Chapter 1

INTRODUCTION

Timely adoption of the technology plays an important role in the long term success of the business. The highly demanding and ever-changing business environment, especially after the liberalization, privatization and globalization, has necessitated the organizations to be astute in the competitive market, offering products and services of superior quality. Such products and services enable them to attract new customers and strengthen their relationship with the existing ones. Timely adoptions of technological innovations have served to break the geographical boundaries, resulting in more informed and demanding customers than in yester years. Increased pressure from the customers, competitors and the environment is forcing the managements to implement strategies for lowering the operating costs and improving efficiency, without compromising quality. Quality is now a familiar word that has a variety of interpretation according to its use. Quality has to be defined in clear terms for the industries to follow.

Some important definitions of quality are as follows:

- According to Mr. Crosby ‘Quality is conforming to specifications’. Whenever a product was manufactured or a service rendered, it will be done to suit the specification (Crosby, 1979).
- According to Mr. Deming quality is Customer Satisfaction. Such a product which brings a satisfaction to the customer is termed as a quality product (Deming, 1986).
- Mr. Juran explained that Quality is fitness for use. It only stresses in addition to conformance to specification, fitness for use has to be insisted (Juran, 1995)
- The ISO definition (ISO 8402) for quality is stated as: ‘quality is conformance to requirements---the totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs’.

EVOLUTION OF QUALITY DURING THE DIFFERENT AGES

1. Quality through early ages: Quality has always been in existence, it has been gaining more attention. The emphasis laid on the various aspects of quality is varied from time to time.
Present work is an attempt to arrange the events connected with and changes made in course of quality movement through the ages. The data which was available during the primitive time, is rather hazy and non authoritative. It becomes clear, definite, and verifiable at later stages. Quality movement can be chronicled in the following ways:

Joseph Juran is known as the father of modern quality management, highlights the quality history of different regions of the world through a seminal book entitled “A History of managing for quality”. It is referring the period from 21 century BC to 1911AD it states:

“The direct control over the economic sphere by the bureaucracy had influenced China’s ancient productivity activities and quality control. ---- china’s ancient quality control system is closely related with china’s ancient society starting from the western Zhou Dynasty (eleventh century to eighteenth century), a system to control the production of handicraft had already been set up especially in the state administrative organisation.

The large number of books also records quality improvement techniques were used by Scandinavian ship builders over the four thousand year period from the beginning of the third millennium BC to the end of the first millennium. There are still verifiable evidences of quality control applied in the construction of the ancient pyramids in Egypt.

Kautilya’s Arthashastra dated in the fourth century BC is the key document from the India revealing the practice of quality control in this country. A very brief quote from Arthashastra will suffice to prove the point. The (artisan) shall deliver in the same condition as to quality as they receive the entrusted metal. Another early evidence of the strict control of quality often cited is the code of law of Hammurabi, king of Babylon, circa 1800BC. The uniformity of Babylonian weights and measure is well established as also the quality of Babylonian weapon of war.

In ancient Rome Well laid out town planning was evident, which was an example of quality. The reorganisation of Pompeii’s civil forum during the second century BC also provides clear evidence of urban planning.

II. Quality through the middle ages: In the middle ages guilds and government carried on the quality control. Guilds existed all over Europe in the middle ages. Crafts guild, consisting of
masters, journeymen and apprentices emerged to make it sure that craftspeople were properly trained. Every effort was made to ensure that quality was build into the final product. During this period the craft men left marks on their product as an assurance of its quality. The oldest marks by the stonemasons in the German speaking area were found in the cathedral of Speyer, which was erected 1080-1106”.

Craft men formed guilds or union for the purpose to regulate and control the skills of their member as well as the quality of their product. Such guilds provided marking on the product of their members.

“From the end of thirteenth century to the fall of the holy roman empire in 1806, organised union of all professions, especially trades: developed in the three cities of the empire. These cooperation, often called guilds... Protected their members.... Regulated the working conditions.... And rules concerning the quality of products and services were strictly enforced. Inspection committee identified flawless goods with visible marks, which guaranteed their quality”.

III. Quality in the modern ages:--The Industrial Revolution, which reached its fullness in Britain, can be stated as the very foundation of modern management for the quality. Explosive growth of factory produced goods made it necessary to have conscious control over the quality of goods ‘...the concept of interchangeably part led to the Industrial Revolution, and made quality assurance a necessary characteristics of production processes.

The twentieth century witnessed fast movements in the field of quality movement because of the contributions of individuals and institutions. “The modern day quality movement has its root in the works of Frederick W Taylor and Frank B Gilbreth. This school of scientific management laid the foundation of the ideas that form the basis for modern concepts of quality improvement.

Quality from 1950 to 1980:

Juran codified the element of quality control (in his quality control handbook) in 1951. This book is still one of the most notable books on the matter of quality control. JUSE in 1954 invited JM Juran to give seminars for executives and top managers. At that time Statistical quality control
started being practiced in Japanese industries. In late 1950’s unofficial work groups were formed to improve quality. This was the root of the quality circles, which became famous worldwide in the later period. The period from mid 1950’s to 1960’s was the period recognised as a time of rapid growth: both in the effectiveness of quality control and in the Japanese economy. Quality control training for shop supervisors and factory worker was started in late 1950’s via the medium of radio. On the idea of Total quality control, a journal was published by JUSE. Later in 1962, it started publishing a new journal quality control for Forman. Under the inspiration of the journal a number of work groups were started at the shop floors. These groups were named by the editors as the quality circle groups, when Juran visited Japan in 1966 he said “quality circle is on the road to world quality leadership”.

If the American quality advocates Deming, Juran and Shewart initiated the Japanese quality revolution, it was Japan’s own karou Ishikawa gave definite direction and new thrust to this quality revolution. Ishikawa, as a member of editorial board of the journal Quality Control for Foremen) and as chief executive director of quality control circles at JUSE(Japanese Union of Scientists and Engineers), he played a vital role in the growth of quality circles. Ishikawa stressed the support from the top management as a key element in quality strategy. Quality consciousness spread through the length and breadth of Japan and became a national movement. Juran summarises this development in Japan thus

“Atention to quality has become virtually a national movement...they supplemented their knowledge by import. American import included Deming on statistical quality control and Juran of management of quality control. They created independent laboratories to certify goods for export.

In America, Armand V Feign Baum the originator of the term ‘total quality management” (TQM) laid the foundation for the modern quality control. His name is used synonymously with the term which he coined i.e., “Total Quality Control”. Feign Baum’s idea was contained in his now famous book “Total Quality Control” first published in 1951. The book has been translated into a large number of languages such as Japanese, Chinese, French and Spanish.
Several things happened in the late 1970s that brought quality into the lime light. First, American industries were facing increasing competition from Japanese on the account of product quality, price and overall product reliability. Second in 1979, Philip Crosby wrote Quality is free in which he categorised the cost of quality and showed that the cost of prevention could be significantly lower than the cost of detection and the cost of failure in the absence of prevention.

**Quality from 1980 to 2000**

In 1980 NBC broadcasted a documentary on the success of Japanese companies with the challenging title ‘If Japan can, why can’t we?’ this struck a public chord in the public mind from 1980 large US companies really took quality seriously. By the end of the decade, virtually all major US corporations were in the middle of quality revolution, which have continued into the 1990s attention to quality spread from the shop floor to other parts of the organisation. There was born a realisation that prevention is better than detection of defects. A number of contributions from quality gurus all emphasised on the improvement of quality. The new term TOTAL QUALITY MANAGEMENT or better known in its acronym TQM became a catchword all the levels of industries. The Malcolm Bal ridge national quality award, named after the late commerce secretary of the US, was established by the congress in 1987 to be administered by the national institute of standards and technology (NIST). The award has given American companies something to compete for has done much to accelerate the quality movement in the country.

Europe was not far behind in catching the wave of quality. In 1989 the European foundation for quality management (EFQM) was founded as a forum for those companies in Europe who have committed to quality. It launched the European quality award in 1991 to stimulate interest in quality improvement. Europe’ contribution to the quality movement is the quality standard, ISO 9000(adaptation of the British standard BS 5750). These standards were first publish by the international organisational standards with its headquarters at Genève, Switerland, in 1987. This certification initially was concentrated in Europe and later spread top other parts of globe especially after 1993, when the European community made it a basic condition for doing business with any firm at home or abroad.
IV. **Introduction of TQM**:- Total quality management (TQM) is an enhancement to the traditional way of doing business. It is a proven technique to guarantee survival and world-class competition. The culture and action of the organisation can be transformed only by changing the action of management. Analysing the three words of TQM, we have

**Total**- Made up of the whole

**Quality**- Degree of excellence a product or service provider.

**Management**- Art of handling, controlling, directing etc.

Therefore, TQM is the art of managing the whole to achieve excellence. The golden role is a simple but effective way to explain it. TQM is defined as both a philosophy and set guiding principles that represent the foundation of a continuously improving organisation. It is the application of quantitative methods and human resources to improve all the processes within an organisation and exceed customer needs now and in the future. TQM integrates fundamental management techniques, existing improvement efforts, and technical tools under a disciplined approach.

**Some definitions of Total Quality Management are as follows:**

*According to Joseph Juran “Total quality is defined as fitness for use or purpose”.*

*According to Philip Crosby “Total quality is conformance to requirements”.*

*According to Deming Total Quality is defined as “A predictable degree of uniformity and dependability at low cost and suited to the market”.*

The purpose of TQM is to provide a quality product or service to customers, which will, in turn, increase productivity and lower cost. With a higher quality product and lower price, competitive position in the market place will be enhanced. This series of the organisation to achieve the objectives of profits and growth with greater ease. In addition, the work force will have job security which will create a satisfying place to work.
Table no. 1.1 showing Gain in productivity with improved quality:

<table>
<thead>
<tr>
<th>Item</th>
<th>Before improvement 10% nonconforming</th>
<th>After improvement 5% nonconforming</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative total cost for 20 units</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Conforming units</td>
<td>18</td>
<td>19</td>
</tr>
<tr>
<td>Relative costs for non conforming units</td>
<td>.10</td>
<td>.05</td>
</tr>
<tr>
<td>Productivity increases</td>
<td></td>
<td>(100)(1/18)=5.6%</td>
</tr>
<tr>
<td>Capability increases</td>
<td></td>
<td>(100)(1/18)=5.6%</td>
</tr>
<tr>
<td>Profit increases</td>
<td></td>
<td>(100)(1/18)=5.6%</td>
</tr>
</tbody>
</table>

Source: Adapted from W. Edwards Deming, quality productivity and competitive position (Cambridge, Mass: Massachusetts institute of technology, centre for advanced engineering studies, 1982)

Quality and productivity are not mutually exclusive. Improvements in quality can lead directly to increased productivity and other benefits. As table exhibits, the improved quality results in a 5.6% improvement in productivity, capacity and profit. Many quality improvements are achieved with the same workforce, same overhead, and no investment in new equipment. Recent evidences shows that more and more collaborations are recognizing the importance and necessity of the quality improvement if they are to survive domestic and world-wide competition. Quality improvement is not limited to the conformance of the product or service to specifications; it also involves the inherent quality in the design of the system. The prevention of the product, service and process problems in a more desirable objective than taking corrective action after the product is manufactured or a service rendered. TQM is not occur overnight; there are no quick remedies. It takes a long time to build the appropriate emphasis and techniques into the culture. Over emphasis on the short term results and profit must be set aside so long term planning and constancy of purpose will prevail.
According to the survey of manufacturing firm in Georgia, the benefits of TQM are improved quality, employees participation, teamwork, working relationships, customer satisfaction, employees satisfaction, productivity, communication, profitability and market share (Christopher et al. 2000).

V. Contributors of Total Quality Management:-

Shewhart

Walter A. Shewhart, PhD, spent his professional career at western electric and Bell telephone laboratories, both division of AT&T. He developed control chart theory with control limits, assignable and chance causes of variation, and rational subgroups. In 1931, he authored *economic control of quality of manufactured product*, which is regarded as a complete and through work of the basic principles of quality control. He also developed the PDSA cycle for learning and improvement.

Deming

W. Edwards Deming, PhD, was a protégé of Shewhart. In 1950, he taught statistical process control and the importance of quality to the leading CEOs of Japanese industry. He is credited with providing the foundation for the Japanese quality miracle and resurgence as an economic power. Deming is the best known quality expert in the world. His 14 point provides a theory for management to improve quality, productivity, and competitive position. He is authored a number of books including *Out of the crises and quality, productivity, and competitive position* and 161 scholarly studies.

Juran

Joseph M. Juran, PhD, worked at western electric from 1924 to 1941. There he was exposed to the concepts of Shewhart. Juran travelled to Japan in 1954 to teach quality management. He emphasised the necessity for management at all levels to be committed to the quality effort with hands on involvement. He recommended project improvements based on return on investment to achieve the breakthrough results. The Juran Trilogy for management quality is carried out by the
three interrelated process of planning, controlling, and improvements. In 1951, the first edition of *Juran's quality control handbook* was published.

**Feiganbaum:**

Armand V. Feigenbaum, PhD, argues that the total quality control is necessary to achieve productivity, market penetration, and competitive advantage. Quality begins by identifying the customer’s requirements and ends with the product or service. In the hands of satisfied customer. In addition to customer satisfaction, some of the Feigenbaum’s quality principles are genuine management involvement, employee involvement, first line supervision leadership, and companywide quality control. In 1951, he authored, *Total quality control.*

**Ishikawa:**

Kaoru Ishikawa, PhD, studied under Deming, Juran and Feigenbaum. He borrowed total quality control concept and adapted it for the Japanese. In addition, he authored SPC texts in Japanese and in English, Ishikawa is best known for the development of the cause and effect diagram, which is sometimes called the Ishikawa diagram. He developed the quality circle concepts in Japan, whereby workgroups, including their supervisor, were trained in SPC concepts. The groups then meet to identify the solve quality problems in their work environment.

**Crosby:**

Philip B. Crosby authored his first book; *Quality is free,* in 1979, which was translated into 15 languages. He sold 1.5 million copies and changed the way management looked at quality. He argued that “doing it right the first time” is less expensive than the cost of detecting and correcting nonconformities. In 1984, he authored *Quality without tears,* which contained his four absolutes of quality management. These absolutes are: quality is conformance to requirements, prevention of non-conformance is the objective not appraisal, the performance standard is zero defects not “that’s close enough,” and the measurement of quality is the cost of non-conformance.
Taguchi:

Genichi Taguchi, PhD, developed his loss function concepts that combine cost, target, and variation into one metric. Because the loss function is reactive, he develops the signal to noise ratio as a proactive equivalent. The corner stone of Taguchi’s philosophy is the robust design of parameters and tolerances. It is built on the simplification and use of traditional design of experiments.

**ISO 9000 AND QUALITY MANAGEMENT**

VI. **Emergence of ISO registration**: - ISO published the international quality system standard ISO9000 in 1987. ISO 9000 is a family of standards that provide a series of guidelines on how to establish a quality system to manage the processes that affect its product or services. It is subsequently update in 1994, 2000, 2008. The quality system is required to be documented procedures. After the quality system is implemented, the firms can obtain registration through an audit performed by an independent registrar. This is in a way the crystallization and international acceptance for the TQM concept. TQM concept, the basis for the ISO 9000 standard, and the productivity concept, both aim at profitability through organization efforts the two factors influencing each other can be see clause as a complimentary business philosophies ISO 9000 standard does lay down the guidelines for implementation of the standard and thus specify the action to be taken by the organization. The ISO is global standard. The world change faster than standard and hence standard need to be revised to keep them continuing suitable to user needs. This may be due to emergence of new industry sectors.

As an agreement between ISO and IAF existing ISO 9001:2000 certified organization shall upgrade to ISO 9000:2008 within 24 months from the date of release of ISO 9001:2008 Certification bodies can issue certificate to ISO 9001:2000 up to 12 months from the date of release of ISO 9001:2008. Certification bodies will issue new certificate of ISO 9001:2000 till 12 Nov 2008 which will be valid till 14 Nov 2010 not three years. From 15 Nov 2009, all audits, new certification based on ISO 9001:2008 only. The implementation of ISO 9000 standard is likely to influence the productivity of the organization. The net effect of the implementation of ISO 9000 will be directly reflected in the organization sales volume, export and profitability. So, an analysis of these parameters will bring out the net tangible benefits of the ISO 9000 standard.
ISO 9001 is a global standard. World changes standards and faster then hence standards need to be revised to keep them continuing suitable to user needs. This may be due to emergence of new industry sectors, World Wide Web, outsourcing, off-shoring, globalization etc.

ISO 9000 has been established now for most of the past two decades, albeit in different revisions. The conformation and application of standardized quality system models (ISO 9000) in business is considered one of the most important recent phenomena in quality management development and globalization (Dick, 2000).

Many businesses have benefited, many others have failed to achieve quality and competitive benefits through ISO 9000 implementation. For this reason, it is important to take a closer look at the issues surrounding the implementation of ISO 9000 and construct a brief roadmap for its successful implementation.

Table 1.2: ISO 9000 Quality Assurance Standards

<table>
<thead>
<tr>
<th>Standard</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISO 9000:</td>
<td>Outlines quality management and quality assurance standards, defines key terms for fundamental quality concepts, offers guidance on the usage of 9001, 9002 and 9003.</td>
</tr>
<tr>
<td>ISO 9001:</td>
<td>It is a standard for design, development, production, installation and servicing. It is an comprehensive standard in the series.</td>
</tr>
<tr>
<td>ISO 9002:</td>
<td>It is a standard for production and installation only. It includes the prevention, detection and correction of problems during production and installation.</td>
</tr>
<tr>
<td>ISO 9003:</td>
<td>It is a standard to perform testing and final inspection. It includes the detection and control of problems during final inspection.</td>
</tr>
<tr>
<td>ISO 9004:</td>
<td>It is a guide for the development and implementation of a quality system.</td>
</tr>
</tbody>
</table>

Source: ISO 9000 Series
The ISO 9000 family of standards has been revised twice since its initial publications. The first version in 1994, and was not a major revision. The second revision, published in 2000, is a major re-haul.

**ISO 9001 AND ITS CLAUSES**

Figure 1 — Model of a process-based quality management system

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**Key**

- → Value-adding activities
- ——— Information flow
The guidelines and the requirements of ISO 9001 for the certification adhering:

1 Scope

Clause 1.1 General
This International Standard specifies requirements for a quality management system where an organization

- a) needs to demonstrate its ability to consistently provide product that meets customer and applicable statutory and regulatory requirements, and
- b) aims to enhance 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.

NOTE 1 In this International Standard, the term “product” only applies to

- a) product intended for, or required by, a customer,
- b) any intended output resulting from the product realization processes.

NOTE 2 Statutory and regulatory requirements can be expressed as legal requirements.

Clause 1.2 Application
All requirements of this International Standard are generic and are intended to be applicable to all organizations, regardless of type, size 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.

Where exclusions are made, claims of conformity to this International Standard are not acceptable unless these exclusions are limited to requirements within Clause 7, and such exclusions do not affect the organization's ability, or responsibility, to provide product that meets customer and applicable statutory and regulatory requirements.
Clause 2 Normative references
The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

- ISO 9000:2005, *Quality management systems — Fundamentals and vocabulary*

Clause 3 Terms and definitions
For the purposes of this document, the terms and definitions given in ISO 9000 apply.

Throughout the text of this International Standard, wherever the term “product” occurs, it can also mean “service”.

Clause 4 Quality management system

Clause 4.1 General Requirements

The organization shall establish, document, implement and maintain a quality management system and continually improve its effectiveness in accordance with the requirements of this international standard.

The organization shall

a) Determine the processes needed for the quality management system and their application throughout the organization (see clause 1.2),
b) Determine the sequence and interaction of these processes,
c) Determine criteria and methods needed to ensure that both the operation and control of these processes are effective,
d) Ensure the availability of resources and information necessary to support the operation and monitoring of these processes,
e) Monitor, measure where applicable, and analyze these processes, and
f) Implement actions necessary to achieve planned results and continual improvements of these processes.
These processes shall be managed by the organization in accordance with the requirements of this international standard.

Where an organization chooses to outsource any process that affects product conformity to requirements, the organization shall ensure control over such processes shall be defined within the quality management system.

Note: processes needed for the quality management system include processes for management activities, provision of resources, product realization, measurement, analysis and improvement.

Note 2: An “outsourced process” is a process that the organization needs for its quality management system and which the organization chooses to have performed by an external party.

Note 3: Ensuring control over outsourced processes does not absolve the organization of the responsibility of conformity to all customer, statutory and regulatory requirements. The type and extent of control to be applied to the outsourced process can be influenced by factors such as:

a) The potential impact of the outsourced process on the organization’s capability to provide product that conforms to requirements.
b) The degree to which the control for the process is shared,
c) The capability of achieving the necessary control through the application of clause 7.4.

Clause 4.2 Documentation requirements

Clause 4.2.1 General

The quality management system documentation shall include:

a) Documented statements of a quality policy and quality objectives,
b) A quality manual,
c) Documented procedures and records required by this international standard, and
d) Documents, including records, determined by the organization to be necessary to ensure the effective planning, operation and control of its processes.
NOTE 1: where the term “documented procedure” appears within this international standard, this means that the procedure is established, documented, implemented and maintained. A single document may address the requirements for one or more procedures. A requirement for a documented procedure may be covered by more than one document.

NOTE 2: the extent of the quality management system documentation can differ from one organization to another due to

a) The size of the organization and types of activities;
b) The complexities of processes and their interactions, and
c) The competence of personnel.

NOTE 3: The documentation can be in any form or type of medium.

Clause 4.2.2 Quality manual

The organization shall establish and maintain a quality manual that included

a) The scope of the quality management system, including details of and justification for any exclusions (see clause 1.2),
b) The documented procedures established for the quality management systems, or reference to them, and
c) A description of the interaction between processes of the quality management systems.

Clause 4.2.3 Control of documents

Documents required by the quality management system shall be controlled. Records are a special type of document and shall be controlled according to the requirements given in clause 4.2.4.

A documented procedure shall be established to define the controls needed

a) To approve documents for adequacy prior to issue,
b) To review and update as necessary and reapprove documents,
c) To ensure the changes that changes and the current revision status of documents are identified,
d) To ensure that relevant versions of applicable documents are available at point of use,
e) To ensure that documents remain legible and readily identifiable,
f) To ensure that documents of external origin determined by the organization to be necessary for the operation of the quality management system are identified and their distribution controlled, and

g) To prevent the unintended use of obsolete documents, and to apply suitable identification to them if they are retained for any purpose.

**Clause 4.2.4 Control of records**

Records established to provide evidence of conformity to requirements and of the effective operation of the quality management system shall be controlled.

The organization shall establish a documented procedure to define the controls needed for the identification, storage, protection, retrieval, retention and disposition of records.

Records shall remain legible, readily identifiable and retrievable.

**Clause 5 Management Responsibilities**

**Clause 5.1 Management Commitment**

Top management shall provide evidence of its commitments to the development and implementation of the quality management system and continually improving its effectiveness by

a) Communicating to the organization the importance of meeting customer as well as statutory and regulatory requirements,
b) Establishing the quality policy,
c) Ensuring that quality objectives are established,
d) Conducting management reviews, and
e) Ensuring the availability of resources.

**Clause 5.2 Customer focus**

Top management shall ensure that customer requirements are determined and we are with the aim of enhancing customer satisfaction (see clause 7.2.1 and 8.2.1).
Clause 5.3 Quality policy

Top management shall ensure that the quality policy

a) is appropriate to the purpose of the organization,
b) includes a commitment to comply with requirements and continually improve the effectiveness of the quality management system,
c) provides a framework for establishing and reviewing quality objectives,
d) is communicated and understood within the organization, and
e) is reviewed for continuing suitability.

Clause 5.4 Planning

Clause 5.4.1 Quality objectives

Top management shall ensure that quality objectives, including those needed to meet requirements for product [(see clause 7.1 a)], are established at relevant functions and levels within the organization. The quality objective shall be measurable and consistent with the quality policy.

Clause 5.4.2 Quality management system planning

Top management shall ensure that

a) the planning of the quality management system is carried out in order to meet the requirements given in clause 4.1, as well as the quality objectives, and
b) the integrity of the quality management system is maintained when changes to the quality management system are planned and implemented.

Clause 5.5 Responsibility, Authority and Communication

Clause 5.5.1 Responsibility and Authority

Top management shall ensure that responsibilities and authorities are defined and communicated within the organization.
Clause 5.5.2 Management representative

Top management shall appoint a member of the organization’s management who, irrespective of the other responsibilities, shall have responsibility and authority that includes

a) ensuring that processes needed for the quality management system are established, implemented and maintained,

b) reporting to top management on the performance of the quality management system and any need for improvements, and

c) ensuring the promotion of awareness of customers’ requirements throughout the organization.

NOTE: The responsibility of a management representative can include liaison with external parties on matters relating to the quality management systems.

Clause 5.5.3 Internal communication

Top management shall ensure that appropriate communication processes are established within the organization and that communication take place regarding the effectiveness of the quality management system.

Clause 5.6 Management review

Clause 5.6.1 General

Top management shall review the organization’s quality management system, at planned intervals, to ensure its continuing suitability, adequacy and effectiveness. This review shall include assessing opportunities for improvement and the need for changes to the quality management systems, including the quality policy and quality objectives.

Records from management reviews shall be maintained (see clause 4.2.4).

Clause 5.6.2 Review input

The input to management review shall include information on

a) results of audits,
b) Customer feedback,
c) Process performance and product conformity,
d) Status of preventive and corrective actions,
e) Follow up actions from previous management reviews,
f) Changes that could affect the quality management system, and
g) Recommendations for quality.

Clause 5.6.3 Review output

The output from the management review shall include any decisions and actions related to

a) Improvement of the effectiveness of the quality management system and its processes,
b) Improvement of product related to customer requirements, and
c) Resource needs

Clause 6. Resource management

Clause 6.1 Provisions of resources

The organization shall determine and provide the resources needed

a) To implement and maintain the quality management system and continually improve its effectiveness, and
b) To enhance customer satisfaction by meeting customer requirements.

Clause 6.2 Human resources

Clause 6.2.1 General

Personnel performing work affecting conformity to product requirements shall be competent on the basis of appropriate education, training, skills and experience.

NOTE: Conformity to product requirements can be affected directly or indirectly by personnel performing any task within the quality management system.

Clause 6.2.2 Competence, training and awareness

The organization shall
a) Determine the necessary competence for personnel performing work affecting conforming to product requirements,
b) Where applicable, provide training or take other actions to achieve the necessary competence,
c) Evaluate the effectiveness of the actions taken,
d) Ensure that its personnel are aware of the relevance and importance of their activities and how they contribute to the achievement of the quality objectives, and
e) Maintain appropriate records of education, training, skill and experience (see clause 4.2.4),

Clause 6.3 Infrastructure

The organization shall determine, provide and maintain the infrastructure needed to achieve conformity to product requirements. Infrastructure includes, as applicable,

a) Building, workspace and associated utilities,
b) Process equipment (both hardware and software), and
c) Supporting service (such as transport, communication or information systems).

Clause 6.4 Work environment

The organization shall determine and manage the work environment needed to achieve conformity to product requirements.

NOTE: The term “work environment” relates to those conditions under which work is performed including physical, environment and other factors (such as noise, temperature, humidity, lighting or weather).

Clause 7 Product realization

Clause 7.1 Planning of product realization

The organization shall plan and develop the processes needed for product realization. Planning of product realization shall be consistent with the requirements of the other processes of the quality management system (see clause 4.1).
In planning product realization, the organization shall determine the following, as appropriate:

a) Quality objectives and requirements for the product;
b) The need to establish processes and documents, and to provide resources specific to the product;
c) Required verification, validation, monitoring, measuring, inspection and test activities specific to the product and the criteria for product acceptance;
d) Records needed to provide evidence that the realization processes and resulting product meet requirements (see clause 4.2.4).

The output of this planning shall be in a form suitable for the organization’s method of operations.

NOTE 1 A document specifying the processes of the quality management system (including the product realization processes) and the resources to be applied to a specific product, project or contract can be referred to as a quality plan.

NOTE 2 The organization may also apply the requirements given in clause 7.3 to the development of product realization processes.

Clause 7.2 Customer-related processes

Clause 7.2.1 Determination of requirement related to the product

a) Requirements specified by the customer, including the requirements for delivery and post-delivery activities,
b) Requirements not stated by the customer but necessary for specified or intended use, where known,
c) Statutory and regulatory requirements applicable to the product, and
d) Any additional requirements considered necessary by the organization.
Note post delivery activities include, for example, actions under warranty provisions, contractual obligations such as maintenance services, and supplementary services such as cycling or final disposal.

Clause 7.2.2 Review of requirements related to the product

The organization shall review the requirements related to the product. This review shall be conducted prior to the organization’s commitment to supply a product to the customer (e.g. submission of tenders, acceptance of contracts or orders, acceptance of changes to contracts or orders) and shall ensure that

a) Product requirements are defined,
b) Contract or order requirements differing from those previously expressed are resolved, and
c) The organization has the ability to meet the defined requirements.

Records of the results of the review and actions arising from the review shall be maintained (see clause 4.2.4).

Where the customer provides no documented statements of requirement, the customer requirements shall be confirmed by the organization before acceptance.

Where product requirements are changed, the organization shall ensure that relevant documents are amended and that relevant personnel are made aware of the changed requirements.

NOTE In some situations, such as internet sales, a formal review is impractical for each order. Instead the review can cover relevant product information such as catalogues or advertising material.

Clause 7.2.3 Customer communication

The organization shall determine and implement effective arrangements for communicating with customers in relation to

a) Product information,
b) Enquiries, contracts or order handling, including amendments, and
c) Customer feedback, including customer complaints.

**Clause 7.3 Design and development**

**Clause 7.3.1 Design and development planning**

The organization shall plan and control the design and development of product.

During the design and development planning, the organization shall determine

a) The design and development stages,

b) The review, verification and validation that are appropriate to each design and development stage, and

c) The responsibilities and authorities for design and development.

The organization shall manage the interfaces between different groups involved in design and development to ensure effective communication and clear assignment of responsibility.

Planning output shall be updated, as appropriate, as the design and development progresses.

NOTE: Design and development review, verification and validation have distinct purposes. They can be conducted and recorded separately or in any combination, as suitable for the product and the organization.

**Clause 7.3.2 Design and development inputs**

Inputs relating to product requirements shall be determined and records maintained (see clause 4.2.4). These inputs shall include

a) Functional and performance requirements,

b) Applicable statutory and regulatory requirements,

c) Where applicable, information derived from previous similar designs, and

d) Other requirements essential for design and development.

The inputs shall be reviewed for adequacy. Requirements shall be complete, unambiguous and not in conflict with each other.
Clause 7.3.3 Design and development outputs

The outputs of design and development shall be in a form suitable for verification against the design and development input and shall be approved prior to release.

Design and development output shall

a) Meet the input requirements for design and development.
b) Provide appropriate information for purchasing, production and service provision.
c) Contain or reference product acceptance criteria, and
d) Specify the characteristics of the product that are essential for its safe and proper use.

NOTE: Information for production and service provision can include details for the preservation of product.

Clause 7.3.4 Design and development review

At suitable stages, systematic reviews of design and development shall be performed in accordance with planned arrangements (see clause 7.3.1)
a) to evaluate the ability of the results of design and development to meet requirements,
   and
b) to identify any problem and purpose necessary actions.

Participants in such review shall include representatives of functions concerned with the design and development stage(s) being reviewed. Records of the results of the reviews and any necessary actions shall be maintained (see clause 4.2.4).

Clause 7.3.5 Design and development verification

Verification shall be performed in accordance with planned arrangements (see clause 7.3.1) to ensure that the design and development outputs have met the design and development input requirements. Records of the results of the verification and any necessary actions shall be maintained (see clause 4.2.4).

Clause 7.3.6 Design and development validation

Design and development validation shall be performed in accordance with planned arrangements (see clause 7.3.1) to ensure that the resulting product is capable of meeting
the requirements for the specified application or intended use, where known. Wherever practicable, validation shall be completed prior to the delivery or implementation of the product. Records of the results of validation and any necessary actions shall be maintained (see clause 4.2.4).

**Clause 7.3.7 Control of design and development changes**

Design and development changes shall be identified and records maintained. The changes shall be reviewed verified and validated, as appropriate, and approved before implementation. The review of design and development changes shall include evaluation of the effect of the changes on constituent parts and product already delivered. Records of the results of the review of changes and any necessary actions shall be maintained (see clause 4.2.4)

**Clause 7.4 Purchasing**

**Clause 7.4.1 Purchasing process**

The organization shall ensure that purchased product conforms to specified purchase requirements. The type and extent of control applied to the supplier and the purchased product shall be dependent upon the effect of the purchased product on subsequent product realization or the final product. The organization shall evaluate and select suppliers based on their ability to supply product in accordance with the organization’s requirements. Criteria for selection, evaluation and re-evaluation shall be established. Records of the results of evaluations and any necessary actions arising from the evaluation shall be maintained (see clause 4.2.4).

**Clause 7.4.2 Purchasing Information**

Purchasing information shall describe the product to be purchased, including, where appropriate,

a) requirements for approval of product, procedures, processes and equipments.

b) requirements for qualification of personnel, and

c) quality management system requirements
The organization shall insure the adequacy of specified purchase requirements prior to their communication to the supplier.

**Clause 7.4.3 Verification of purchased product**

The organization shall establish and implement the inspection or other activities necessary for ensuring that purchased product meets specified purchased requirements.

Where the organization or its customers intents to perform verifications at the supplier’s premises, the organization shall state the intended verifications arrangements and method of product release in the purchasing information.

**Clause 7.5 Production and service provision**

**Clause 7.5.1 Control of production and service provision**

The organization shall plan and carry out production and service provision under controlled conditions. Controlled conditions shall include, as applicable,

a) the availability of information that describes the characteristic of the product,
b) the availability of work instructions, as necessary,
c) the use of suitable equipment,
d) the availability and use of monitoring and measuring equipment,
e) the implementation of monitoring and measuring, and
f) the implementation of product release, delivery and post delivery activities.

**Clause 7.5.2 Validation of processes for production and service provision**

The organization shall validate any processes for production and service provision where the resulting output cannot be verified by subsequent monitoring or measurement and, as a consequence, deficiencies become apparent only after the product is in use the service has been delivered.

Validation shall demonstrate the ability of these processes to achieve planned results.

The organization shall establish arrangements for these processes including, as applicable,
a) defined criteria for review and approval of the processes,
b) approval of equipment and qualification of personnel,
c) use of specific methods and procedures,
d) requirements for records (see clause 4.2.4), and
e) revalidation.

Clause 7.5.3 Identification and traceability

Where appropriate, the organization shall identify the product by suitable means throughout product realization.

The organization shall identify the product status with respect to monitoring and measurement requirements throughout product realization.

Where traceability is a requirement, the organization shall control the unique identification of the product and maintain records (see clause 4.2.4).

NOTE in some industry sector, configuration management is a means by which identification and traceability are maintained.

Clause 7.5.4 Customer property

The organization shall exercise care with customer property while it is under the organization’s control or being used by the organization. The organization shall identify, verify, protect and safeguard customer property provided for use or incorporation into the product. If any customer property is lost, damaged or otherwise found to be unsuitable for use, the organization shall report this to the customer and maintain records (see clause 4.2.4).

NOTE customer property can include intellectual property and personal data.

Clause 7.5.5 Preservation of product

The organization shall preserve the product during internal processing and delivery to the intended destination in order to maintain conformity to requirements. As applicable, preservation shall include identification, handling, packaging, storage and protection. Preservation shall also apply to the constituent parts of a product.
Clause 7.6 Control of monitoring and measuring equipment

The organization shall determine the monitoring and measurement to be undertaken and the monitoring and measuring equipment needed to provide evidence of conformity of product to determined requirements.

The organization shall establish processes to ensure that monitoring and measurement can be carried out and are carried out in a manner that is consistent with the monitoring and measurement requirements.

Where necessary to ensure valid results, measuring equipment shall

a) Be calibrated or verified, or verified, or both, at specified intervals, or prior to use, against measurement standards traceable to international or national measurement standards; where no such standards exist, the basis used for calibration or verification shall be recorded (see clause 4.2.4);

b) Be adjusted or re-adjusted as necessary;

c) Have identification in order to determine its calibration status;

d) Be safeguard from adjustments that would invalidate the measurement result;

e) Be protected from damage and deterioration during handling, maintenance and storage.

In addition, the organization shall assess and record the validity of the previous measuring results when equipment is found not to conform to requirements. The organization shall take appropriate action on the equipment and any product affected.

Records of the results of calibration and verification shall be maintained (see clause 4.2.4).

When used in the monitoring and measurement of specified requirements, the ability of computer software to satisfy the intended application shall be confirmed. This shall be undertaken prior to initial use and reconfirmed as necessary.

NOTE confirmation of the ability of computer software to satisfy the intended application would typically include its verification and configuration management to maintain its suitability for use.
Clause 8 Measurement, analysis and improvement

Clause 8.1 General

The organization shall plan and implement the monitoring, measuring, analysis and improvement processes needed

a) To demonstrate conformity to product requirements,
b) To ensure conformity of the quality management system, and
c) To continually improve the effectiveness of the quality management system.

This shall include determination of applicable methods, including statistical techniques, and the extent of their use.

Clause 8.2 Monitoring and Measurement

Clause 8.2.1 Customer satisfaction

As one of the measurements of the performance of the quality management system, the organization shall monitor information relating to customer perception as to whether the organization has met customer requirements. The methods for obtaining and using this information shall be determined.

NOTE monitoring customer perception can include obtaining input from sources such as customer satisfaction surveys, customer data on delivered product quality, user opinion surveys, lost business analysis, compliments, warranty claims and dealer reports.

Clause 8.2.2 Internal audit

The organization shall conduct internal audits at planned intervals to determine whether the quality management system

a) Conforms to the planned arrangements (see clause 7.1), to the requirements of the international standard and to the quality management system requirements establishes by the organization, and
b) Is effectively implemented and maintained.
An audit programme shall be planned, taking into consideration the status and importance of the processes and areas to be audited, as well as the results of previous audits. The audit criteria, scope, frequency and methods shall be defined. The selection of auditors and conduct of audits shall ensure objectivity and impartiality of the audit process. Auditors shall not audit their own work.

A documented procedure shall be established to define the responsibilities and requirements for planning and conducting audits, establishing records and reporting results.

Records of the audits and their results shall be maintained (see clause 4.2.4).

The management responsible for the area being audited shall ensure that any necessary corrections and corrective actions are taken without undue delay to eliminate detected non-conformities and their causes.

Follow-up activities shall include the verification of the actions taken and the reporting of verification results (see clause 8.5.2).

**Clause 8.2.3 Monitoring and measurement of processes**

The organization shall apply suitable methods for monitoring and, where applicable, measurement of the quality management system processes. These methods shall demonstrate the ability of the processes to achieve planned results. When planned results are not achieved, correction and corrective action shall be taken, as appropriate.

NOTE when determining suitable methods, it is advisable that the organization consider the type and extent of monitoring or measurement appropriate to each of its processes in relation to their impact on the conformity to product requirements and on the effectiveness of the quality management system.

**Clause 8.2.4 Monitoring and measurement of product**

The organization shall monitor and measure the characteristics of the product to verify that product requirements have been met. This shall be carried out at appropriate stages of the product realization process in accordance with the planned arrangements (see clause 7.1). Evidence of conformity with the acceptance criteria shall be maintained.
Records shall indicate the person(s) authorizing release of product for delivery to the customer (see clause 4.2.4)

The release of product and delivery of service to the customer shall not proceed until the planned arrangements (see clause 7.1) have been satisfactorily completed, unless otherwise approved by a relevant authority and, where applicable, by the customer.

**Clause 8.3 Control of non conforming product**

The organization shall ensure that product which does not conform to product requirements is identified and controlled to prevent its unintended use or delivery. A documented procedure shall be established to define the controls and related responsibilities and authorities for dealing with non conforming product.

Where applicable, the organization shall deal with non conforming product by one or more of the following ways:

a) By taking action to eliminate the detected non conforming;

b) By authorizing its use, release or acceptance under concession by a relevant authority and, where applicable, by the customer;

c) By taking action to preclude its original intended use or application;

d) By taking action appropriate to the effects, or potential effects, of the non conformity when non conforming product is detected after delivery or use has started.

e) When non conforming product is corrected it shall be subject to re-verification to demonstrate conformity to the requirements.

Records of the nature of non conformities and any subsequent actions taken, including concessions obtained, shall be maintenance (see clause 4.2.4).

**Clause 8.4 Analysis of data**

The organization shall determine, collect and analyze appropriate data to demonstrate the suitability and effectiveness of the quality management system and to evaluate where continual improvement of the effectiveness of the quality management system can be made.
This shall include data generated as a result of monitoring and measurement and from other relevant sources.

The analysis of data shall provide information relating to

a) Customer satisfaction (see clause 8.2.1),

b) Conformity to product requirements (see clause 8.2.4),

c) Characteristics and trends of processes and products, including opportunities for preventive action (see clause 8.2.3 and 8.2.4), and

d) Suppliers (see clause 7.4).

Clause 8.5 Improvement

Clause 8.5.1 Continual improvement

The organization shall continually improve the effectiveness of the quality management system through the use of the quality policy, quality objectives, audit results, analysis of data, corrective and preventive actions and management review.

Clause 8.5.2 Corrective action

The organization shall take action to eliminate the causes of non conformities in order to prevent recurrence. Corrective actions shall be appropriate to the effects of the non conformities encountered.

A documented procedure shall be established to define requirements for

a) Reviewing non conformities (including customer complaints),

b) Determining the causes of nonconformities,

c) Evaluating the need for action to ensure that non conformities do not recur

d) Determining and implementing actions needed,

e) Records of the results of actions taken (see clause 4.2.4), and

f) Reviewing the effectiveness of the corrective action taken.
**Clause 8.5.3 Preventive action**

The organization shall determine action to eliminate the causes of potential non conformities in order to prevent recurrence. Preventive actions shall be appropriate to the effects of the potential problems.

A documented procedure shall be established to define requirements for

- a) Determining potential nonconformities and their causes,
- b) Evaluating the need for action to prevent occurrence of non conformities
- c) Determining and implementing actions needed,
- d) Records of the results of actions taken (see clause 4.2.4), and
- e) Reviewing the effectiveness of the preventive action taken.

**ISO 9001 AND PRODUCTIVITY**

**VII. Productivity** - Productivity refers to the physical relation between the quality produced (output) and the quantity of resource used in the course of production (input)

\[
\text{Productivity (P)} = \frac{\text{Output}}{\text{Input}}
\]

Output implies production while input means land, labour, capital, management etc. Productivity measures the efficiency of the production system. Higher productivity means producing more from a given amount of input or producing a given amount with minimum level of inputs. Productivity and production are two different terms. Productivity is a relative term indicating the ratio between total output and the total inputs used therein on the other hand production is an absolute concept, which refers to the volume of output. The volume of production may increase but productivity may decline due to inefficient use of resource. Efficient use of input may increase productivity but the volume of production may not increase. Production refers to the end result of production system whereas productivity reflects its efficiency.
SIGNIFICANCE

Benefits derived from higher productivity are as follows:

1. It helps to cut down cost per unit and thereby improve the profits.

2. Gains from productivity can be transferred to the consumers in form of lower priced products or better quality products.

3. These gains can also be shared with workers or employees by paying them at higher rate.

4. A more productive entrepreneur can have better chances to exploit export opportunities.

5. It would generate more employment opportunities.

FACTORS INFLUENCING PRODUCTIVITY

Productivity is outcome of several interrelated factors, which may broadly be divided into two categories- human factors and technological factors.

1. Human Factors: Human behaviour is the most significant determinant of productivity. Human factors include both their ability as well as their willingness:

   (a) Ability to work: Productivity of an organization depends upon the competence and calibre of its people-both workers and managers Ability to work is governed by education, training, experience, aptitude, etc. of the employees.

   (b) Willingness to work: Motivation and morale of people are very important factors that determine productivity. These are affected by wage incentive schemes, labour participation in management, communication systems, informal group relations, promotion policy, union management relations, quality of leadership, working hours, sanitation, and ventilation, subsidized canteen, company transport, etc.

2. Technological Factors: Technological factors exert significant influence on the level of Productivity. These include the following:
(a) Size and capacity of plant

(b) Product design and standardization

(c) Timely supply of materials and fuel

(d) Rationalization and automation measures

(e) Repairs and maintenance

(f) Production planning and control

(g) Plant layout and location

(h) Materials handling system

(i) Inspection and quality control

(j) Machinery and equipment used

(k) Research and development

(l) Inventory control

3. Managerial factors: The competence and attitudes of managers have an important bearing on productivity. In many organizations, productivity is low despite latest technology and trained manpower. This is due to inefficient and indifferent management. Competent and dedicated managers can obtain extraordinary results from ordinary people. Job performance of employees depends on their ability and willingness to work. Management is the catalyst to create both. Advanced technology requires knowledgeable workers who in turn work productively under professionally qualified managers. No ideology can win a greater output with less effort. It is only through sound management that optimum utilization of human and technical resources can be secured.
4. **Natural Factors:** Natural factors such as physical, geographical and climate conditions exert considerable influence on productivity, particularly in extreme climates (too cold or too hot) tends to be comparatively low. Natural resources like water, fuel and minerals influence productivity.

5. **Sociological Factors:** Social customs, traditions and institutions influence attitudes towards work and job. For instance, bias on the basis of caste, religion, etc., inhibited the growth of modern industry in some countries. The joint family system affected incentive to work hard in India. Close ties with land and native place hampered stability and discipline among industrial labour.

6. **Political Factors:** Law and order, stability of Government, harmony between States, etc. are essential for high productivity in industries Taxation policies of the Government influence willingness to work, capital formation, modernization and expansion of plants etc. Industrial policy affects the size, and capacity of plants. Tariff policies influence competition. Elimination of sick and inefficient units also helps to improve productivity.

7. **Economic Factors:** Size of the market, banking and credit facilities, transport and communication systems, etc. is important factors influencing productivity.

**VIII. Variables for evaluating the impact of ISO 9001 implementation on the productivity of selected sectors:**

   a) **Input variables:** Training, quality awareness among employees, employees’ morale, and motivation critical factors for the productivity of the employees. Through the standardization the reduction in the accidents, inefficiency and other rework and complaints.

   b) **Output variables:** Total productivity, Net profit margin, Return on assets, Sales growth.

The statistics and relevant information being compiled from different sources of data like prowess data base, The economic times and websites www.bse.com. The study preferred ATO (Asset turnover ratio) which signifies the firm’s ability to use assets productively and NPM (Net
Profit Margin). The methodology adopted for study is similar to that used by D’Archimoles, Treburg, Borstadt and Zwerlein. The data set analyzed for getting productivity index by

\[
\text{Assets Turnover Ratio} = \frac{\text{Sales}}{\text{Total assets}}
\]

Productivity issues are either becoming increasingly important in the United States. By improving the quality, resultantly improved productivity, helps to capture the market with lower price and better quality. Improve reliability or conformance to standards leads to increased productivity and efficiency and decreased scrap or rework costs and product liability costs, resulting to decreased manufacturing service costs. These then leads to higher profit (Gravin, 1984). An ISO 9000 and Six Sigma share a focus on improving and adhering to repeatable organizational processes as a mechanism for the improving quality, efficiency and financial performance. These programs being with mapping or documenting an organization’s operating processes (e.g. Dean and Bowen, 1994; Hackman and Wageman, 1995, Hammer and Champy, 1993; ISO 2007). This is typically followed by concerted efforts to improve and streamline processes by eliminating the wasted steps and coordinating the handoffs between processes across the organization (e.g. Hackman and Wageman, 1995; would act as and incentive to act as an incentive to increase productivity and performance. An economically viable only it improves productivity and firms performance through quality management by improving employees.

Certain parameters are selected to evaluate the productivity of the companies on the basis of above mention variables such as total productivity, sales growth, net profit margin, and return on assets.

a) **Total productivity**: A general definition is that productivity is the relationship between the output generated by a production or service system and the input provided to create this output. Thus productivity is defined as an efficient use of resources labour, capital, land, material, energy and information- in the production of various goods and services. Higher productivity means accomplishing more with the same amount of resources or achieving higher output in terms of volume and quality for the same input. This is usually stated as:
Total Productivity = \frac{Output}{Input}

\text{(In Rupees)}

Total Productivity = \frac{Total income}{Total expenses}

b) \textbf{Net profit margin:} Profit margin, net profit margin or net profit ratio all refer to a measure of profitability. It is calculated by finding the net profit as a percentage of the revenue.

Where,

Net Income = Revenue - Cost

The profit margin is mostly used for internal comparison. It is difficult to accurately compare the net profit ratio for different entities. Individual businesses' operating and financing arrangements vary so much that different entities are bound to have different levels of expenditure, so that comparison of one with another can have little meaning. A low profit margin indicates a low margin of safety: higher risk that a decline in sales will erase profits and result in a net loss, or a negative margin.

Profit margin is an indicator of a company's pricing strategies and how well it controls costs. Differences in competitive strategy and product mix cause the profit margin to vary among different companies.

c) \textbf{Return on Assets:} The percentage shows how profitable a company’s assets are in generating revenue. It reflects how much the company has earned on the investment of all the financial resources committed to the company. In this ratio the base set equal to the sum of equity and all liability- the total source of fund invested in the company’s assets. ROA shows how well the company has used its funds irrespective of the relative magnitude of the sources of those funds (current liabilities, long term liability and equity). As the ROA ratio brings in the debt element of the company as well it affords the comparison between the efficiency of the companies with different debt and equity ratios.

The ROA ratios are used to evaluate the management performance at corporate level and at the individual business unit level (division within the company). The business unit managers usually having a significant influence over the assets used in business unit but it has a little control over how those assets are financed.
Return on Assets (ROA) = \frac{\text{Net profit}}{\text{Average Total assets}}

ROA gives an indication of the capital intensity of the company. Companies required large initial investment will generate have lower return on assets. It is also indicates that how profitable a company is before leverage, and is compared with other companies.

d) **Sales growth rate:** Sales growth rate is used to measure the growth in current year sales as compare to the base year sales. Following formulae has been used to know the sales growth rate:

\[
\text{Sales growth Rate (SGR)} = \frac{\text{Current year sales} - \text{last year sales}}{\text{Last year sales}} \times 100
\]

**Role of quality in productivity:**

Productivity has become a household word as almost everyone talks about it. Yet, the term ‘productivity’ means different things to different persons. As a phenomenon, it ranges from efficiency to effectiveness, to rates of turnover and absenteeism, to output measures, to measure of client or consumer satisfaction, to intangibles such as disruption in workflow and to further intangibles such as morale, loyalty and job satisfaction. To put it bluntly, the definition of productivity is complex and this is because it is both a technical and managerial concept. Productivity is a matter of concern to government bodies, trade unions and other social institutions not minding the disagreements over its conceptualization by different groups and individuals.

Hence, productivity at all levels is common because of the direct relationship between productivity and the standard of living of a people. It is perceived that the more different are the goals of the different individuals, institutions and bodies that have a stake in productivity as a problem, the more different their definitions of productivity will be. To date, at least three perspectives have dominated the field of productivity namely economics, industrial engineering, and administration. These perspectives have complicated a search for any precise definition of the concept ‘productivity’. One additional problem to the conceptualization of the term ‘productivity’ is the fact that productivity is not only to be defined and managed; it is also to be
measured. Its measurement poses no fewer problems than its definition. Perhaps, Krugman (1990) intended to assert that defining or measuring productivity is a Herculean task when he asserted that “productivity isn’t everything, but in the long run it is almost everything”. Here I attempt to demystify productivity conceptually by examining in detail what productivity is and what it is not. Enhanced understanding of the meaning of productivity is likely to be guaranteed if its measurement is equally examined to attempt a balance between theory of productivity and practice of productivity. This will delve into issues of productivity measurement whereby conscious effort will be made to define what is definable, measure what is measurable and count what is countable? In effect, productivity becomes the attainment of the highest level of performance with the lowest possible expenditure of resources. It represents the ratio of the quality and quantity of products to the resources utilized.

With management functions getting more complex, maintenance of quality in functional areas is becoming increasingly challenging. Organizations, which have successfully implemented ISO 9001, always promote customer relations, and quality is closely knitted in their corporate strategy. An organization is a system of interrelated units, and for ISO 9001 to succeed in all the entities within the organization, all the units have to be involved totally. In the initial stages, organizations used to implement ISO 9001, on the assumption that improvement in the shop floor activities would solve all existing productivity and quality problems. TQM (Total Quality Management) is a management approach originated in 80's in developed countries. It is considered a revolutionary step forward to improve business efficiency it redefines quality and upgrades its importance within the company. The top management is involved totally and stands committed. Under TQM, everybody becomes a quality leader. The customer defines quality, and the requirements of the customers are treated very seriously and these are met promptly and satisfactorily. The working level personnel are empowered and this enables them to carry out innovations which will help eventually to reduce scrap, rework and cut costs. Everyone works towards a common goal. Training imparted to the top management makes identification of critical success factors of the organization easy.

One of the most important issues that businesses have focussed on in the last 20 to 30 years has been quality. Quality is the first and foremost about meeting the needs and expectations of the customers. Here, customer means anyone who is impacted by the product or process. Quality
management is a process of identifying and administering the activities needed to achieve the quality objectives of an organisation. It is important to understand that quality management is concerned with controlling activities with the aim of ensuring that products and services are fit for their purpose and meet the specifications.

BACKGROUND OF SECTORS SELECTED AMONG ALL THE SECTORS OF ECONOMY

I. **Steel sector:**

**At Global Scenario:**

In 2011 the world crude steel production reached 1518 million tonnes (mt) and showed a growth of 6.2% over 2010. *(Source: World Steel Association or WSA).* China remained the world’s largest crude steel producer in 2011 (684 mt) followed by Japan (108 mt), the USA (86.4 mt) and India (72.2 mt; prov) at the 4th position (72.2 mt). The WSA has projected that global apparent steel use will increase by 3.6% to 1422 Mt in 2012, following growth of 5.6% in 2011. In 2013, it is forecast that world steel demand will grow further by 4.5% to around 1486 Mt. China’s apparent steel use in 2012 and 2013 was expected to increase by 4% in both the years. For India, growth in apparent steel use is expected to grow by 6.9% in 2012 and by 9.4% in 2013. Per capita finished steel consumption in 2011 is estimated at 215 kg for world and 460 kg for China.

**Domestic Scenario:**

The Indian steel industry has entered into a new development stage from 2007-08, riding high on the resurgent economy and rising demand for steel. Rapid rise in production has resulted in India becoming the 4th largest producer of crude steel and the largest producer of sponge iron or DRI in the world. As per the report of the Working Group on Steel for the 12th Plan, there exist many factors which carry the potential of raising the per capita steel consumption in the country, currently estimated at 55 kg (provisional). These include among others, an estimated infrastructure investment of nearly a trillion dollars, a projected growth of manufacturing from current 8% to 11-12%, increase in urban population to 600 million by 2030 from the current
level of 400 million, emergence of the rural market for steel currently consuming around 10 kg per annum buoyed by projects like Bharat Nirman, PradhanMantri Gram SadakYojana, Rajiv Gandhi AwaasYojana among others.

At the time of its release, the National Steel Policy 2005 had envisaged steel production to reach 110 million tonnes by 2019-20. However, based on the assessment of the current ongoing projects, both in greenfield and brownfield, the Working Group on Steel for the 12th Plan has projected that the crude steel capacity in the country is likely to be 140 mt by 2016-17 and has the potential to reach 149 mt if all requirements are adequately met. The National Steel Policy 2005 is currently being reviewed keeping in mind the rapid developments in the domestic steel industry (both on the supply and demand sides) as well as the stable growth of the Indian economy since the release of the Policy in 2005. Steel industry was delicensed and decontrolled in 1991 & 1992 respectively. Today, India is the 4th largest crude steel producer of steel in the world. In 2011-12 (prov), production for sale of total finished steel (alloy + non alloy) was 73.42 mt. Production for sale of Pig Iron in 2011-12 (prov), was 5.78 mt. India is the largest producer of sponge iron in the world with the coal based route accounting for 76% of total sponge iron production in the country (20.37 mt in 2011-12; prov.): Last five year's production for sale of pig iron, sponge iron and total finished steel (alloy + non-alloy) are given below:

<table>
<thead>
<tr>
<th>Indian Steel Industry: Production for Sale (in million tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category</td>
</tr>
<tr>
<td>Pig Iron</td>
</tr>
<tr>
<td>Total Finished Steel (alloy + non alloy)</td>
</tr>
</tbody>
</table>

Source: Joint Plant Committee; *provisional (2012)

Opportunities for growth of Iron and Steel in Private Sector: The New Industrial policy opened up the Indian iron and steel industry for private investment by (a) removing it from the list of industries reserved for public sector and (b) exempting it from compulsory licensing. Imports of foreign technology as well as foreign direct investment are now freely permitted up to
certain limits under an automatic route. Ministry of Steel plays the role of a facilitator, providing broad directions and assistance to new and existing steel plants, in the liberalized scenario.

(i) Steel

The liberalization of industrial policy and other initiatives taken by the Government have given a definite impetus for entry, participation and growth of the private sector in the steel industry. While the existing units are being modernized/expanded, a large number of new steel plants have also come up in different parts of the country based on modern, cost effective, state of-the-art technologies. In the last few years, the rapid and stable growth of the demand side has also prompted domestic entrepreneurs to set up fresh Greenfield projects in different states of the country.

Crude steel capacity was 89 mt in 2011-12 (prov) and India, the 4th largest producer of crude steel in the world, has to its credit, the capability to produce a variety of grades and that too, of international quality standards. The country is expected to become the 2nd largest producer of crude steel in the world by 2015-16, provided all requirements for creation of fresh capacity are adequately met.

(ii) Pig Iron

India is also an important producer of pig iron. Post-liberalization, with setting up several units in the private sector, not only imports have drastically reduced but also India has turned out to be a net exporter of pig iron. The private sector accounted for 91% of total production for sale of pig iron in the country in 2011-12 (provisional). The production of pig iron has increased from 1.6 mt in 1991-92 to 5.78 mt in 2011-12 (provisional).

(iii) Sponge Iron

India is the world’s largest producer of sponge iron with a host of coal based units, located in the mineral-rich states of the country. Over the years, the coal based route has emerged as a key contributor and accounted for 76% of total sponge iron production in the country (20.37 mt in
Capacity in sponge iron making too has increased over the years and stands at around 35 mt.

**Background of selected companies from steel sector:**

1. **Tata Steel Ltd:** Established in 1907, Tata Steel is among the top ten global steel companies with an annual crude steel capacity of over 28 million tonnes per annum (mt). It is now one of the world's most geographically-diversified steel producers, with operations in 26 countries and a commercial presence in over 50 countries. Tata Steel’s vision is to be the world’s steel industry benchmark through the excellence of its people, its innovative approach and overall conduct. Underpinning this vision is a performance culture committed to aspiration targets, safety and social responsibility, continuous improvement, openness and transparency. Tata Steel’s larger production facilities include those in India, the UK, Netherlands, Thailand, Singapore, China and Australia. Operating companies within the Group include Tata Steel Limited (India), Tata Steel Europe Limited (formerly Corus), NatSteel, and Tata Steel Thailand (formerly Millennium Steel).

2. **SAIL:** Steel Authority of India Limited (SAIL) is the leading steel-making company in India. It is a fully integrated iron and steel maker, producing both basic and special steels for domestic construction, engineering, power, railway, automotive and defence industries and for sale in export markets. SAIL is also among the five Maharatnas of the country's Central Public Sector Enterprises. SAIL manufactures and sells a broad range of steel products, including hot and cold rolled sheets and coils, galvanized sheets, electrical sheets, structural, railway products, plates, bars SAIL's International Trade Division (ITD), in New Delhi- an ISO 9001:2000 accredited unit of CMO, undertakes exports of Mild Steel products and Pig Iron from SAIL’s five integrated steel plants.

With technical and managerial expertise and know-how in steel making gained over four decades, SAIL's Consultancy Division (SAILCON) at New Delhi offers services and consultancy to clients world-wide. SAIL has a well-equipped Research and Development Centre for Iron and Steel (RDCIS) at Ranchi which helps to produce quality steel and develop new technologies for the steel industry. Besides, SAIL has its own in-house Centre for Engineering
and Technology (CET), Management Training Institute (MTI) and Safety Organization at Ranchi. Our captive mines are under the control of the Raw Materials Division in Kolkata. The Environment Management Division and Growth Division of SAIL operate from their headquarters in Kolkata. Almost all our plants and major units are ISO Certified.

3. **Jindal Steel Ltd**: Jindal SAW Ltd. is a part of the USD $ 16.5 billion O.P. Jindal Group, one of the country's topmost industry houses and the foremost indigenous steel producers and exporters. It started operation in the year 1984, when it became the first company in India to manufacture Submerged Arc Welded (SAW) Pipes using the internationally acclaimed U-O-E technology.

4. **Jindal SAW Ltd**: This company is in a commanding position in India’s tubular market, being the undisputed leader with a turnover in excess of Rs. 7500 Crore. With integrated facilities at multiple locations and an ever expanding market opportunity, Jindal SAW Ltd. has diversified from a single product company to a multi-product company, manufacturing large diameter submerged arc pipes and spiral pipes for the energy transportation sector; carbon, alloy and stainless steel seamless pipes and tubes manufactured by conical piercing process used for industrial applications; and Ductile iron (DI) pipes for water and wastewater transportation. Besides these, the company also provides various value added products like pipe coatings, bends and connector castings to its clients. Over the years Jindal SAW has continued to gain the confidence and trust of its stakeholders - from employees, associates, shareholders and people whose lives have benefitted by the company’s endeavours.

With its vision of sustainable development firmly in place, Jindal SAW has played a leading role in developing liveable cities across the world - that in turn has helped transform the lives of people staying in them. JSW Steel is India’s largest integrated steel producer with a capacity of 14 MTPA. The Group is also leading from the front in every sector that it operates in. By maintaining exemplary operational efficiencies, JSW Energy has grown ten-fold in just three years while JSW Cement creates the building blocks of India with its environment friendly product. JSW Infrastructure is contributing to the nation’s development by providing world class services to clients through state-of-the-art ports, terminals, shipyards and other facilities.

Our ethical practices, transparent businesses, strong Corporate Governance and focused employees have contributed to make every endeavour a success. And we are not stopping here.
Expansions, upgradation and technological innovations are a way of life at JSW and we are focused on becoming the Company that puts India on the global map by developing vibrant communities along the way. The JSW Group is committed to creating more smiles at every step of the journey. JSW Foundation, the Group’s CSR and sustainability arm, is in constant pursuit of making life better for communities with its various initiatives in the fields of health, education, livelihood and sports along with art and culture. Our zero effluent plants, green townships and happy employees are changing the course of the nation with their spirited growth. JSW Group is proud to be charting a course to excellence that creates opportunities for every Indian and leads to the creation of a sustainable, dynamic and developed nation.

5. **Sesa Goa Ltd:** Sesa Goa Limited is India's largest producer and exporter of iron ore in the private sector. For more than five decades, Sesa is engaged in the business of exploration, mining and processing of iron ore. In fiscal 2011, it produced 18.8 million tonnes and 18.1 million tonnes (DMT) respectively of iron ore. In the same year, its turnover was above US$ 2 billion. Sesa is among the low-cost producers of iron ore in the World and is well placed to serve the growing demand of Asian countries. Sesa's iron ore markets/customers are primarily in China, India, Japan, Korea, Europe and other Asian countries. Sesa has mining operations in Goa and Karnataka in India. While iron ore from its Goa mines is shipped through the Mormugoa port, the ore from Karnataka mines is exported through the ports of Goa, Mangalore and Krishnapatnam. As of 31 March 2011, Sesa owns or has rights to reserves and resources of 306 million tonnes of iron ore; which has been independently reviewed and certified as per Joint Ore Reserves Committee (JORC) standards. Sesa Industries Limited and the Met Coke Division awarded ISO 14001 certification for their Environment Management Systems. This EMS is based on International Guidelines for Environment Management, ISO 14001: 1996

SESA now has the unique distinction of having all the three certification systems, ISO 9001 for Quality, ISO 14001 for Environment Management and OHSAS 18001 for Safety for three of its Divisions: Mining, Pig Iron and Met Coke and 9001: 2000. SESA Goa won a Special Commendation Award for its all-round efforts at the 5th International Trade Fair and Seminar on Minerals, Metals, Metallurgy and Materials (MMMM - 2004). SESA Goa Limited was adjudged the Best Established Value Creator (Runner-Up-Large Size) for the Year 2004 by the Outlook.
6. **Bhushan Steel Limited:**

Bhushan Steel Ltd is engaged in the steel business. The company has a portfolio of flat products, which are manufactured at steel processing facilities at Sahibabad, Uttar Pradesh. The company is producing cold rolled close annealed coils (CRCA), galvanized sheets, precision tubes, high tensile steel, hardened and tempered steel strip (H&T strips), wire-rods, color-coated sheets and galume. They also produce, sponge iron, pig iron, billets, slabs, HRC and power. Bhushan Steel Ltd was incorporated on January 7, 1983 with the name Jawahar Metal Industries Pvt Ltd. In January 14, 1987, Brij Bhushan Singal and his sons Sanjay Singal, Neeraj Singal and associate companies took over the management of the company by acquiring the entire stake.

In the year 1989, the company became a deemed public limited company. In the year 1992, the company was renamed as Bhushan Steel and Strips Ltd after diversifying into wide-width cold-rolled (CR) steel strips. Also, they completed the cold rolling plant during the year. In the year 1993, the company came out with their first public issue to finance their forward integration project for the manufacture of 1,00,000tpa of continuous annealed/ galvanised steel strips. In January 1994, the company commissioned the galvanising plant with a capacity to manufacture 120000 tonnes per annum of wide width cold rolled steel strips and 100000 tonnes per annum of galvanised sheets. In April 1995, the company came out with their second public issue to part-finance for project of setting up of facilities to manufacture an additional 1,50,000 TPA of CRCA and 40,000 TPA of GP/GC sheets. In the year 1998, the company commissioned a cold rolled steel plant at Ghaziabad, in collaboration with Sumitomo of Japan to cater to the needs of the automotive sector. In the year 1999, the company also set up a dedicated service centre for large OEM customers at Sahibabad. In the year 2000, the company approved the amalgamation of Bhushan Ltd with the company. In the year 2001, the company implemented the expansion project of 2,50,000 TPA of Cold Rolling Cum Galvanising & Tube Complex in Khopoli, Maharashtra at cost of Rs 4860 million. In the year 2003, they entered into a strategic alliance with Sumitomo Metal Industries of Japan for the process know-how regarding the manufacture of automotive steel sheets.

The company changed their name from Bhushan Steel and Strips Ltd to Bhushan Steel Ltd with effect from April 12, 2007. During the year 2007-08, the company successfully
completed Phase I of the Orissa Project. The company started the production facilities of Sponge Iron (680000 tpa), Billets (300000 tpa) and Power Plant (110 MW) thus completing Phase-I of Orissa Project on schedule. The company has acquired a major stake in Bowen Energy Ltd of Australia. Additionally, through their 100% subsidiary Bhushan Steel (Australia) Pty Ltd, the company entered into a JV to develop their coking coal/thermal coal projects in Australia. The company incorporated two wholly owned subsidiaries namely Bhushan Steel (Australia) Pty Ltd and Bhushan Steel Global FZE. During the year 2008-09, the company successfully commissioned the Cold Rolling Mill (narrow) 50000 tpa, Tube Mill (40000 tpa) and balancing equipment viz. Pass Mill, CR siltler, Cut to Length Line and annealing furnaces etc. at existing Khapoli Plant.

The company also commissioned two Hardened and Tempered Lines of 2500 tpa each. The company has been allotted one prospecting License by Ministry of Mines, Govt. of India for Iron Ore over an area of 281 Hectares in villages Marsuan, Tiriba and Narsinghpur, District Keonjhar of Orissa. The company signed an MOU with Bowen Energy Ltd (BWN), an exploration company in Australia to meet long term requirements of the Coke for the Orissa Project. BWN has the license for exploring three coking coal mines in Bowen Basin in Queensland, near to Brisbane. During the year 2009-10, the company along with Railway Vikas Nigam Ltd and Jindal Steel & Power Ltd formed a special purpose vehicle (SPV) under the name and style of Angul Sukinda Railway Ltd for the construction of new railway line in the jurisdiction of East Coast Railway between Angul in Angul district, Orissa to Sukinda Road in Jajpur district, Orissa. The company acquired Bowen Energy Ltd, Australia through wholly-owned subsidiary, which has coking coal mines in Queensland, Australia. The Ministry of Coal, Government of India allotted Andal East Coal Block jointly to the company, Jai Balaji Steel Ltd and Rashmi Cement Ltd. As per the terms of the allotment, three companies formed a joint venture company under the name and style of Andal East Coal Company Pvt Ltd for mining of coal from Andal East Coal Block. During the year 2010-11, the company partially installed the phase II of the integrated steel plant at Orissa with the production facility of Hot Roll Coil Mill (1.90 MTPA). The company started their backward integration with capacity of 1.9 MTPA of hot rolled steed at their integrated steel plant at Orissa coupled with another capacity expansion (a Brownfield one) which shall enhance the HR capacity to 4.40 MTPA by October 2012. The
company is also coming up with 0.50 MTPA ERW API pipe plant at Khopoli and 0.45 MTPA Collled Rolled Complex at Orissa which shall be ready by FY 13.

In order to maintain their leadership in this segment and to maximize the margins the company proposes to set up the downstream capacity of 1.8 MTPA, where the company shall set up PLTCM of 1.8 MTPA and CAL of 1 MTPA with the capex of around Rs 5000 crores to fully utilize their additional HR capacity. In addition, the company shall also be completing the second Coke oven plant (1.3 MTPA), Coal Washery (2.5 MTPA) and 2 DRI Kilns (aggregate capacity of 0.34 MTPA) and 197 MW Power Plant of the existing site of Integrated steel plant of Orissa.

II. Power sector:

The power sector in India is mainly governed by the Ministry of Power. There are three major pillars of power sector these are Generation, Transmission, and Distribution. As far as generation is concerned it is mainly divided into three sectors these are Central Sector, State Sector, and Private Sector. Central Sector or Public Sector Undertakings (PSUs), constitute 29.78% (62826.63MW) of total installed capacity i.e., 210951.72 MW (as on 31/12/2012) in India. Major PSUs involved in the generation of electricity include NHPC Ltd., NTPC Ltd., and Nuclear Power Corporation of India (NPCIL). Besides PSUs, several state-level corporations are there which accounts for about 41.10% of overall generation, such as Jharkhand State Electricity Board (JSEB), Maharashtra State Electricity Board (MSEB), Kerala State Electricity Board (KSEB), in Gujarat (MGVCL, PGVCL, DGVCL, UGVCL four distribution Companies and one controlling body GUVNL, and one generation company GSEC), are also involved in the generation and intra-state distribution of electricity. Other than PSUs and state level corporations, private sector enterprises also play a major role in generation, transmission and distribution, about 29.11%(61409.24MW) of total installed capacity is generated by private sector. The Power Grid Corporation of India is responsible for the inter-state transmission of electricity and the development of national grid.

The Ministry of Power is the apex body responsible for the development of electrical energy in India. This ministry started functioning independently from 2 July 1992; earlier, it was known as the Ministry of Energy. Due to India’s economic rise, the demand for energy has
grown at an average of 3.6% per annum over the past 30 years. At the end of December 2012, the installed power generation capacity of India stood at 210951.72MW, while the per capita energy consumption stood at 733.54 KWh (2008-09). The Indian government has set an ambitious target to add approximately 78,000 MW of installed generation capacity by 2012. The total demand for electricity in India is expected to cross 950,000 MW by 2030. India is the sixth largest in terms of power generation. About 65% of the electricity consumed in India is generated by thermal power plants, 22% by hydroelectric power plants, 3% by nuclear power plants and rest by 10% from other alternate sources like solar, wind, biomass etc. 53.7% of India’s commercial energy demand is met through the country’s vast coal reserves.

Electricity losses in India during transmission and distribution are extremely high, about 28.44% (2008-09). India needs to tide over a peak power shortfall of 13% between 5pm and 11pm by reducing losses due to theft and pilferage. Due to shortage of electricity, power cuts are common throughout India and this has adversely effected the country’s economic growth. Theft of electricity, common in most parts of urban India, amounts to 1.5% of India’s GDP. The condition of utilities are not good either, cumulative loss of 110 power utilities are estimated as Rs 86,136 crores which is expected to rise to Rs 1,16,089 crores by 2014-15. Despite an ambitious rural electrification program, some 400 million Indians lose electricity access during blackouts. While 84.9% of Indian villages have at least an electricity line, just 46 percent of rural households have access to electricity (Data Source CEA, as on 31/12/2012).

Energy is one of the major inputs for economic development of any country. In the case of the developing countries like India the energy sector assumes a critical importance in view of the ever-increasing energy needs requiring huge investments to meet them. India’s per capita electrical energy consumption is targeted for 50% growth in the Eleventh five year plan from present level of 704 units per year. Therefore, it considered as backbone of industrial & agricultural growth.

Presently India is facing serious challenges of energy security threat due to short fall of peak power supply by 16.6% & energy supply by 9.6%, Crude oil domestic source meets only 23% of demand, whereas shortfall in gas supply is up to 43%. Under the above scenario, coal based thermal power plant is being focused as major source of commercial energy. To meet the
demand of future energy requirement, not only growth of power sector is required but optimum utilization of existing resources in the energy sector is more important. Nuclear power though occupies only about three percent of energy basket, but it is targeted as one of the important source of power in the years to come. In this paper an effort has been made to focus on energy resources. An attempt is made to study the impact of ISO 9001 on the productivity of the power sector particularly.

**Background of companies’ selected:**

1. **Adani**, a conglomerate with a formidable presence in multiple businesses across the globe, has entered the power sector to haringer a ‘power full’ India, by generating 20,000 MW of power by 2020. Our comprehension of the criticality in meeting the power requirement and its crucial role in ensuring the energy security of India, spurs us to build India’s largest and one of the world’s top 5 single location thermal power plant in Mundra. Along with thermal power generation, Adani power has made a paradigm shift by venturing into solar power generation in Gujarat. It is Adani’s endeavour to empower one and all with clean, green power that is accessible and affordable for a faster and higher socio-economic development. We are achieving it with our out-of-the-box thinking, pioneering operational procedures, motivated team and a yen for trendsetting. Our enthusiasm and energy has earned us accomplishments that make us the FIRST, FASTEST AND LARGEST Power Company in many aspects. Adani Power Limited has commissioned the first supercritical 660 MW unit in the country. Mundra is also the WORLD’S FIRST supercritical technology project to have received ‘CLEAN DEVELOPMENT MECHANISM (CDM) Project’ certification from United Nations Framework Convention on Climate Change (UNFCCC). Adani power has the FASTEST turnaround time of projects in the industry poised to be the LARGEST private power generating company in India.

2. **The BHEL** had a high level of quality & reliability of their products is due to adherence to international standards by acquiring and adapting some of the best technologies from leading companies in the world including General Electric Company, Alstom SA, Siemens AG and Mitsubishi Heavy Industries Ltd., together with technologies developed in our own R&D centres. Most of their manufacturing units and other entities have been accredited to Quality Management Systems (ISO 9001:2008), Environmental Management Systems (ISO 14001:2004)
and Occupational Health & Safety Management Systems (OHSAS 18001:2007). They have a share of 59% in India’s total installed generating capacity contributing 69% (approx.) to the total power generated from utility sets (excluding non-conventional capacity) as of March 31, 2012. Continuous training and retraining, career planning, a positive work culture and participative style of management - all these have engendered development of a committed and motivated workforce setting new benchmarks in terms of productivity, quality and responsiveness.

3. **JSW Energy** is the dynamic vertical of JSW Group. The company plans to foray in all areas of power: Generation, Transmission, Distribution and Trading. In less than a decade of its operations the company has crossed several milestones working on power solutions in the States of Karnataka, Maharashtra, Rajasthan and Himachal Pradesh. The Company has forayed in all areas of power business with an operational capacity of 2600 MW and a generating capacity of 1050 MW in the construction and implementation phase. Aiming to generate 11770 MW, JSW Energy is treading to become one of the leading private power producers in the country. The Company is an early entrant in the Power generation, Power Trading & Transmission Business and is exploring opportunities in the power generation through non-conventional energy sources. Achieving 735 MW of Power Generation Capacity in a single year. Growing rapidly as a leading private power producer in the country. Ensuring fuel security JSW Energy acquired majority stake in South African Coal Mining Holding Limited. (SACMH) - a listed South African Company having 13 Million Tons of coal reserves through acquisition of shares in Royal Bafokeng Capital (RBC) and Mainsail. Having commissioned 55 Kms. Double circuit 400 KV transmission line from Jaigad to New Koyna and expecting to extend it to 110 Kms, Jaigad Karad transmission line in FY 2011-12, the Company has successfully established itself in Transmission business in joint venture with Maharashtra State Electricity Transmission Company limited (MSETCL).

4. **NTPC** has been operating its plants at high efficiency levels. Although the company has 19% of the total national capacity it contributes 29% of total power generation due to its focus on high efficiency. NTPC’s share at 31 Mar 2001 of the total installed capacity of the country was 24.51% and it generated 29.68% of the power of the country in 2008–09. Every fourth home in India is lit by NTPC. As at 31 Mar 2011 NTPC's share of the country's total installed capacity is 17.75% and it generated 27.4% of the power generation of the country in 2010-11. NTPC is
lighting every third bulb in India. 170.88BU of electricity was produced by its stations in the financial year 2005–2006. The Net Profit after Tax on 31 March 2006 was 58.202 billion. Net profit after tax for the quarter ended 30 June 2006 was 15.528 billion, which is 18.65% more than that for the same quarter in the previous financial year. It is listed in Forbes Global 2000 for 2011 ranked it 348th in the world.

5. **APAR Industries Ltd.**, incorporated in the year 1981, is one of the reckoned and quality conscious manufacturers and exporters of vast line of electrical and telecom cables, marketed under the brand name "UNICAB". Scaling new heights in its business domain, since inception, the company has established five major divisions for manufacturing and testing different power & telecom cables. The company is standing firm on the values of honesty and integrity, which together form the essential ingredients of its renowned business presence. Credible to all these, the company's brand "UNICAB" has become one of the known name amidst domestic and international telecom and power sector majors. Their production motto is “TO ATTAIN IMPROVED PRODUCTIVITY WITH CONSISTENT IMPROVEMENT IN QUALITY”.

6. **PGCL Power Grid Corporation of India Limited (POWERGRID)**, (NSE: POWERGRID, BSE: 532898) is an Indian state-owned electric utilities company headquartered in Gurgaon, India. Power Grid transmits about 50% of the total power generated in India on its transmission network. Power Grid has a pan-India presence with around 101,886 Circuit Kilometers of Transmission network and 170 EHVAC & HVDC sub-stations with a total transformation capacity of 168,063 MVA. The Inter-regional capacity is enhanced to 32,000 MW. Power Grid has also diversified into a Telecom business and established a telecom network of 29,279 Kilometers and points of presence in 210 locations across the country. Power Grid has consistently maintained the transmission system availability over 99.00% which is at par with the International Utilities. In 1980, the Rajadhyaksha Committee on Power Sector Reforms submitted its report to the Government of India suggesting extensive reforms in the Indian power sector. Pursuant to this decision to form a national power grid, Power Grid was incorporated on 23 October 1989 under the Companies Act, 1956 as the National Power Transmission Corporation Limited, with the responsibility of planning, executing, owning, operating and maintaining the high voltage transmission systems in the country. The Company received a certificate for commencement of business on 8 November 1990. Subsequently, the
name of the Company was changed to Power Grid Corporation of India Limited and took effect October 23, 1992. As of 30 September 2010, the total number of holders of Equity Shares of the Company was 792,096. The Company is presently listed on the BSE and the NSE. The Company is not operating under any injunction or restraining order.

Transfer of transmission assets from generating units Initially, the Company was engaged in the management of the transmission assets owned by the central generating companies such as the NTPC, NHPC Limited ("NHPC") and North-Eastern Electric Power Corporation Limited. In January 1993, the National Thermal Power Corporation Limited, the National Hydro Electric Power Corporation Limited and the North-Eastern Electric Power Corporation Limited (Acquisition and Transfer of Power Transmission Systems) Ordinance, 1993 ("Power Transmission Systems Ordinance") was enacted pursuant to which the right, title and interest of these three power generating companies in relation to the power transmission system, comprising the main transmission lines, including the extra high voltage alternative current transmission lines and the HVDC lines, and sub-stations, owned by them, were acquired by the GoI and transferred to the Company, with effect from 1 April 1992. Under the Power Transmission Systems Ordinance, the Company acquired all the rights, liabilities, assets, leaseholds, powers, authorities and privileges and all movable and immovable property relating to the power transmission systems owned by the three generating companies. The Power Transmission Systems Ordinance also provided that all employees of the three generating companies who were associated with power transmission systems would be deemed to be the employees of our Company. In April 1993, the Power Transmission System Ordinance became a statute after receiving the assent of the President of India.

III. Textile sector:

International scenario:

- China is the world’s 2nd largest economy with a GDP of USD 5.8 trillion and growing at a CAGR of 10% plus.
• As a natural transition to developed economy, China concentration on high end industries is increasing and textile is not as focused industry as it was 20 years back.

• Textile is an energy consuming industry. China has started facing problems for generation of power due to environmental concerns. China is a major contributor to CO2 emissions.

• With rising per capital income, China is becoming self consuming economy. Huge Domestic consumption growing at a CAGR of about 13% likely to impact Chinese ability to export.

The Indian textile industry has a significant presence in the economy as well as in the international textile economy. Its contribution to the Indian economy is manifested in terms of its contribution to the industrial production, employment generation and foreign exchange earnings. It contributes 20 percent of industrial production, 9 percent of excise collections, and 18 percent of employment in the industrial sector, nearly 20 percent to the country’s total export earning and 4 percent to the Gross Domestic Product. In human history, past and present can never ignore the importance of textile in a civilization decisively affecting its destinies, effectively changing its social scenario. A brief but thoroughly researched feature on Indian textile culture:

**Position Of Textile Industry In India**

Textile constitutes the single largest industry in India. The segment of the industry during the year 2000-01 has been positive. The production of cotton declined from 156 lakh bales in 1999-2000 to 1.40 lakh bales during 2000-01. Production of man-made fibre increased from 835 million kgs in 1999-2000 to 904 million kgs during the year 2000-01 registering a growth of 8.26%. The production of spun yarn increased to 3160 million kgs during 2000-01 from 3046 million kgs during 1999-2000 registering a growth of 3.7%. The production of man-made filament yarn registered a growth of 2.91% during the year 1999-2000 increasing from 894 million kgs to 920 million kgs. The production of fabric registered a growth of 2.7% during the year 1999-2000 increasing from 39,208 million sqmtrs to 40,256 million sqmtrs. The production
of mill sector declined by 2.6% while production of handloom, powerloom and hosiery sector increased by 2%, 2.7% and 5.1% respectively. The exports of textiles and garments increased from Rs. 455048 million to Rs. 552424 million, registering a growth of 21%. Growth in the textile industry in the year 2003-2004 was Rs. 1609 billion. And during 2004-05 production of fabrics touched a peak of 45,378 million square meters. In the year 2005-06 up to November, production of fabrics registered a further growth of 9 percent over the corresponding period of the previous year. With the growing awareness in the industry of its strengths and weaknesses and the need for exploiting the opportunities and averting threats, the government has initiated many policy measures as follows.

The Technology Upgradation Fund Scheme (TUFS) was launched in April 99 to provide easy access to capital for technological upgradation by various segments of the Industry. The Technology Mission on Cotton (TMC) was launched in February 2000 to address issues relating to the core fibre of Cotton like low productivity, contamination, obsolete ginning and pressing factories, lack of storage facilities and marketing infrastructure. A New Long Term Textiles and Garments Export Entitlement (Quota) Policies 2000-2004 was announced for a period of five years with effect from 1.1.2000 to 31.12.2004 covering the remaining period of the quota regime.

**India’s strength and weakness of textile sector:**

**Strength**

• Long textile tradition  
• Large pool of skilled and cheap work force  
• Entrepreneurial skills  
• Efficient multi-fiber raw material manufacturing capacity  
• Large domestic market  
• Enormous export potential  
• Very low import content  
• Flexible textile manufacturing systems

**Weaknesses**

• Use of out dated manufacturing technology
• Huge unorganized and decentralized sector
• Poor supply chain management
• Power and other infrastructure constraints
• Lack of Effective Labour Policies

**Indian Textiles—Major Domestic Growth Drivers**

Higher growth in urban population—The urban population is growing gradually. The favorable demography coupled with rising urban population and income levels will act as a key growth factor for the Indian textile and apparel Industry.

• Increased usage of credit cards.
• Sustainable real GDP growth outlook of around 8% p.a., increasing industrial output, rising disposable income, vibrant construction activity etc., to drive demand for home textiles.
• Hotel room demand is expected to grow at 10% p.a. years necessitating addition of room capacity—driving demand for home textiles.
• Healthcare delivery market to grow at 13% p.a. over next few years, creating demand for more hospitals (to boost demand for home textiles and work wear)
• Rising disposable income in the hands of rural consumers due to rising agriculture income and increased employment generation to drive the demand of basic textile products.

**Companies selected from the textile sector which are as follows:**

1. **OCM:** OCM is a leading men’s apparel fabric retailer & manufacturer of India, with its integrated plant in Amritsar. The company has a 37-acre complex, with contemporary processes for manufacturing world class fabrics. OCM India limited, popularly known as OCM, a leading multi National Company began its illustrious pursuit 80 years ago, with them and manufacture of handmade carpets and carpet yarn. The Ownership: The ownership of OCM is split between the US-based, WL Ross & Co. LLC, a global private equity fund management company and HDFC Ltd. Management and Staff of the Company has its Corporate & Sales office in Delhi, while its manufacturing facilities are in Amritsar, Punjab. It has a strong employee base of 1020 people, who work relentlessly towards achieving customer satisfaction.

2. **DCM:** It started its operations in 1889 by establishing a spinning mill at Delhi. Over the years, it expanded and diversified its activities into a number of manufacturing activities
such as Textiles, Sugar, Chemicals, Rayon, Tyre Cord, Fertilizers, Electronic Data Processing Machines and Engineering Products etc. The business of the Company was reorganized with effect from 1.4.1990 under a Scheme of Arrangement under section 391 / 394 of the Companies Act, 1956. Under the said reorganization, all units of the Company existing at that time stood vested and / or continued to vest in terms of the said Scheme into four separate companies namely; DCM has been an industrial front runner in the Indian sub continent. The history of DCM group goes back to 1889 with the Delhi Cloth and General Mills, when industry was in its infancy in India. DCM Textiles is a Division of DCM Ltd., a 120 years old company. Over this long period of history, DCM has built its corporate philosophy synonymous with corporate dynamism and business integrity. DCM inherits its values from late Lala Sri Ram, one of India's most prominent, honored and dynamic business leaders. "Company employs more than 1000 people at its manufacturing plant at Hisar, Haryana.

Company’s registered office is at New Delhi and listed at BSE and NSE. Anticipating the tremendous boom in the textile sector, nationally as well internationally, the DCM Group set up spinning mills at Hisar in the year 1991 with a capacity of 33000 spindles as a unit of DCM Limited. Capacity was increased over the years. In 2005 the unit had a capacity of 43000 spindles when further expansion plan was put into implementation with modern, state-of-the-art technology with this expansion, Capacity increased to 74436 spindles. Earlier exports were restricted to only Bangladesh but over a period of time we have added more countries. Now we have presence in 25 countries which include Spain, Portugal, Egypt, S. Korea, Brazil, Hong Kong, Italy and Israel.

3. **Nuchem Ltd.**: Nuchem Limited is an environmental friendly diversified Company having its registered head office at Faridabad, Haryana. One of the ISO 9001:2000 certified Companies, Nuchem nearly 1000 employees, over 45,000 shareholders and 800 trade associates. Nuchem Limited is a technology driven chemical engineering Company that uses a variety of chemical processes to produce primary materials that go into the manufacture of numerous products consumed by other industries: electrical, building & construction, lamination, pharmaceuticals, furniture, artifacts, consumer durables such as kitchen and tableware, machine building etc.
Being a major player in the field of environment management and water, all its products conform to IS Standards and the corresponding British and American Standards. Nuchem Limited is an environmental friendly diversified Company having its registered head office at Faridabad, Haryana. One of the ISO 9001:2000 certified Companies, Nuchem nearly 1000 employees, over 45,000 shareholders and 800 trade associates. Nuchem Limited is a technology driven chemical engineering Company that uses a variety of chemical processes to produce primary materials that go into the manufacture of numerous products consumed by other industries: electrical, building & construction, lamination, pharmaceuticals, furniture, artifacts, consumer durables such as kitchen and tableware, machine building etc. Being a major player in the field of environment management and water, all its products conform to IS Standards and the corresponding British and American Standards.

The emphasis on growth through research and innovations has always reflected in Nuchem's philosophy. Its R&D Centre was setup in 1973 and is fuelled by an efficient team of well qualified scientists and technologists. The R&D Centre boasts to its fourteen patents and is regarded as the leading testing labs in Northern India.

4 **Grasim Textiles:** Grasim Industries Limited, a flagship company of the Aditya Birla Group, ranks amongst India's largest private sector companies, with a consolidated net revenue of Rs.252 billion and consolidated net profit of Rs.26.5 billion (FY 2012). Grasim started as a textile manufacturer in 1948. Today its core businesses are Viscose Staple Fibre (VSF) and Cement, contributing over 90 per cent of its revenues and operating profits. It is also present in Chemicals which is essentially a backward integration of VSF. The Aditya Birla Group is the world’s largest producer of VSF, commanding a 21 per cent global market share. Grasim, with an aggregate capacity of 352 KTPA has a global market share of 9 per cent. It is also the second largest producer of caustic soda (which is used in the production of VSF) in India.

5 **Alok Apparel Ltd:** Alok was established in 1986 as a private limited company, with our first polyester texture using plant being set up in 1989. We became a public limited company in 1993. Over the years, we have expanded into weaving, knitting, processing, home textiles and garments. And to ensure quality and cost efficiencies we have integrated backward into cotton spinning and manufacturing partially oriented yarn
through the continuous polymerisation route. Alok has a strong foothold in the domestic retail segment through a wholly owned subsidiary, Alok H&A Limited, under the cash & carry model that offer garments and home textiles at attractive price points. Alok also has an international presence in the retail segment through its associate concern, Grabal Alok (UK) Limited. This entity owns more than 200 outlets across England, Scotland and Whales vending value for money ranges for menswear, women wear, children wear, footwear, home ware and accessories.

6  **Aditya Birla Nuvo Ltd.:** Aditya Birla group’s most diversified conglomerate. Earlier it was known as Indian Rayon Ltd. (IRIL), it was rechristened as Aditya Birla Nuvo in 2005. It is the second largest producer of viscose filament yarn in India. It is also the largest branded apparel company in India. It is a diversified company and operates a wide range of businesses. Its focus areas are viscose filament yarn, carbon black, branded apparels, textiles and insulators. It has also made forays into insurance, software and Business Process Outsourcing (BPO). Aditya Birla Nuvo Ltd. (ABNL) is a US$ 4.75 billion premium conglomerate. It is part of the Aditya Birla Group, a US$ 42 billion Indian multinational operating in 36 countries in six continents. Vision: To be a premium conglomerate building leadership in businesses and creating value for all the stakeholders.

**Mission**

- Investing in promising sectors
- Building leadership in businesses
- A platform to drive synergy of resources
- Delivering best value to all the stakeholders
- To be a responsible corporate citizen

With a market cap of ~US$ 2.5 billion (Rs. 14,000 Crore) as on 23 July 2013, ABNL is present across Financial Services, Telecom, Fashion and Lifestyle, IT-ITeS and Manufacturing businesses. Anchored by about 69,000 employees, ABNL touches the lives of more than 125 million Indians.
ABNL’s Fashion & Lifestyle business is the largest branded apparel player in India selling one branded apparel every second. With the acquisition of Pantaloons, its annual revenue has reached USD 1 billion. Louis Philippe and Van Heusen are the best selling brands in India. The nation-wide reach of Madura, Pantaloons and Jaya Shree Textiles, combined together, stands expanded to 1,443 exclusive brand outlets / stores spanning across 3.7 million square feet besides more than 4,750 departmental stores and multi brand outlets. The business generated return on operating capital employed of 25% driven by strong earnings and working capital management. While Madura and Jaya Shree are divisions of ABNL, Pantaloons Fashion & Retail Ltd. is a listed subsidiary in which ABNL holds 67.95%. Its shares are listed on BSE and NSE.