilitator
• Team work complacency
• Lack of consistency and persistence by the management
• Haste and thereby waste
• Looking for immediate gains
• Adhoc organization
• Lack of resources
• Quick obsolescence of products
• Losing confidence in the middle of the journey due to various reasons
• Working harder than smarter
• Lack of effective measurement of quality improvement
• Unable to find right kind of leaders within the organization
• Not properly staffed- too many or too less number of employees

3.3 THE 5S HOUSEKEEPING APPROACH [3] [23]

3.3.1 Introduction
5S is a set of techniques providing a standard approach to housekeeping and it is often promoted as being far more than simply housekeeping and some of the elements described below certainly have broader implications.

It is originated, as did most of the elements of JIT, within Toyota. A cornerstone of 5S is that untidy, cluttered work areas are not productive.

The logic behind 5S practices is that organization, neatness, cleanliness, standardization and discipline at the workplace are basic requirements for producing high quality product and services with little or no waste and with high productivity. This is the reason why it is important to combine Japanise 5-S practice in TQM. [2]
Naturally enough, the elements of 5S are all Japanese words beginning with the letter ‘S’. Since their adoption within Western implementations of JIT, or Lean, various versions of the terms have been adopted by different writers and educators. These are listed below against the individual elements and it can be seen that none are entirely satisfactory.

### 3.3.2 5S "pillars"

The individual items within 5S are known as the "pillars" and are:

#### 3.3.2.1 Seiri (Sort)

This means sorting and organizing the items as critical, important, frequently used, useless, or not needed as of now. Proper organization would certainly reduce the search time to a great extent.

It is a generally tendency to retain things. Many a times obsolete or rejected items are also retained which may create problems of untidy and clumsy shop floor.

The major element of Seiri is simply a critical look at the area. Involving cross-functional teams, or looking at each other's areas as people tend to be blind to failings in their own workplace and a fresh pair of eyes can be useful.

**Benefits of Seiri:**

- It helps to save floor space
- Gives a clear idea of material in stock
- Reduces unnecessary buying of materials
- Helps to get rid of obsolete items
- Effective utilization of existing materials
3.3.2.2 5s Seiton (Set)

Seiton is the series of steps by which the optimum organization identified in the first pillar are put into place.

The standard translation is Orderliness but again some wish to keep the initial S and use Sort (yes, that is also one of the translations of Seiri), Set in order, Straighten and Standardization.

The sorting out process is essentially a continuation of that described in the Seiri phase. Removing items to be discarded or held in an alternative location will create space. This space will be visible and facilitate the alternative layout of the area.

Seiton emphasizes “A rational, orderly and methodical arrangement of all items we use, rework or write off.” The basic concept over here is that “Each item has a place, and only one place.” If the items are used, they should be placed at the same place after the usage.

Benefits of Seiton:

- Retrieval of material is easy
- Reduction in searching time
- Improved visibility of materials
- Lesser production downtime due to better access of required material
- Down time of machine can be reduced

3.3.2.3 5s Seiso (Shine)

Seiso is about believing in cleanliness. The principle here is that we are all happier and hence more productive in clean, bright environments. There is a more practical element in that if everything is clean it is immediately ready for use.
We would not want a precision product to be adjusted by a spanner that is covered in grease which may get into some pneumatic or hydraulic fittings. We would not wish to compromise a PCB assembly by metallic dust picked up from an unclean work surface. Other issues are health and safety (perhaps slipping in a puddle of oil, shavings blowing into people's eyes) and machine tools damaged by coolant contaminated by grease and dust.

Basically it involves cleaning the work place, making free from burrs, grease, oil, waste, scrap etc. The theme is “Cleaning not for beautification alone but with a purpose.” People are made aware that keeping their machines and workplace clean is their responsibility.

Seiso is also known as Spic and Span.

Benefits of Seiso:

- Better working environment
- Workplace conducive for higher productivity
- No blockage in material flow
- Sense of achievement
- Greater confidence of customers
- Fast corrective actions
- Inventory levels can be found visually
- Higher product quality achieved
- Set up time reduction
3.3.2.4 5s Seiketsu (Standardization)

This is well described as Standardized cleanup, but other names adopted include Standardization (not to be confused with the second pillar), Systematization and Sanitation.

Seiketsu can be the thought of as the means by which we maintain the first three pillars. There is, obviously, a danger in any improvement activity that once the focus is removed and another 'hot button' grabs management attention, things go back to the way they were before. Seiketsu is the set of techniques adopted to prevent this happening. Basically this involves setting a schedule by which all the elements are revisited on a regular basis - usually referred to as the '5S Job Cycle.'

Finally within Seiketsu people from other areas visit and cast a critical eye over the state of the area. Again, an external assessor may notice degradation that is not clear to the people who work in the area. Hirano talks of a checklist within Seiketsu whereby the external visitors mark the area on a number of key criteria defined at the outset of the programme. For example, are the storage areas still clearly defined? Does the tool rack still have clear outlines or profiles for each tool to be stored in it? Does the area meet the general standards of cleanliness?

Benefits of Shiketsu:

- Standardized procedures emphasize system approach
- Standardized procedures restore confidence, minimize errors
- Reduction of defects
- Increase in the productivity
- Easier and safer working condition
- Easier to adhere to quality system
- Sense of ownership and pride among employees
3.3.2.5 5s Shitsuke (Self Discipline)

The theme of Shitsuke is “Habit formation and disciplined workplace.”

The step emphasizes training, sincerity and constancy of purpose on following the rules and standards developed in earlier 4S’s.

There is a fundamental difference between Seiketsu and Shitsuke. The fourth pillar is the introduction of a formal, rigorous review programme to ensure that the benefits of the approach are maintained. The fifth pillar is more than this; it is not simply the mechanical means by which we continue to monitor and refine, it is the set of approaches we use to win hearts and minds, to make people want to keep applying good practice in shop organization and housekeeping. In this sense, discipline is perhaps an unfortunate term as it implies people forced to do something, with consequent penalties if they do not.

There are a number of elements to any ongoing improvement activity in any business, which take pre-eminence in a particular organization. They vary with the history and culture of that organization. Suffice to say that key points are:

- Communication. We need people to be aware of what we are trying to achieve, and why.
- Education. They need to understand the concepts and the individual techniques.
- Rewards and Recognition. People need to feel that their efforts are recognized. Whether the reward is a senior manager walking past and saying "that's very good, well done" or some form of award (financial gain, prize or formal presentation of a certificate) depends on the organization.
• Time. If we want people to spend five minutes every four hours removing swarf from the floor around their machine we have to make sure that we allow them this time. We cannot give this as an instruction yet at the same time push for more time spent achieving productivity targets.

• Structure. We need to identify what is to be done, by whom, and ensure that schedules are updated and clearly visible.

### 3.3.3 5-S Programme in a Tabular format [2]

Following table (Table 3.6) gives a clear idea about the 5S programme with meanings of each Japanese S and equivalent S in English language with typical examples of each one of them:

**Table 3.6 The 5-S Programme**

<table>
<thead>
<tr>
<th>Japanese Term</th>
<th>Meaning</th>
<th>Equivalent ‘S’ Term</th>
<th>Typical Example</th>
</tr>
</thead>
</table>
| Seiri         | • Organization  
               • Distinguishes between necessary and unnecessary items  
               • Putting things in order | Sorting out / Structurize | To discard unnecessary things and retain necessary things |
| Seiton        | • Keeping necessary things in designated places | Systematic arrangement / Systemize | Reducing searching time |
| Seiso         | • Making things clean  
               • Keeping the workplace spic and span | Sanitizing / Spic and span | Getting rid of waste, grime and foreign matter. Make cleaning a form of inspection |
| Seiketsu      | • Standardization of 1 S, 2 S and 3 S  
               • Emphasis on visual management | Standardization / Serene atmosphere | Continually and repeatedly maintain neatness and cleaning standards in the organization |
| Shitsuke      | • To respect and cultivate standards  
               • Instilling or having the ability to do things the way they are supposed to be done. | Self-discipline | Emphasis on creating a congenial workplace with good habits and discipline |
3.3.4 Advantages of 5S [3]

- Nice to work in a clean, beautifully organized work place
- Time taken to reach things minimized
- Lesser time required for material handling
- Problem detected fact
- Machine production down time reduced
- Lower cost of production
- More usable space
- Better preventive maintenance
- Higher employee morale
- Consistent and better quality of product
- Higher productivity
- Lesser accidents
- Higher employee involvement
- Sustenance of quality system
- Reduction in error/ defects due to standardized procedure]

3.4 QUALITY CIRCLE [2] [24]

The concept of Quality Circle was originated in Japan in 1962 by Dr. K. Ishikawa.

Quality circle is a small team of people usually from the same work area who voluntarily meet on a regular basis to identify, investigate, analyze and solve their work related problems. It adopts a democratic process and introduces a participative management culture in the organization. All people in the circle put their minds together to solve the problems.
3.4.1 Concept of Quality Circle

The quality circle concept has three major attributes:

1. Quality Circle is a form of participative management
2. Quality Circle is a human resource development technique
3. Quality Circle is a problem solving technique

It is based on the concept that suggestions affecting the workplace should come from those who perform the work and who have the greatest knowledge about the job. It assumes that people closest to the problem better understand the nature of the problem and what is or is not a feasible solution.

3.4.2 Organizational Structure of Quality Circle

A quality circle in order to work effectively and efficiently needs to have a proper organization structure. It may vary from organization to organization, but it certainly has a basic framework. It may consist following basic elements:

1. A steering committee
2. Facilitator
3. Circle leader
4. Circle members

Each element has a specific role to play in the formation and proceedings of Quality Circles as under:

3.4.2.1 Steering Committee

This committee is consisting of the senior executives of the company; they have to announce officially about the initiation of Quality circle movement and to create awareness about the need of establishing Quality circles in the organization. The committee also requires to provide the Quality Circles to present their ideas or suggest solutions for the problems faced in their work.
areas. It is also expected from this committee to provide resources such as space for meetings, time, and training facilities etc. to the Quality Circles.

3.4.2.2 Facilitator

A facilitator usually is a managerial level person who is responsible for guiding and directing the activities of the Quality Circle. He provides training to the leader and members of the Quality Circles. The training may be regarding time management, idea generation, presentation skills, behavioural skills etc. One facilitator can take care of more than one quality circle. The facilitator’s role is more important when the circle is newly formed.

3.4.2.3 Leader

Generally a foreman or a supervisor or a senior employee of the workgroup is appointed as a leader of the quality circle. Leader’s role is to conduct meetings and ensure participation by all members. He helps the circle in collecting data related to problems. The leader is also required to maintain records of the meetings, make notes of the ideas given by the members and to help the circle to discuss only work area related problems and to make sure that the discussion is on the right track. Finally the leader has to make a presentation to the top management regarding the circle proceedings and suggestions.

3.4.2.4 Members

Circle members are the employees working in the work area, who become the members on voluntary basis. The circle members are the lifeblood of quality circles. When the leader announces the problem, the members are expected to be active and give their ideas or suggestions to resolve the problem which they are facing in their work area. They are required to offer views, opinions and ideas freely during the problem solving process. The
members are also educated about not bringing personal problems in the quality circle meetings and to demonstrate mutual respect.

The quality circles can use brainstorming techniques to generate ideas and cause and effect diagram (Fish bone diagram) originated by Ishikawa for the pictorial representation of the various probable causes for a particular effect or problem.

3.4.3 Objectives of Quality Circles

- To identify and solve work related problems
- To improve quality and productivity
- To reduce the cost of production by waste reduction and effective utilization of resources
- To motivate employees to use their creativity and knowledge for the betterment of organization
- To improve communication within organization
- To increase loyalty and commitment of the employees towards the organization
- To improve attitude and behaviour of employees
- To promote job involvement
- To satisfy the human needs of recognition, achievement and self development
- To give opportunities to the workers to participate in decision making process