CHAPTER 4.0

REVIEW OF LITERATURE

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CHAPTER 4.0
REVIEW OF LITERATURE

4.1 QUALITY – HAS MANY DEFINITIONS:

It is true that Quality has a number of definitions.

4.1.1 Oxford Advanced Learner’s Dictionary72 defines Quality as “The standard of something when it is compared to other things like it” This would mean that a process of comparison occurs in the mind of a customer before the quality is judged and decision made. Customers usually compare products or services with their past experience or the experience of their friends or family members before a judgment is made. This is normally how a common man looks at quality issue.

4.1.2 The Oxford dictionary also defines quality as “How good or bad something is”

4.1.3 The other definition and which is very short and common is “Quality is customer satisfaction”. This is defined by J. M. Juran55 and adopted by ISO – 840271. This definition has a vast spectrum of “Quality” definition as each and every customer has his or her own perception of quality and therefore wide variation in the level of satisfaction. All the latest techniques of Quality Management are designed to take care of this aspect of satisfying every customer for the product or service he buys. The word “customer” must also be defined. Juran55 defines customer as “A customer is anyone who is impacted by the product or process:

a) External customers are end users and also intermediate processors and commercial dealers. Other customers are not purchasers but are concerned with the product e.g. government regulatory bodies, inspection agencies etc.
b) Internal customers include other departments who receive components for further processing. Other example is production department receiving specifications from design department. For processing.

4.1.4 A number of organizations have corporate quality definitions, which focus on customer. Ford of Europe defines quality as:
“Quality is defined by the customer. The customer wants products and services that throughout their life meet his or her needs and expectations at a cost that represents value”

Dale says “these superior-performing organizations listen closely to their customers and real users to gain a clearer perspective of customer experience”.

4.1.5 A line operator of Philips Components, Blackburn defines quality as – “never having to say sorry to a customer”. Dale says “it is highly desirable for an individual’s personal esteem and pride to be associated with a product, service and organization with which the customer is totally satisfied”. If the staff has always to apologize to customers, it is an indication of an unhealthy organization.

4.1.6 Quality Guru Genichi Taguchi has defined quality as “the loss imparted to society from the time a product is shipped”

Societal losses include failure to meet customer requirements, failure to meet ideal performance and harmful side effects.

4.1.7 Phil. Crosby has defined quality as “Conformance to agreed and fully understood requirements”. While contracting with a customer the product features, performance characteristics, terms and conditions, delivery commitments and the price etc. must be fulfilled but it does
not always happen. Anything wrong in this respect invites customer
dissatisfaction. Phil Crosby believes that there is no such thing as
high quality or low quality, or quality in terms of goodness, feel,
excellence, luxury etc. He says\textsuperscript{73} “A product or service either
conforms to requirements or it does not. In other words quality is an
attribute (a characteristic which by comparison to a standard or
reference point is judged to be correct or incorrect) not a variable (a
characteristic which, is measurable)”

4.1.8 Dale H. Besterfield\textsuperscript{74} has however attempted to quantify quality as:

\[ Q = \frac{P}{E} \]

Where \( Q = \text{Quality} \),

\( P = \text{Performance} \)

\( E = \text{Expectations} \)

If \( Q \) is greater than 1.0 then the customer has a good feeling about the
product or service. In other words, this can be described as “customer
satisfaction” \( P \) & \( E \) are usually based on perception of the supplier deciding
the performance and expectations are decided by the customer. The effect
on Customer Satisfaction due to Quality Improvement and Cost Reduction
Projects undertaken by the units in the sample has been surveyed and the
results are stated at 5.2.5 – the section on Analysis and Interpretations.
Quality has nine different dimensions as shown in Table 4.1
Table 4.1
The Dimensions of Quality

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Dimension</th>
<th>Meaning &amp; Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Performance</td>
<td>Primary Product Characteristics such as brightness of Picture (Colour T.V.)</td>
</tr>
<tr>
<td>2.</td>
<td>Features</td>
<td>Secondary Characteristics, added features, such as remote control</td>
</tr>
<tr>
<td>3.</td>
<td>Conformance</td>
<td>Meeting Specifications or industry standards, workmanship</td>
</tr>
<tr>
<td>4.</td>
<td>Reliability</td>
<td>Consistency of Performance over time, average time for the unit to fail</td>
</tr>
<tr>
<td>5.</td>
<td>Durability</td>
<td>Useful life, includes repairs</td>
</tr>
<tr>
<td>6.</td>
<td>Service</td>
<td>Resolution of problems and complaints, ease of repairs</td>
</tr>
<tr>
<td>7.</td>
<td>Response</td>
<td>Human to Human interface, such as the courtesy of the dealer</td>
</tr>
<tr>
<td>8.</td>
<td>Aesthetics</td>
<td>Sensory characteristics such as exterior finish</td>
</tr>
<tr>
<td>9.</td>
<td>Reputation</td>
<td>Past performance and other intangibles such as being ranked first</td>
</tr>
</tbody>
</table>


4.1.9 ISO-8402:1994 "Quality Management and Quality Assurance Vocabulary-1994\textsuperscript{71}" defines quality as “Totality of characteristics of an entity that bear on its ability to satisfy stated and implied needs”. It however clarifies that, needs may not always be specified (by the customer) but needs have to be identified and defined. Also needs may change with time calling for periodic review of requirements. To express quality qualifying adjectives such as “relative quality” or “quality level” (as used in acceptance sampling) or “quality measure” for precise technical evaluation need to be used.
4.1.10 Quality Guru Deming defined Quality as "Meeting Customer Requirements". Although this is only a three word definition it involves a great amount of planning and hard work as customers never get satisfied.

4.1.11 Sandvik Asia defines Quality as “Quality is the value perceived by the customer”.

4.1.12 Quality is expressed by different methods like Quantitative (i.e. Percentage, A.Q.L. – Acceptance Quality Level or PPM – Parts Per Million), Uniformity of Product Characteristics (i.e. Design Tolerance and Process Variation) Fitness (i.e. Quality of Design, Quality of Conformance, Quality of Performance).
4.2 EVOLUTION OF QUALITY:

The evolution of Quality has its roots in the History of Manufacturing which is about 200 years old. Table 4.2 gives historical summary of evolution of Quality.

**Table 4.2**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Concept &amp; Tools</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.2.1</td>
<td>Division of Labour</td>
<td>1776</td>
</tr>
<tr>
<td>4.2.2</td>
<td>Mass Production and Interchangeability</td>
<td>1790</td>
</tr>
<tr>
<td>4.2.3.1</td>
<td>Principles of Scientific Management,</td>
<td>1910s</td>
</tr>
<tr>
<td>4.2.3.2</td>
<td>Moving Assembly Line</td>
<td>1910s</td>
</tr>
<tr>
<td>4.2.4</td>
<td>Statistical control of Product Variables – By Bell Telephone Co.</td>
<td>1924</td>
</tr>
<tr>
<td>4.2.5</td>
<td>Quality Control – Sampling Inspection and Statistical Tables for Quality Control – By Walter Shewhart H.F. Dodge, H.G. Romig</td>
<td>1930s</td>
</tr>
<tr>
<td>4.2.6</td>
<td>S.Q.C. Procedures and Acceptance Sampling</td>
<td>1930s</td>
</tr>
<tr>
<td>4.2.7</td>
<td>American Society for Quality Control Formed</td>
<td>1946</td>
</tr>
<tr>
<td>4.2.8</td>
<td>Deming in Japan to teach Japanese Engineers</td>
<td>1947</td>
</tr>
<tr>
<td>4.2.9</td>
<td>Deming Prize</td>
<td>1951</td>
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<tr>
<td>4.2.10</td>
<td>Juran in Japan</td>
<td>1954</td>
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<td>4.2.11</td>
<td>Quality Circles in Japan</td>
<td>1960</td>
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<td>4.2.12</td>
<td>DOE, Robust Design – Taguchi</td>
<td>1970s</td>
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<tr>
<td>4.2.13</td>
<td>Service Quality and Productivity – Mc Donald’s restaurants</td>
<td>1970s</td>
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<td>4.2.14.1</td>
<td>Just in Time</td>
<td>1980s</td>
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<tr>
<td>4.2.14.2</td>
<td>Total Quality Control</td>
<td>1980s</td>
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<td>4.2.14.3</td>
<td>Kanban</td>
<td>1980s</td>
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<td>4.2.14.4</td>
<td>PokaYoke</td>
<td>1980s</td>
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<td>Synchronous Manufacturing / Simultaneous Engineering</td>
<td>1980s</td>
</tr>
<tr>
<td>4.2.15.2</td>
<td>Bottleneck Analysis – Eliyahu M. Goldratt (Israel)</td>
<td>1980s</td>
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<td>4.2.16.1</td>
<td>Malcolm Baldrige National Quality Award – U.S. Government</td>
<td>1987</td>
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<tr>
<td>Sr. No.</td>
<td>Concept &amp; Tools</td>
<td>Year</td>
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<tr>
<td>4.2.16.2</td>
<td>TQM (Total Quality Management)</td>
<td>1987</td>
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<tr>
<td>4.2.17</td>
<td>I.S.O. 9000. The first International standard on Management of Quality</td>
<td>1987</td>
</tr>
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<td>4.2.18</td>
<td>Quality Function Deployment</td>
<td>1990s</td>
</tr>
<tr>
<td>4.2.19</td>
<td>Q.S. 9000 Std. For Automotive Industry By Ford, G.M. &amp; Chrysler</td>
<td>1994</td>
</tr>
<tr>
<td>4.2.20</td>
<td>Supply Chain Management</td>
<td>1998</td>
</tr>
<tr>
<td>4.2.21</td>
<td>Customer Satisfaction Measurement – Saturn Auto (US)</td>
<td>1998</td>
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<tr>
<td>4.2.22</td>
<td>Failure mode Effect Analysis (FMEA)</td>
<td>1995</td>
</tr>
<tr>
<td>4.2.24</td>
<td>Total Productive Maintenance</td>
<td>1970s</td>
</tr>
<tr>
<td>4.2.25</td>
<td>Kaizen-Small incremental sustained improvement involving all By Masaaki Imai</td>
<td>1960</td>
</tr>
<tr>
<td>4.2.26</td>
<td>Six Sigma – The most powerful Breakthrough Management – Tool ever devised</td>
<td>1995</td>
</tr>
</tbody>
</table>

**4.2.1 Division of Labour:**

This means specialization. Work to be allocated as per skills of people. The more people specialize the more efficiently they can perform their work. Fayol described work specialization as the best way to use the human resources in an organization. “Division of Labour” was significant development from quality point of view. This laid the foundation for recognition of skills. Skills are necessary to perform processes which are difficult – demanding more precision, care and better workmanship.

**4.2.1 Mass Production and Interchangeability:**

Mass production to be successful needs assured and consistent quality of inputs for customer satisfaction. Special tools and techniques have to be used to save time, reduce cost of manufacture and get consistency in quality and productivity for effective mass production. Without consistent quality and assured supply improvement in demand may not be possible and without
substantial demand mass production may not be feasible. Hence quality, customer demand and mass production are supplementary to each other and are inter-dependent.

The most important criteria for “Interchangeability” is that the quality to be consistent. Products designed for mass consumption are needed to be designed such that its sub-systems or components broken down to nuts and bolts must be interchangeable, so that they can be freely assembled without trial and error and thus reduce the cost of production.

4.2.3.1 Principles of Scientific Management:
In early 1900s, Fredrick W. Taylor (1856-1918) who developed “Principles of Scientific Management” is considered the Father of scientific management which applied scientific analysis to eliminating wastage of efforts from manual labour. He was interested in applying scientific methods of observation, data collection and data analysis for improving managerial practice. He conducted time and motions studies of employees in which he carefully observed worker’s motions and time needed to perform an activity. He analysed their motions in small fractions and suggested improvements. This was an important step towards systematizing “workmanship”.

4.2.3.2 The Moving Assembly Line:
The moving assembly line concept using activity scheduling chart was first mooted by Henry Ford in 1913 to make model T car. Ford developed a system where quality was a critical prerequisite. The constraint then was existing technology and capabilities of work force. On time delivery was also very critical. This was later extrapolated by Toyota in Japan as “Just in Time” (JIT). The extent of implementation of J.I.T. by the units in the sample has been surveyed and the results are stated at 5.2.22 – the section on Analysis and Interpretations.
4.2.4 Statistical Control of Product Variables:
In 1924 W.A. Shewhart of Bell Telephone Laboratories developed a statistical chart for control of variables. This chart is considered to be the beginning of statistical quality control. Dr. W. Edwards Deming who assisted W. A. Shewhart, spent much time together during following years. Shewhart discovered products as “victims of variability”.

4.2.5 Quality Control:
W. A. Shewhart, H. F. Dodge and H. G. Romig all of Bell Telephone laboratories developed the area of acceptance sampling as a substitute for 100% inspection. (1924-1930) It is interesting that W. E. Deming, Joseph M. Juran and Phil Crosby – the famous Quality Gurus – were students of Shewhart, Dodge and Romig in 1930s.

4.2.6 Statistical Quality Control (S.Q.C.) Procedures and Acceptance Sampling:
Business processes are subject to variations due to a number of factors, more so in manufacturing processes. Statistical tools are applied to analyse data collected from the sample. The greatly increased precision demanded of manufactured parts and products has been accompanied by the need for better methods to measure, specify and record. SQC (Statistical Quality Control) includes – defining Frequency Distribution, the Standard Deviation and the Range, Control charts, identifying common and special causes, sampling and 100% inspection and Acceptance Quality Level.

4.2.7 American Society for Quality Control:
In 1946 American Society for Quality Control (ASQC) was formed. Of late the name is changed to ASQ (American Society for Quality). This organization publishes periodicals viz. “Quality Progress” and “Q.M. Forum”, conducts training sessions, organizes conferences and has promoted the cause of quality in various walks of life.
4.2.8 Deming in Japan:
Dr. W. Edwards Deming was the first expert on quality to teach Japanese Statistical Quality Control. He first visited Japan in 1947 as a statistician. After three years he visited Japan again to teach Japanese engineers and managers about better quality products through S.P.C. His teachings covered a wide spectrum of Japanese Corporates e.g. Sony, Nissan, Toyota etc. Dr. Deming’s contribution was to help Japanese understand S.P.C. in a simple way right up to production worker level.

4.2.9 Deming Prize:
Deming was called as “father of the third wave of industrial revolution”. In 1951 the most sought after and coveted award has been the “Deming Award” given annually to chosen Japanese companies, worker groups and individuals who have distinguished themselves in the area of Total Quality. Of late this is also available to non-Japanese Cos. In India, the only company to have received Deming Award is T.V. Sundaram Group company “Sundaram Clayton”.

4.2.10 Juran in Japan:
Dr. Joseph M. Juran is regarded as the highest ranking quality guru. He has his consultancy “Juran Institute” in New York. Mumbai has a branch of Juran Institute. One of the most outstanding work done by Dr. Juran on Quality is publication in 1950s “Quality Control Handbook” which is widely referred even today as a standard reference book on Quality. After Deming returned Juran went to Japan to build on Deming’s work there. His main message to Japanese managers was that “quality control is an integral part of management at all levels not just the work of specialists in quality control departments”.

4.2.11 Quality Circles in Japan:
Quality Circles, in early 60s were developed in Japan by Prof. Kaoru Ishikawa (1915-1989), who was known as “Father of Quality Circles”. The
first quality circle was piloted at Nippon Telegraph and Cable Co. in 1962. By 1978 there were one million quality circles with 10 million employees mostly in manufacturing. Today, there are over 2 million quality circles with 20 million members and extended in service sector also. The concept of quality circle is to promote team working and that an employee knows best in his area of work than anyone else and he also knows solutions how to solve his problems. Quality circle gives a worker a democratic opportunity to play a small role in the management of problems in his area of work using small group technique. The extent to which Quality Circles are practiced by the units in the sample are surveyed and stated at 5.2.26 - the section on Analysis and Interpretations.

4.2.12 Design of Experiments (DOE), Robust Design:
Dr. Genichi Taguchi is famous for his work on Design of Experiments. In Japan, some companies e.g. Nippon Denso have adopted Taguchi approach. Taguchi approach is complicated one, it is expensive and tedious as it involves substantial statistical calculations which, shop floor workmen find difficult to digest. His other work viz. Loss Function Concept combines cost, target and variation into one metric with specifications being of secondary importance. He developed the concept of Robust Design which, takes into account noise factors to ensure system correctness.

4.2.13 Service Quality and Productivity:
Service industry has a very great diversity from department stores to airlines, banks and courier service. The main criteria for service quality are fastest delivery and economical price. Quality of product or deliverable is taken for granted. One of the pioneers in systematically organizing service quality on a global basis in service sector is Mc Donald’s fast food restaurants. Mc Donald’s unique approach to quality and productivity has been so successful that it is a benchmark for all other high volume standardized services.
4.2.14.1 JIT (Just in Time)\textsuperscript{67}:
A management philosophy aimed at eliminating waste from every aspect of manufacturing and its related activities.

4.2.14.2 Total Quality Control\textsuperscript{67}:
A concept of quality operations of the business with all the people in all the areas of the organization involved to meet customer needs. This was a former definition which, that time included mainly the operations or manufacturing areas of business. As the businesses grew, and business became customer-centric due to the effects of globalization and stiff competition. Management of quality became more prominent rather than control itself and it popularly changed to Total Quality Management.

4.2.14.3 Kanban\textsuperscript{67}:
A communication tool in the Just in time production and inventory control system developed by Taiichi Ohno at Toyota.

4.2.14.4 Poka Yoke\textsuperscript{67}:
Poka Yoke helps operators to work easily and at the same time it eliminates troubles associated with defects, safety, mistakes in operation etc. without requiring operator's undue attention. This is a prevention mechanism to get 100% acceptable quality without need for inspection.
The extent to which Poka Yoke is being practiced by the units in the sample has been surveyed and is stated at 5.2.19 – the section on Analysis and Interpretations.

4.2.15.1 Simultaneous Engineering / Synchronous Manufacturing:
This technique carries out use of all internal and external customers' requirements during the design-stage simultaneously including critical evaluations by all other functions viz. manufacturing, inspection and quality, service and maintenance, cost control, process planning etc at an early
stage in the design to reduce later problems from process areas and the market.

4.2.15.2 Bottleneck Analysis:
Dr. Eli Goldratt wrote a best-selling novel "The Goal" around 1980. The theme of this novel was "Optimized Production Technology (OPT)" concerning the common problem that manufactures do not control and schedule production activities properly. A software was developed which schedules the jobs considering various constraints like limitations in facilities, machines, personnel, tools, materials affecting objective and ability to adhere to a schedule. The OPT technique separates bottleneck and non-bottleneck operations. Simultaneous Engineering or Concurrent Manufacturing is an offshoot of Dr. Goldratt's theory of constraints.

4.2.16.1 Malcolm Baldrige National Quality Award:
To recognize total quality management (TQM) in American industry the U.S. government on 20<sup>th</sup> August, 1987 enacted U.S. Public Law 100-17 to initiate Malcolm Baldrige National Quality Improvement Award. This was to endorse that increased quality and value to customer was an essential factor for business for American companies. Improvement of quality and productivity are the primary important results the award seeks through following actions:
1. Helping to improve quality and productivity.
2. Sets standards to be used by all to evaluate quality improvement efforts.
3. Recognize companies having achieved improvements.
4. Provide examples to motivate other companies.
5. Guide those companies who are willing to manage improvements.

The criteria<sup>3</sup> for Malcolm Baldrige National Quality Award (year 2000) is as mentioned at Table 4.3. The criteria gets regularly updated.
Table 4.3
Malcolm Baldrige National Quality Award Criteria (2000)

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Examination Category / Item</th>
<th>Maximum Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Leadership</td>
<td>125</td>
</tr>
<tr>
<td>2.</td>
<td>Strategic Quality Planning</td>
<td>85</td>
</tr>
<tr>
<td>3.</td>
<td>Customer and Market Focus</td>
<td>85</td>
</tr>
<tr>
<td>4.</td>
<td>Information and Analysis</td>
<td>85</td>
</tr>
<tr>
<td>5.</td>
<td>Human Resource Focus</td>
<td>85</td>
</tr>
<tr>
<td>6.</td>
<td>Management of Processes</td>
<td>85</td>
</tr>
<tr>
<td>7.</td>
<td>Business Results</td>
<td>450</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>1000</strong></td>
</tr>
</tbody>
</table>

Ref.: Operations Management for Competitive Advantage – Chase et. al.
The Baldrige criteria is an indication of how management has changed in the
global competitive environment with fast changing technology and
expectations of customers.

4.2.16.2 Total Quality Management:
Total Quality Management means improvement in carrying out business in
conventional manner. TQM requires a cultural change. TQM was born as an
after-effect of loss of markets and share value for the U.S. companies. Jobs
were lost in American companies due to severe competition from Japan in
early 80’s. Soul searching in U.S. corporate world resulted in keen
observation of the Japanese techniques of doing business especially,
manufacturing business and six basic concepts for TQM were evolved:
1. A committed and involved management to provide long term top-to-
   bottom organizational support and leadership.
2. An unwavering focus on customer, both, internal and external
   customers.
3. Effective involvement and utilization of entire work force.
4. Continuous improvement of business and production processes.
5. Suppliers treated as partners
The concept of TQM spread rapidly across the world in many companies. The major change needed is a cultural change resulting in change in mindset and attitudes of people. At many places TQM movement has been subsequently taken over by more modern concepts viz-Toyota Production System, Statistical Process Control and Lean Six Sigma.

4.2.17 I.S.O. 9000 (1987):
I.S.O. is a short form for “International Organization for Standardization”.
The first issue of ISO-9000 Standard in 1987 together with the accompanying terminology standard (ISO-8402) has brought harmonization of business process on an international scale. This is because the needs of about 200 different countries and as many cultures and languages were to be brought under one cover document to enable smooth international commerce. The first issue in 1987 focused mainly on “walk the talk” theme expecting activities with consistency. This was further extrapolated in the first revision brought out in 1994.

4.2.18 Quality Function Deployment (QFD):
QFD is a planning tool to meet customer expectations, QFD focuses on customer requirements referred to as ‘voice of customer’. It is a disciplined approach to product design, engineering and production and provides in-depth evaluation of a product. It was initiated by Dr. Mizuno, professor emeritus of Tokyo Institute of Technology. Briefly, QFD process consists of approaching the end users of product to get their feedback to know the gap between the performance status of various features of a product vis-à-vis competitors product features to be bench-marked for improvements.

4.2.19 QS 9000 - 1994:
It was a standard for quality systems for automotive industry and ancillaries who support auto industry. The three major car manufacturers i.e. General Motors, Ford and Chrysler in the U.S. have brought out a common document on the quality system mainly for their vendors to comply with. QS 9000 is
based on ISO 9000-94 clauses but with additional requirements special to auto industry. Also there are special additions of requirements such as Production Part Approval Process (PPAP), Statistical Process Control (SPC), Failure Mode Effect Analysis in Design and in processes (FMEA), Advanced Product Quality Planning (APQP), Measurement Systems Analysis (MSA) and Quality System Audits (QSA).

However since ISO-9000 has undergone a major revision in 2000, Q.S. 9000 is now an obsolete standard. ISO has therefore brought out a special standard for the automotive industry called TS-16949 published in 2002.

4.2.20 Supply Chain Management (SCM):
The concept of supply chain management is to apply a total systems approach to managing the flow of information, materials and services from raw materials routed through warehouses and factories to finished product to the end user.
The fundamental principle of supply chain management is based on the belief that efficiency can be improved by sharing information and joint planning.

4.2.21 Customer Satisfaction Measurement:
Customer satisfaction assessment is now being practiced by many large organizations with a view to identify the "Gap" between the existing status and the best industry practice. This is done by conducting a Customer Satisfaction Survey of select customers by preparing a questionnaire and seeking answers, which are analyzed and findings are used to know the gap with respect to a benchmark. The first customer satisfaction survey was done in 1996 by Saturn Division of General Motors to know the recovery of the lost market share to the Japanese. The current ISO-9001-2000 calls for the measurement of customer satisfaction as one of the important requirements to be met.
(Ref. Clause 8.2.1, ISO-9001-2000)45
4.2.22 Failure Mode Effect Analysis (FMEA):

Failure Mode Effect Analysis first was widely known to the industry as a mandatory requirement at the instance of Q.S. 9000. FMEA is an important requirement of design and process skills for the suppliers of components. FMEA is a group of activities to recognize, identify and evaluate the potential failure of a product or a process and its effects on the product quality and reliability. It is intended to identify actions that could eliminate or reduce the chance of a potential failure occurring and documenting the process. The extent to which FMEA is being practiced by the units in the sample is surveyed and stated at 5.2.21 – the section on Analysis and Interpretations.

4.2.23 ISO-9001-2000:

ISO-9001-2000 is a 2nd revision since its first introduction in 1987. While the first two issues i.e. 1987 and 1994 were mainly intended for bringing consistency in activities, “walk the talk” and discipline in the management of the business processes, the 2000 edition is totally radical, in that, it can be said as providing the foundation for Total Quality Management once the 2000 standard is adopted and implemented. The 9001-2000 standard is designed with three major concepts:

1. Customer Focus
2. Process Approach
3. Continuous improvement
4.2.24  **Total Productive Maintenance (T.P.M.):**
Predictive Maintenance and Preventive Maintenance are the approaches normally used for an effective maintenance. Total Productive Maintenance (TPM) is to keep plant and machinery at the highest productive level through the contribution of all. The objectives of TPM are:
1. Maintaining and improving equipment capacity.
2. Maintaining equipment for long life.
3. Organizing and ensuring involvement from all departments and sections of the organization.
4. CFT (Cross Functional Teamwork) for continuous work.
   - Total Productive Maintenance (TPM) is an extrapolation of Total Quality Management (TQM).

4.2.25  **Kaizen:**
Kaizen means small incremental continuous improvements in a process to make it more efficient, effective, adaptable and under better control. The extent to which Kaizen is being practiced by the units in the sample has been surveyed and stated at 5.2.24 – the section on Analysis and Interpretations.

4.2.26  **Six Sigma:**
This is the most powerful breakthrough management tool ever devised. It helps make substantial improvements in the bottom line of an organization. It minimizes wastes and non-value-added activities in day-to-day business activities. Existing tools viz: Downsizing, Outsourcing, Activity Based Costing (ABC), Business Process Re-engineering, Just-in-time, Kaizen and Total Quality Management have limitations to make break-through improvements in the bottom line. Kaizen, which means small, continuous and incremental improvements works well up to 3 to 4 sigma level.
For 5 or 6 sigma, Quality function deployment, Design of Experiments and Failure Mode Effect Analysis are needed.

Sigma (σ) is a Greek alphabet used to designate “spread” about mean (average). In business processes, sigma capability is a metric used to indicate process behaviour. Higher the sigma, better is the process. Most companies are able to achieve 3 sigma capability, which represents 99.7% accuracy i.e. 3 defects as per 1000. This level is not acceptable now with the global competition. If every product has a maximum 99.7% quality capability then the quality of the total product will be ridiculously low. For a global competition a much higher level of quality capability is necessary. The extent to which Six Sigma is being practiced by the units in the sample has been surveyed and is stated at 5.2.23 – the section on Analysis and Interpretations.
4.3 WHAT QUALITY GURUs HAVE SAID:

4.3.1 Dr. W. Edwards Deming:
At the instance of JUSE – Union of Japanese Scientists and Engineers Dr. Deming took special efforts in teaching managerial groups about advanced statistical control techniques. He covered hundreds of industries in early 50's including Sony, Nissan, Mitsubishi, Toyota etc. His quality message was exceptionally well received by the business community and the government.

What was more appreciated by the Japanese was Deming simplified a tedious subject like statistics so that a shop-floor worker could be comfortable with Statistical Process Control (SPC).

The Japanese, as a token of their deep appreciation of Deming’s valuable contribution to support work in re-building Japan, started giving the most coveted award called the “Deming Prize” since 1965 to the Japanese Companies who have done significant contribution and progress in Quality and productivity based on the 14 principles which he insisted upon. This is called as Deming Philosophy. The Deming award has been instituted by the Union of Japanese Scientists and Engineers (JUSE). Outside Japan, very few organizations have won the Deming Prize. In India only the TVS group by its three subsidiaries have won Deming Prize.

Deming Cycle or Deming Wheel as it is called is a graphical definition of Management. It is an effective improvement technique, which was initially developed by Shewhard and subsequently improved by Deming. It is also called as PDCA cycle. PDCA cycle or Deming Cycle is shown at Fig. 4.1

Fig 4.1 The Deming Cycle
Deming Philosophy:
Deming Philosophy developed by Dr. Deming through 14 points is regarded as a theory for management for improvement for quality, productivity and competitive position. These 14 points are shown at Table 4.4 and are widely viewed as directives for a new way to manage. Dr. Deming says in his famous book "Out of the crisis" that, “The 14 points are the basis for transformation of American Industry. It will not suffice merely to solve problems, big or little. Adoption and action on the 14 points are a signal that the management intends to stay in business and aims to protect investors and jobs”.

Table 4.4
Deming’s 14 Points of Management

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Management must demonstrate constantly their commitment to a widely published statement of the purpose of the company. The extent to which commitments are honored by the management (walk the talk) of the units in the sample are surveyed and stated at 5.2.18 – the section on Analysis and Interpretations.</td>
</tr>
<tr>
<td>2.</td>
<td>Learn the new philosophy, top management and everybody.</td>
</tr>
<tr>
<td>3.</td>
<td>Understand the purpose of inspection, for improvement of processes and reduction of cost. The extent to which Quality Improvement programmes and Cost Reduction programmes are undertaken and being implemented by the Units in the sample has been surveyed and stated at 5.2.1, 5.2.2, 5.2.3, 5.2.4, 5.2.8, 5.2.9, 5.2.10, 5.2.11 and 5.2.12 in the section on Analysis and Interpretations</td>
</tr>
<tr>
<td>4.</td>
<td>End the practice of awarding business on the basis of price tag alone.</td>
</tr>
<tr>
<td>5.</td>
<td>Improve constantly and forever the system of production and service.</td>
</tr>
<tr>
<td>6.</td>
<td>Institute training.</td>
</tr>
<tr>
<td>7.</td>
<td>Teach and institute leadership.</td>
</tr>
<tr>
<td></td>
<td></td>
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<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>8.</td>
<td>Drive out fear. Create a climate for innovation. The extent to which creation of work environment is being attempted by the units of the sample is surveyed and stated at 5.2.14 the section on Analysis and Interpretations.</td>
</tr>
<tr>
<td>9.</td>
<td>Optimize toward the purposes of the company the efforts of teams, groups, staff areas.</td>
</tr>
<tr>
<td>10.</td>
<td>Eliminate exhortations for the work force</td>
</tr>
<tr>
<td>11a.</td>
<td>Eliminate numerical quotas for production and institute methods for improvement.</td>
</tr>
<tr>
<td>11b.</td>
<td>Eliminate Management by Objectives and improve the capabilities of processes.</td>
</tr>
<tr>
<td>12.</td>
<td>Remove barriers that rob people of pride of workmanship</td>
</tr>
<tr>
<td>13.</td>
<td>Encourage education and self-improvement for everyone</td>
</tr>
<tr>
<td>14.</td>
<td>Take action to accomplish the transformation</td>
</tr>
</tbody>
</table>


Ref.: Total Quality Management in the Global Environment⁴
- Michael Stahl – pp7

4.3.2 Dr. Joseph M. Juran:

Dr. Joseph M. Juran, is a well-known Quality Guru. He has published a famous handbook “Quality Control Handbook” which, even today, is the number one reference book on the subject of quality and is popular throughout the world. He followed Deming to visit Japan to further the cause what was initiated by Deming.

Juran pointed out that at least 85 percent of quality problems are as a result of the system for which managements are responsible. Endorsing the analysis of Wilfredo Pareto, a 19th Century Italian economist, famous for the
well-known quality tool “Pareto Diagram”, Juran used a similar analogy to observe that a large proportion of quality problems are attributed to a small number of causes – hence 80/20 rule. Juran defined quality as “Fitness for purpose / use” which was later adopted by ISO-8402. Juran classifies fitness for purpose / use into categories of quality of design, quality of conformance, abilities and field service. Focusing on fitness for use helps to prevent the over specification of products. Over-specification adds costs to the product. He advocated to the Japanese managers that quality control is inseparable from the mainstream management and as such, everyone is involved in quality control activities and is not the responsibility of people in quality control department alone.

JUSE (Union of Japanese Scientists and Engineers) and JSA (Japanese Standards Association) were instrumental in spreading Juran's lectures on quality throughout the organization levels in the industry.

Juran insisted that quality improvement happens only through projects. Juran in 1985 outlined his basic approach toward quality improvement – Juran Trilogy. There is a good similarity between financial processes and trilogy processes:

<table>
<thead>
<tr>
<th>Financial Processes</th>
<th>Trilogy Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Budgeting</td>
<td>Quality planning</td>
</tr>
<tr>
<td>2. Cost Control</td>
<td>Quality Control</td>
</tr>
<tr>
<td>3. Cost Reduction or Profit Improvement</td>
<td>Quality Improvement</td>
</tr>
</tbody>
</table>
The above trilogy has a great similarity with Deming Cycle, which has elements – Plan, Do, Check and Act. Juran\textsuperscript{55} says “in order to achieve quality objectives the processes must rest on a foundation of inspirational leadership with environment and practices strongly supportive to quality. Without such a culture the trilogy cannot be fully effective”.

Ref: The Quality Planning and Analysis\textsuperscript{55} – J. M. Juran, F. M. Gryna pp10.
Juran’s TQM philosophy can be summarized as follows:

1. Awareness of the need and opportunity for quality improvements must be created.
2. Goals to be set for continuous improvement.
3. Establish necessary milestones in T.Q.M. journey such as
   - Appointing Quality Council
   - Identifying Problems
   - Select a Project
   - Appoint Teams
   - Choose facilitators
4. Training for everyone
5. Implement projects to solve problems
6. Report progress
7. Show recognition
8. Communicate results
9. Keep record of success
10. Implement improvements in regular production.

This keeps momentum.

The end results of Juran’s Trilogy are shown at Table 4.5

Table 4.5

<table>
<thead>
<tr>
<th>Trilogy Process</th>
<th>End Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality Planning: The process for preparing to meet quality goals.</td>
<td>A process capable of meeting quality goals under operating conditions.</td>
</tr>
<tr>
<td>Quality Control: The process for meeting quality goals during operations.</td>
<td>Conduct of operations in accordance with the quality plan</td>
</tr>
<tr>
<td>Quality improvement: The process for breaking through to unprecedented levels of performance</td>
<td>Conduct of operations at levels of quality distinctly superior to planning performance</td>
</tr>
</tbody>
</table>

* The Essence of Total Quality Management John Bank pp73
As a result of Juran's vast experience in consultancy and teaching a database on Trilogy related performance is summarized in Table 4.6

Table 4.6
Juran's Trilogy related to Performance*

<table>
<thead>
<tr>
<th>Trilogy Process</th>
<th>Self-assessment by Managers</th>
<th>Prevailing Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality Planning</td>
<td>Weak</td>
<td>Limited Priority</td>
</tr>
<tr>
<td>Quality Control</td>
<td>Very Strong</td>
<td>Top Priority by a wide margin</td>
</tr>
<tr>
<td>Quality Improvement</td>
<td>Very Weak</td>
<td>Very Low Priority</td>
</tr>
</tbody>
</table>

* Ref.: The Essence of Total Quality Management – John Bank pp73

4.3.3 Philip B. Crosby
He came up through ranks with rich experience of shop floor starting as an inspector rising to the level of corporate vice-president during his thirty-eight years with ITT. With his own TQM programme he saved in one year $ 720 million for ITT. Subsequently he started his own "Quality College" and firm called "Philip Crosby Associates Inc. of which he is the Chairman. Phil Crosby has written six books on quality. The most popular and famous being Quality is Free – having sold more than a million copies. Crosby's main emphasis is on zero defects as the goal, which he says, is practical and achievable.

Crosby defines quality as “Conformance to agreed and fully understood requirements”. He believes that quality is an attribute (a characteristic which, by comparison to a standard or reference point, is judged to be correct or incorrect), not a variable (a characteristic which is measurable).

Since 1970 Phil. Crosby has been advocating his ideas about cost of quality. The cost of quality refers to the cost incurred in producing and providing poor quality products and services. Crosby helped US managers understand that
improved quality can lead to lower costs if the product or service and the process that generates it are performed correctly.

The most outstanding contribution made by Crosby in quality arena is “Right first time – every time”. The conviction with TQM is that it is possible to achieve defect free work most of the time. This is achieved through perfection in work, emphasis on prevention, the diligent use of measurement, process controls and the data driven elimination of waste and error. Quality Assurance is achieved through prevention and quality management is all about prevention. Phil. Crosby said: “the purpose of quality management is to set-up a system and a management discipline that prevents defects from happening in the performance cycle of an organization. To accomplish this you have to act now on situations, which may cause problems some time later. Act now for reward later”.

Phil; Crosby has visited India a number of times. During one of his visits he said “By interacting with suppliers and increased training, prevention can be practiced as the best cure and concept of zero defects instead of (AQL) acceptable quality levels”. To make the theory more acceptable he brought it down to money terms and that is how cost of quality became a universal watchword.

His quality theory is based on four absolutes;

- Quality means conformance to requirements, not goodness.
- The system of quality is prevention, not detection.
- The performance standard for quality is freedom from defects.

Talking about the effect of liberalization and Indian companies Crosby said, “foreign companies are going to employ Indians and they will teach them differently than what Indian companies have done. This is not an unequal competition. Just that Indian companies have to realize that the real world is coming to them and they no longer have the privileged sanctuary. They must learn quality management. It does not cost much either. It is just a matter of having a mind change. Although the national cultures are different, the
business culture, which is contracts, money etc. is very much standard all over the world”. Compared with other Asian countries like China, Malaysia and Thailand, India is down at the bottom of quality ladder, but a proper management education will solve the problem.

Crosby has developed fourteen steps to a quality improvement programme.

**Step 1:** Management’s clear-cut commitment to quality in the form of Quality Policy.

**Step 2:** Make everyone aware of T.Q.M. so that Quality Improvement Teams with members from each department can be set up.

**Step 3:** Institute quality measurement to display current and potential problems for awareness of everyone.

**Step 4:** Identify Cost of Quality and use it as a management tool. Prevention is a solution for reduction of cost of quality. The extent to which the Cost of Quality is being taken seriously for elimination of it by the units in the sample has been surveyed and is stated at 5.2.6 and 5.2.7 in the section on Analysis and Interpretations.

**Step 5:** Improvement Team to run quality awareness programmes.

**Step 6:** Conduct periodical meetings for taking corrective actions.

**Step 7:** Plan zero defects programme. Do it right the first time and every time. Let everyone commit to eliminate defects.

**Step 8:** Train all white-collar employees.

**Step 9:** Hold a zero-defect-day to let employees know of change. Such an event / gathering is effective.

**Step 10:** Goal setting for improvement by everyone.

**Step 11:** Feedback from employees in the form of suggestions. Prompt response to worker’s suggestions is expected. The extent to which suggestion Schemes are working with the units in the sample has been surveyed and stated at 5.2.25 – the section on Analysis and Interpretations.

**Step 12:** To recognize and appreciate all who participate in the programme.

**Step 13:** Establish Quality Council to communicate on regular basis.

**Step 14:** Do it all over again and again.
4.3.4 Kaoru Ishikawa:

Prof. Ishikawa (1915-89) is called as father of Quality Circles as he was initiator and instrumental in promoting the philosophy leading to the development of quality circles in 1960s. He advocated for best of American, Japanese and European practices to be blended to get best management style and results. He also considered bringing craftsmanship back to groups instead of individuals. These concepts were used in Quality Circles. Japan had one million quality circles with ten million employees in 1978 in manufacturing areas. These figures were continuously rising – crossing 2 million quality circles involving more than twenty million employees in Japan a decade ago.

Quality Circle is a group of people consisting of 8 to 10 members from the same work area coming together voluntarily to identify work area problems, analyze them and find solutions. The circle presents the solutions to the management and implements them after approval. Juran estimates that “savings on such quality circle projects typically range from $ 5000 to $ 25000 per year per circle with a benefit-to-cost ratio of at least four to one”.

Ishikawa is also known for his fish bone diagram which bears his name – “Ishikawa Diagram” or cause effect analysis diagram. A typical cause effect diagram is shown at Figure 4.3.

Cause effect diagram is Ishikawa’s one of seven basic tools for problem solving. It is called as fish-bone diagram because of its skeletal appearance of a fish.
The seven quality tools are:

1. Pareto Analysis
2. Fishbone Diagram
3. Stratification
4. Tally Charts
5. Histogram
6. Scatter Diagram
7. Control Chart

Ishikawa insisted that these seven basic tools were indispensable for quality control.

4.3.5 Masaaki Imai:

Masaaki Imai is the originator of concept Kaizen and has helped more than 200 non-Japanese companies to introduce Japanese management practices.
He teaches and writes about Japanese Business Philosophy of step by step improvement. He has written a famous book entitled “Kaizen- The key to Japan’s Competitive Success”. He is also the author of “Never take yes for an answer” and “16 ways to avoid saying No”. According to Imai various terms of Japanese concepts related with quality and productivity viz.: TQC, QC Circles, TPM, 5S, JIT etc can be reduced to one word i.e. Kaizen. Kaizen is an umbrella concept covering most of those “Uniquely Japanese” practices that are now very well known all over the world. Kaizen can be initiated as a first step towards continuous improvement by the introduction of 5-S techniques. 5-S deals with cleanliness, orderliness, tidiness and retrievability in a disciplined manner. In fact, it is the first step towards quality. The extent to which units in the sample are practicing 5-S has been surveyed and stated at 5.2.40 in the section on Analysis and Interpretations.
4.4 THE CONCEPT OF TOTAL QUALITY MANAGEMENT:

4.4.1 T.Q.M. Definition:

Total Quality Management (T.Q.M.) can be defined as "Managing the entire organization and its business so that it excels on all dimensions of products, processes and services to the customer"

The word 'Total' has a very wide meaning covering "ALL" — i.e. all employees, internal customers and suppliers, top to bottom, permanent or temporaries, all the members of supply chain including raw material suppliers, tier one, tier two, tier three vendors, logistics providers as well as all those helping to reach the products or services to the customers i.e. distributors, dealers, franchisees, retailers, logistics operators, service and spare parts out-lets as well as publicity — promotion agents.

All these people have to act like an orchestra carefully tuned to the organizational goals and strategies. The word "quality" of course relates with not only the quality of products or services but quality of processes, culture, customer response, quality of design, quality of communications, quality of human resources and training, quality of house keeping and cleanliness, material conservation, environmental concern, governance, ethics and concern for society at large.

The word "Management" can be derived from Deming Cycle or PDCA cycle (Ref. Figure 4.1) which covers most of the management functions. However, there are other aspects of management activities viz Leadership, motivation, empowerment, provision or resources and providing Vision, Mission and Objectives statements for the orientation of all in one direction.
4.4.2 Concepts:

T.Q.M. is in fact a way of life. It is based on main concepts as under:

1) Involvement of All
2) Internal and External Customer Focus
3) Process Approach
4) Continuous Improvement
5) Suppliers to be Treated as Partners
6) Performance Measurement, Analysis of Data and Communication
7) Effective Leadership
8) Value Addition

In addition, some more T.Q.M. concepts can be mentioned as follows:

Cost of Quality
Right First Time
Prevention, Rather than Detection
Acceptance Quality Level
Bench Marking

4.4.2.1 Involvement of All:

In the conventional practice quality department and the production shop floor are held responsible for producing defects. Rest of the functions are normally excluded from quality concerns. The involvement of senior management conventionally is only to ask regimented questions. However, in fact, everyone is collectively responsible for defects in products and services.

In order that everyone involves in improvement activities, especially the lower cadre staff and shop floor workers, two things are very important. One is that an employee should have ownership attitudes. The second is an organization should have a strong and devoted leadership. The CEO must himself first involve in all the quality improvement activities on the shop floor.
MBWA\textsuperscript{74} (Management By Walk Around) is an essential technique. CEO for 85 percent of his time, needs to spend in meeting employees and solving problems on shop floor, meeting suppliers, customers and all those interested parties connected with the business. In order that an employee develops ownership attitude it is necessary that the top management creates conducive culture where employees are empowered to take decisions and actions. This releases considerable time for the seniors to engage themselves in planning, monitoring and improvement projects. The extent to which empowerment of employees is actually followed by the units in the sample has been surveyed and stated at 5.2.15 – in the section on Analysis and Interpretation.

Empowered employee with strong ownership attitude is a result of motivation. As per Maslow's Hierarchy\textsuperscript{74} of needs, which are drivers for motivation viz: survival, security, social status, esteem value and self actualization, motivation is an indirect process. Organisation must create an environment for individuals to motivate themselves. Concepts to achieve a motivated workforce include – know thyself, know your employees, positive attitude, sharing of goals, monitoring progress, developing interesting work, effective communication and recognizing an employee by celebrating success. The extent to which people are involved in improvement activities by the units in the sample has been surveyed and stated at 5.2.16 – in the section on Analysis and Interpretations.

4.4.2.2 Customer Focus:

A business depends solely on customers. It is necessary that customer needs – present and future – must be understood thoroughly and correctly and it is necessary that every effort be taken to not only meet the needs of the customer but also exceed his expectations.

It is necessary to understand customers. They are the most important people in any business. They do not depend on an organization but the
organizations are dependent on them. They do not interrupt the organization work but, in fact, they are the purpose of it. Customers in fact, do a favour when they come for their needs and they are the part of an organization’s business and are not outsiders. Without customers, an organization may have to close its business. Mahatma Gandhi had said, “Customer is God”.

Customer focus starts first with an internal customer i.e. the next process. People may not be very much courteous with their colleagues in an organization who actually are their internal customers. In Japan, of course is a different picture. They are equally courteous to their internal and external customers, most of the time.

Communication skills play a great role in maintaining customer focus while communicating customer needs from one function to the next function in a supply chain. Communication problem is a major source of defects in product or service and is usually experienced with many organizations.

Providing customer focus is best done by analyzing all such processes which are not value-added processes, a technique called Activity Based Management. All the non-value-added functions / activities have to be eliminated to avoid wastages in the system. Any activity which does not add value to the customer is an unwanted process and deserves deletion. It is observed that in most of the organizations the non-value-added activities could be as high as 80 to 85 percent of their annual turn-over. This explains the importance of customer focus.
4.4.2.3 Process Approach:

A process is defined as:

\[
\text{PROCESS} \quad \begin{array}{c}
\text{INPUT} \\
\text{Activity} \\
\text{OUTPUT}
\end{array}
\]

Any process needs certain resources including men, time, material, equipment, money etc. Besides, defined methodology or Standard Operating Procedures (SOP) are needed to convert input resources into an output or a finished product. The quality of output depends on the quality of input resources and the correctness of performing an activity. However, any deviation either in one or all of input resources or deviation in compliance to the set procedure will result in an output, which will invite customer dissatisfaction.

There is always room for improvement in input resources as well as procedure (activity) to make the process more competitive in terms of quality, cost and delivery. The conventional approach of focusing on output or detection (inspection) does not guarantee 100 percent defect free output or product but ends up with increase in costs due to rejects and delayed delivery due to inspection procedure. A focus on prevention i.e. controlling quality of input resources and methodology saves inspection activity and is a preventive activity giving 100 percent foolproof output.

Process approach is a tool for analysis of activities, costs, labour required and identification of hidden losses.

Conventionally only the processes on the shop floor in production departments were under the focus of accountants for working out costs, losses etc. With the process approach all the activities from telephone operator’s work to the CEOs management work and security guards work to
a marketing managers activities all are covered for critical scrutiny with a view to find out hidden costs and linkage of one activity with the other activity in ABC (Activity Based Costing) analysis. This works is a refinement process and avoids wastage in redundant activities.

4.4.2.4 Continuous Improvement:
Continuous improvement is carried out by innovative type of breakthrough as well as small incremental improvements such as through Kaizen activities or Suggestion Schemes or through Quality Circles. Continuous improvement has become a necessity in view of the stiff market competition especially, after globalization to keep pace with the challenges of change in products, markets and changing tastes of the customers. Considering its importance the ISO-9001-2000 standard\(^45\) has included a clause (clause 8.5.1) on continual improvement, which is mandatory for compliance and is auditable. Continuous improvement has acquired a broad meaning – enduring efforts to act upon both chronic and sporadic problems. It means taking corrective actions to reduce variation around a target value.

The process of continuous improvement is about customer orientation and most of the projects are intended to satisfy customer perceptions. Of course, some of the world-class companies even consider to delight the customer by giving more than expected.

Identifying and solving problems as a post-mortem exercise does not warrant that the root cause has been eliminated. Continuous improvement in quality is possible only by prevention at source of a problem and such an improvement becomes a sustainable improvement. The prevention approach needs management strategy back-up which helps to integrate improvement efforts of various departments.

In order to get active involvement of the top management in the process of quality improvement it is necessary to convince the management of the
advantages of the change contemplated. This is best done by collecting, reporting and use of quality related cost information.

Continuous improvement needs patience, tolerance, tenacity and commitment from all concerned especially, from CEO. There is a myth that quality improvement is subject matter of production department people and other service departments (such as planning, maintenance, design, H.R. etc) are not really concerned with it. Some of them also are mistaken that quality improvements is a concern of quality department.

Sometimes, despite providing training, managing support, people seem to understand continuous improvement but nothing happens. This happens because the continuous improvement effort is being implemented in an already established system of behaviors and relationships. The only way to deal with and change a system is through an understanding of how a system works and leveraging the system itself to change the people within it. Rudolf C. Hirzel has observed that at times, internal chaotic situation is not caused by external forces (the customer) e.g. a request by marketing for major changes in a product. However it is found that systems cause their own crisis. The structure of the system itself creates crisis. Rudolf C. Hirzel has found that a systems diagram for continuous improvement as an ideal system diagram would be a positive causal loop starting with suggestions for improvements being made, value added changes being implemented in the organization and a resulting increase in company profits being realized. This would motivate to make further improvements on a continuous basis. This is shown at Figure 4.4
However it does not always work so easily. People may not be clear about priorities of the organization. This will develop confusion about how to focus the suggestion to obtain value added changes. This will be further compounded if there is no method to align the suggestions with the organizational mission and goals. This can result in unfocused changes which counter the effects of adding value and increasing profits. If these limiting factors are severe enough no changes will be implemented, individuals will stop making improvement suggestions and the continuous improvement effort will come to a stop. This is explained in figure 4.5
Hirzel has therefore suggested a tree diagram to show the systems needed to ensure success of the continuous improvement efforts. This is shown in Figure 4.6

Fig. 4.6
Continuous Improvement Tree

Ref.: A system approach to Continuous Improvement – Quality Management Forum Summer 1997 pp 1-4
The phrase "Continuous Improvement is the cornerstone of Quality Management. It can be described as "Continuous reduction of variation". Variation exists in products, materials, methods, measurement, people and environment and results in common and special causes. Variation in production processes is measurable through statistical processes control studies, audits, inspections and tests as well as CpK, (process capability index) control charts and various other statistical tools. The extent to which statistical process control techniques and tools are employed by the units in the sample has been surveyed and stated at 5.2.20 the section for Analysis and Interpretations.

4.4.2.5 Suppliers as Partners:
While discussing continuous improvement supplier relationships need to be incorporated in totality of actions in order to increase company's manufacturing competitiveness. ISO-9001-2000 demands relationship with suppliers to be of partnership status. This is because more than 50 percent of sales turnover is spent on purchase of raw materials, components and services. About 50 percent of quality problems are due to purchased items. Therefore, supplier quality can very much affect the overall cost of product or service and customer satisfaction.

Partnering with suppliers enables an organization to achieve the same quality level for purchased material as attained within an organization for in-house items.

One of the basic concepts in TQM is that quality of product or service is best assured by ensuring foolproof quality upstream in the manufacturing line. This principle can be extended to the relationship between the organization and the vendors.
"Just-in-time" (JIT) principle followed for production these days relies on suppliers to furnish components just in time at the point of consumption and in exact quantities needed. While operating a JIT system, as there is very little or no inventory, the quality of incoming material must be excellent otherwise, the production line can come to a grinding halt. With the conventional purchasing supplier quality problems get hidden by excess inventory. With this situation, relationships with suppliers have changed into mutually beneficial partnerships.

Maruti Suzuki has been partnering with many of its critical component suppliers by equity participation, providing land and building in their own premises at their Gurgaon plant, besides providing technical assistance, tools, tackles and guidance. The advantage is two fold. First, Maruti is able to keep their vendors "loyal" to them by committing confirmed deliveries in desired quantities and schedules convenient to Maruti to align with its JIT programme. Secondly, by becoming partner, Maruti has been able to implement its strategies with the vendor’s management to ensure desired quality at the most competitive prices. In a press report the managing director of Maruti Udyog Ltd. (MUL) Jagdish Khattar said "We are working on a two pronged cost reduction strategy to tide over slowdown. On the one hand we are partnering with our vendors to cut flab and on the other we are implementing aggressive strategic operational adjustments in all our divisions. We are treating the recession as an opportunity because it is forcing us to cut costs. As a part of the strategy we are working on every aspect of cost control, starting with inventory management. Last year our inventory was worth Rs. 412 crores but that has become down to Rs. 260 crores. By the end of the year it should fall below Rs. 200 crores, the target, which has been set. Simultaneously, we have accelerated the pace of localization across all our models and have targeted cost savings of Rs. 10,900 per vehicle this year. For components of all the models monthly and annual targets have been fixed. And we tell vendors "Let us be partners in cutting costs not just buyers and sellers."
As regards technical assistance to the suppliers various vendor related activities are identified and responsibilities assigned. Juran suggests typical list of responsibilities as assigned in one company. Table 4.7 shows a responsibility matrix for providing technical assistance to the vendors as a part of improving supplier relations.

Table 4.7
Responsibility Matrix - Supplier Relations

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Activity</th>
<th>Participating Department</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Product Development</td>
</tr>
<tr>
<td>1.</td>
<td>Defining Product &amp; Programme Quality requirements</td>
<td>✓ ✓</td>
</tr>
<tr>
<td>2.</td>
<td>Evaluating Alternative Suppliers</td>
<td>✓ ✓ ✓</td>
</tr>
<tr>
<td>3.</td>
<td>Selecting Suppliers</td>
<td>– ✓ ✓</td>
</tr>
<tr>
<td>4.</td>
<td>Conducting Joint Quality Planning</td>
<td>✓ ✓</td>
</tr>
<tr>
<td>5.</td>
<td>Co-operating with the supplier during the execution of contract</td>
<td>✓ ✓ ✓</td>
</tr>
<tr>
<td>6.</td>
<td>Obtaining proof of conformance to requirements</td>
<td>✓ ✓ ✓</td>
</tr>
<tr>
<td>7.</td>
<td>Certifying Quality Suppliers</td>
<td>✓ ✓ ✓</td>
</tr>
<tr>
<td>8.</td>
<td>Conducting Quality Improvement Programmes as required</td>
<td>✓ ✓ ✓</td>
</tr>
<tr>
<td>9.</td>
<td>Creating and Utilizing Supplier Quality ratings</td>
<td>– ✓ ✓ ✓</td>
</tr>
</tbody>
</table>

Note: ✓✓ principle responsibility; ✓✓ collateral responsibility

Ref: J. M. Juran, Frank M. Gryna - Quality Planning and Analysis pp 314

Dale H. Beserfield et.al say

"There are three key elements to a partnership relationship"
a) Long Term Commitment:
Benefits of partnership come after a long association and such partnership needs total involvement from both parties. Without long term commitment the supplier may not have sufficient confidence to invest in equipments etc.

b) Trust:
This eliminates adversarial relationship due to combination of energies - resources and knowledge. Financial participation is the right step in this direction. Full transparency helps to consolidate trust amongst the partners. The strength of associations is based on fairness and parity.

c) Shared Vision:
Customer focus must not be lost. Common direction to reach shared goals and objectives must be the mission of each party. Person to person relationship is essential for sharing vision for their common good".

World's largest automobile manufacturer - Toyota Motor Corporation, Japan has spent decades building a world-class supplier network in North America. Suppliers are reacting positively to Toyota's demanding but fair partnership approach. Jeffrey K. Liker\textsuperscript{18} in his study of Toyota for twenty years has observed that "Toyota has been rewarded time and time again for its serious investment in building a network of highly capable suppliers that is truly integrated into Toyota's extended lean enterprise. Much of the award winning quality that distinguishes Toyota and Lexus results from excellence in innovation, engineering, manufacture and overall reliability of Toyota's suppliers. And Toyota's suppliers are integrated to the just-in-time philosophy, both when it is working smoothly and when there is a breakdown in the system".
4.4.2.6 Performance Measurement, Analysis of Data and Communication.

The conventional managements, sometimes, take subjective decisions as deemed fit by the concerned manager. This is observed sometimes as we study the pattern of senior executives up in the management hierarchy ladder including CEOs.

Subjective decisions (or guesswork) are taken sometimes with over confidence. However such decisions can prove to be costly and detrimental to the business interests of the organization. The CEO and members of the senior management team should be prepared to learn about statistical methods and use them in the decision making process. Besides SPC techniques like $\bar{X}$ R charts, more frequently used 7 Quality Tools such as pareto diagram and Ishikawa diagram can be of good assistance for decision making.

The real problem is lack of discipline / habit of recording observations or points of important discussions or even details of discussions on phone. On the shop floor not everyone takes trouble to note down amount of rework done or reasons responsible for the non-conformity observed. These points go un-noticed, which no one wants to talk about. However, if we follow a discipline of recording of observations in a day-to-day working it amounts to a huge data bank-which comes handy-when next time we encounter a similar situation. The extent to which people record observations and generate data for decision making in the units of sample has been surveyed and stated at 5.2.30 in the chapter on Analysis and interpretations.

There are a number of instances, especially in the manufacturing activities, observations are possible only after careful measurement of the parameters of a particular process are done. The examples of such measurements include process temperature, time, variations within high and low limits of process performance e.g. "the shaft speed varies between 1300 RPM and
1650 RPM etc." These measurements help to find gap between the targeted performance desired through a benchmark and the current performance to enable chalk-out improvement programme within a targeted time.

While carrying out measurements it must be borne in mind that the measurements are subject to variation due to involvement of human element and also the measuring equipments themselves cannot be expected to give 100 percent accurate results all the time. Thus, the actual readings obtained through measurements have chances of inaccuracies due to:

A) **Men:** A man cannot be expected to give fault-less performance all the time. This is due to factors like fatigue, attitude and monotonous nature of job. Similarly, two different persons can give different results due to difference in interpretations of individuals.

B) **Measuring Equipment:** These are subject to wear and tear and need to be "adjusted" or repaired to bring back within an acceptable band of accuracy. This process is called as "Calibration" where, relationship of instrument accuracy is established with the National Master Equipment for the sake of uniformity. Instruments also are subject to environmental effects like temperature, pressure, wind, sun, rain, humidity, vibrations and noise. R & R (Repeatability and Reproducibility as specified in Measurement System Analysis in QS-9000) studies are carried out using statistical tools in order to take care of major causes of variations mentioned above.

In situations other than use of measuring equipments such as in commercial transactions an important element i.e. organizational communication through various channels needs to be taken care of. These are:

1. **Physical Presence (Face to Face)**
2. **Interactive geographically separate channels (phones, conference, video / tele conference)**
3. Personal Static channels (memos, letters, e-mail)
4. Impersonal Static Channels (Bulletins / News Letters)

The message complexity and channel richness (channel information capacity) have a definite relationship with each other and the same is shown at Figure 4.7 - "Organizational communication"

**Fig. 4.7 Organizational Communication**

CHANNELS RICHNESS (Amount of Information that can be transmitted and understood in Communication Attempt)

ORGANIZATIONAL COMMUNICATION (Ref. T.Q.M. in the Global Environment - M. J. Stahl pp 372)

However, while using these channels, the message to be conveyed / received gets distorted due to what is called as "Noise" factor and is shown in Figure 4.8 below:
To ensure quality of end result it is therefore necessary that the communication should be clear and conveys the correct meaning avoiding confusion, delay and wastage.

4.4.2.7 Effective Leadership:
ISO-9004-2000 defines leadership as "Leaders establish unity of purpose and direction of the organization. They should create and maintain the internal environment in which people can become fully involved in achieving the organization's objectives". Michael J. Stahl defines leadership as "Leadership is the ability to influence people toward the accomplishment of goals. Leadership is associated with the determination of goals, a vision for the future and the process of change to reach the goals and the future. Leadership is about helping people do things they would not normally do".

Leadership is important in total quality management as TQM involves dramatic changes to a new and improved way of doing business. Influential leaders cause followers to change. Leadership is a critical criterion (125 points out of 1000 Ref. Table 4.3) for the Baldrige National Quality Award and the European Quality Award. In a commercial organization leaders are formally "appointed" such as "C.E.O." However there are born leadership qualities in certain people who do not need any designation for
influencing group of people—especially people in social life like Mahatma Gandhi, Martin Luther King, Indira Gandhi, Ch. Shivaji Maharaj and many more.

The qualities - traits - of leaders can be summarized as follows:

1. Verbal Ability
2. Good Intelligence
3. Extra curricular achievements like Sports, Art, Drama etc.
4. Mature and Stable
5. High ambition for status and economic successes.

Stahl* describes two styles in leadership continuum - one boss centered or autocratic and the other subordinate centered or democratic centered. Autocratic tends to centralize authority, while the democratic tends to delegate authority to others. Figure 4.9 shows these two styles as the two ends of continuum.

Figure 4.9
Leadership Continuum

Use of Authority by the Manager

Area of Freedom for Subordinate

Manager makes decision and announces it
Manager "sells" decision
Manager presents ideas and invites questions
Manager presents tentative decision subject to change
Manager presents problem, gets suggestions, makes decision
Manager defines Limits, asks group to make decision
Manager permits subordinates to function within limits defined by superior

Total Quality Management is a strategic decision and one which can be taken only by the top leadership of the organization i.e. CEO and senior management. Developing Vision, Mission and Policy statements and deployment of these objectives and plans is Leadership's prerogative. Hence the CEO must become personally involved in TQM programme and demonstrate visible commitment towards improvement process. The CEO must himself involve in drafting the future strategy considering the state of internal and external environments, opportunities and threats. The extent to which future strategies are drawn up by the units in sample is surveyed and stated at 5.2.39 in the section on Analysis and Interpretations.

The leadership cannot delegate responsibility of quality down the ladder as quality is too important an issue to be delegated. Without the total commitment of the CEO and his immediate subordinates nothing much happens and even if it does, it is not permanent. B. Dale and G. Cooper\(^73\) have referred that Lascelles and Dale in their research pointed out that "the CEO is a primary internal change agent for quality improvement". Only CEO can persuade and encourage everyone in the organization to change their behaviour and attitude to accept that mistakes when admitted, are an improvement opportunity.

On 'Effective Leadership" a few outstanding examples and what they say about leadership deserves mention. John Chambers\(^87\) CEO of Cisco - an organization sometime back (prior to 2003) was regarded by analysts and publications as an organization of future and for a brief period in those heady days Cisco was more valuable than Microsoft. On the issue of Leadership John Chambers says "I think you learn more about a leader and a company during tough times than you do in good times. To Lead in hyper-growth periods is very difficult, very challenging, but I think most people would agree that to lead in periods of contraction is even more challenging. It can't be much fun. Most people would say that once we got over our initial surprise
nobody in the industry executed (the revival) strategy better than Cisco. Whether it is our leadership team, including myself, or the company, we have emerged from periods of rapid growth and rapid contraction stronger, a much more effective company with closer relations with customers, a company that has learnt to master productivity. We are focused on staying customer driven and we have a management team that probably planned the best (strategy for bad times) as a team". In another instance, Karen Bemowski, Associate Editor of Quality Progress January 1996 issue, brings out what leaders from successful organizations say on Leadership. According to these leaders dynamic and effective leadership includes:

- Creating and articulating a vision and plan
- being customer driven
- creating the necessary environment
- Transforming a company from a process dominated to customer dominated to ensure long term success.

"Everyone is a leader. Discover the leader in you. Showing new leadership at work will give you greater respect and more positive experience of work" says Robin Sharma, the world famous author of the highly successful book "The Monk Who Sold His Ferrari".

4.4.2.8 Value Addition:
In most of the businesses value addition is an inseparable aspect considered essential towards meeting customer requirements. In case of internal customers it is a progressive processing where-in for every activity bit by bit value is added while converting raw material into a finished product as perceived by the customer. Quality no longer means just numbering of defects or adherence to an engineering specification. Quality means delivering value to customers as per their expectations.

Initiated by quality Gurus like Deming, Juran etc. delivering high quality at low price to the customer it is now necessary to address ourselves to the
multiple dimensions of customer value. Michael Stahl\(^4\) has referred in his book "Total Quality Management In The Global Environment" work of Schonberger (Building a chain of Customers) and Garvin (Managing Quality: The Strategic and Competitive Edge) who have together identified 12 dimensions of customer value. These are shown at Table 4.8. These 12 dimensions clearly indicate that quality is more than the presence or absence of defects.

Table 4.8
Multiple Dimensions of Quality

<table>
<thead>
<tr>
<th></th>
<th>Conformance to Specifications</th>
<th></th>
<th>Durability</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Performance</td>
<td></td>
<td>Serviceability</td>
</tr>
<tr>
<td>3</td>
<td>Quick Response</td>
<td></td>
<td>Aesthetics</td>
</tr>
<tr>
<td>4</td>
<td>Quick change expertise</td>
<td></td>
<td>Perceived Quality</td>
</tr>
<tr>
<td>5</td>
<td>Features</td>
<td></td>
<td>Humanity</td>
</tr>
<tr>
<td>6</td>
<td>Reliability</td>
<td></td>
<td>Value</td>
</tr>
</tbody>
</table>

Referring to Sr. No.3 above in Table 4.8 Faster organization response is customer driven and is the result of desire to improve operating efficiency and customer satisfaction. Elimination of NVAs (non-value added activities) results in capacity to respond faster by eliminating wastes. The extent to which units in the sample respond to customer has been surveyed and stated at 5.2.33 in section on Analysis and Interpretations.

In an organization every process has some cost label attached to it. It should be the endeavor of every manager to see if there are any processes which customer is not really interested in e.g. double inspection or resorting to multiple channels of communication etc. Such wastage of activities have to be identified and eliminated. Many of such activities remain unnoticed. Many cost accountants simply ignore these processes and therefore costs incurred in these processes remain "hidden". These are actually due to "non-value-added" activities. It is observed that such non-value-added activities
constitute a very large proportion of the total turnover of an organization – sometimes 85% to 90% and as such offers tremendous potential for cost cutting, profit improvement, become more competitive globally by achieving better business excellence. The gap to excel by the units in the sample has been surveyed and worked out and stated at 5.2.31 in the section on Analysis and Interpretations.

Some other concepts concerning T.Q.M. are enumerated as follows:

4.4.2.9 Cost of Quality:
Cost of Quality varies amongst various organizations throughout the world, but an average works out to be 20 to 30 percent of the annual sales turnover of an organization as shown in Figure 4.10

Cost of (poor) quality refers to all the business costs incurred in achieving quality product or service. These include prevention costs, appraisal costs, internal failure costs, the cost of exceeding customer requirements and the cost of lost opportunities.

Fig. 4.10
Cost of Quality as a proportion of turnover

Cost of Quality
Profit
Operating Costs

20 to 30 %
Relationship of defectives per million occasions (PPM), sigma level and cost of quality is illustrated in Table 4.9 below:

Table 4.9
Cost of Quality as a Function of Level of Defectives

<table>
<thead>
<tr>
<th>Defective PPM</th>
<th>% Quality</th>
<th>Quality Level</th>
<th>Cost of Quality</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>690000</td>
<td>-</td>
<td>1σ</td>
<td>&gt; 40 %</td>
<td>Non-Competent</td>
</tr>
<tr>
<td>308537</td>
<td>-</td>
<td>2σ</td>
<td>30-40 %</td>
<td>Non-Competent</td>
</tr>
<tr>
<td>66807</td>
<td>99.73</td>
<td>3σ</td>
<td>20-30 %</td>
<td>Industry Average</td>
</tr>
<tr>
<td>6210</td>
<td>99.9937</td>
<td>4σ</td>
<td>15-20 %</td>
<td>Industry Average</td>
</tr>
<tr>
<td>233</td>
<td>99.999943</td>
<td>5σ</td>
<td>10-15 %</td>
<td>World Class</td>
</tr>
<tr>
<td>3.4</td>
<td>99.9999998</td>
<td>6σ</td>
<td>&lt; 10 %</td>
<td>World Class</td>
</tr>
</tbody>
</table>

4.4.2.10  Right First Time:
One of the major problems of non-conformities is the lack of adherence to the concept of "Right First Time" as advocated by Phil. Crosby. This is also called as "Working Smarter" or "Zero Defects". This is achieved by concerted efforts on process to be defect free by striving for perfection in the work. A mindset to strive for perfection is most important even if perfection may not be possible to achieve every time. Thomas J. Watson\(^{20}\), the founder of IBM explains this as shown in figure 4.11
4.4.2.11 Prevention Rather than Detection:

Quality Management is all about prevention. Prevention together with careful use of measurement, process control and data driven elimination of waste and error helps to achieve zero defect state. Shigeo Shingo extrapolated this concept to improve product quality by preventing defects what is now

practiced by many organizations called “Poka Yoke” i.e. mistake proofing or fool proofing. Once prevention becomes a regular practice detection or post process inspection is redundant and expenses and delays incurred in inspection activities can be saved.

4.4.2.12 Acceptance Quality Level:
Accepting the concept of Acceptance Quality Levels (AQL) is like following dual performance standard. In such organizations (and most of the organizations still follow this) instead of focusing on zero defects by prevention the company encourages defects by setting AQLs.

Phil. Crosby does not subscribe to AQL built into the policy of the organization. Such policy statement in which non-conformity with the accepted quality level is built into the policy indicative of how to deviate from the policy is completely contradictory to the intensions of TQM.

4.4.2.13 Benchmarking:
Bench marking is a tool to achieve business and competitive objectives. Bench marking is measuring performance against that of best-in-class organizations to find out how they achieve those performance levels and using the data collected as the basis for setting goals, strategies and implementation. In order that an organization always remains a leader it is necessary to carryout competitive benchmarking, with the best in the industry, as a continuous process. The aim of competitive bench marking is to be better than the best competitor with regard to products, processes and people.

There are three types of bench marking methods: Result Bench marking, Product Bench marking and Process Bench marking. The extent to which Bench marking is practiced by the units in the sample has been surveyed and stated at 5.2.13 in the section on Analysis and Interpretations.
The other view:
Benchmarking is sometimes considered as copying, instead of innovating. In today’s conditions, however, benchmarking helps to know what a competitor is doing. Benchmarking has to be done selectively – only where scope exists for improvement. Benchmarking is not a one time activity – but needs to be done on a continuous basis. Patent laws and such legal protections must be understood and followed through before attempting to adopt other’s features.

An example of competitive benchmarking\(^4\) by FORD is illustrated in Table 4.10 showing how FORD pays attention to global competition by internationally benchmarking competitors for the design and production of its Taurus model.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Car</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower ignition switch effort</td>
<td>Ford</td>
</tr>
<tr>
<td>Lowest air register operating</td>
<td>Audi 100</td>
</tr>
<tr>
<td>Best accelerator pedal feel</td>
<td>Audi 100</td>
</tr>
<tr>
<td>Best accelerator pedal location</td>
<td>Chevrolet Celebrity</td>
</tr>
<tr>
<td>Lowest effort to rotate sun visor</td>
<td>Honda Accord</td>
</tr>
<tr>
<td>Lowest effort to adjust rearview mirror</td>
<td>Toyota Cressida</td>
</tr>
<tr>
<td>Best hand control ergonomics</td>
<td>Opel Senator</td>
</tr>
<tr>
<td>Best visual ergonomics</td>
<td>Honda Accord</td>
</tr>
<tr>
<td>Best night-time illumination of switches</td>
<td>Honda Accord</td>
</tr>
<tr>
<td>Best clock readability</td>
<td>Audi 100</td>
</tr>
<tr>
<td>Best fuel gauge accuracy</td>
<td>Toyota Supra</td>
</tr>
<tr>
<td>Best oil filter accessibility</td>
<td>Nissan Maxima</td>
</tr>
<tr>
<td>Best transmission control (travel/feet)</td>
<td>Opel Senator</td>
</tr>
<tr>
<td>Feature</td>
<td>Car</td>
</tr>
<tr>
<td>-------------------------------------------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>Least transmission gear noise</td>
<td>Ford Escort, Supra</td>
</tr>
<tr>
<td>Best steering wheel feel</td>
<td>Porsche 924</td>
</tr>
<tr>
<td>Best outside mirror remote control</td>
<td>Mazda 626</td>
</tr>
<tr>
<td>Most effective sun visor (travel / feet)</td>
<td>Honda Accord</td>
</tr>
<tr>
<td>Best trunk storage capacity</td>
<td>Chevrolet Celebrity</td>
</tr>
</tbody>
</table>

Ref. Total Quality Management – Michael V. Stahl pp 42
4.5  THE BUSINESS PROCESS AND QUALITY:

4.5.1  The Process:
A process has been defined as a perfect blending of resources and activities converting input into an output intended to meet customer requirements. It can be illustrated as shown in Figure 4.12

Fig. 4.12
The Process

A customer could be an Internal Customer if the process belongs to the internal processing / manufacturing area of a supply chain. The term "business process" normally relates to the one concerning the entire supply chain. Feedback from the customer is to be carefully and promptly responded to by the previous operation. A feedback from shopfloor is to be attended to by the supplier / service providers to continuously optimize the quality of resources and methodology provided at the input stage.

4.5.2  The Business Processes:
Oxford Advanced Learners Dictionary defines business as "the activity of making, buying, selling or supplying goods or services for money". A practical definition of business could be: Activities performed for the
customer and in which there may be possibility of some profit / loss. A business process therefore includes all such activities in the supply chain as supply of raw materials, conversion into a finished product and supplying them to the customers. This chain of activities consists of a number of processes (sometimes millions of processes) and each process, as defined above needs a perfect blending of resources at the input stage as well as activity performed in the defined manner to get the desired output. Any mistake either at input stage or in performing an activity in the prescribed manner in the system creates a quality problem.

Problems encountered in business have, for most of the times, their roots in previous processes (upstream processes). Therefore it is necessary to go back to the previous process to know the cause of a problem. According to Masaaki Imai\textsuperscript{62}, to solve a problem one has to ask "why" five times to investigate a root cause and hence a lasting solution. An example for this can be states as under:

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Why did the engine break down?</td>
</tr>
<tr>
<td>1</td>
<td>Because the Lubricating Oil was dirty</td>
</tr>
<tr>
<td>2</td>
<td>Why did the Lub. Oil get dirty?</td>
</tr>
<tr>
<td>2</td>
<td>Because the Oil Filter was not replaced in time, it got burst.</td>
</tr>
<tr>
<td>3</td>
<td>Why was the filter not replaced in time?</td>
</tr>
<tr>
<td>3</td>
<td>Because the operator was not aware of</td>
</tr>
<tr>
<td>4</td>
<td>Why was he not aware?</td>
</tr>
<tr>
<td>4</td>
<td>Because he was not provided with Operator's Manual</td>
</tr>
<tr>
<td>5</td>
<td>Why was he not provided with operator's manual?</td>
</tr>
<tr>
<td>5</td>
<td>Because there was a shortage when we dispatched him an engine.</td>
</tr>
</tbody>
</table>

Major problems are encountered while attempting to deal with process quality. One is, lack of consistent performance i.e. problem of variation.
The other is rejection and reworking i.e. not-first-time-right-needing
duplication of resources, time and higher costs. Besides, there are other
problems like lack of efficiency and poor productivity. This delays delivery
to the customer and results in higher cost of production.

Following summary at Table 4.11 explains remedial tools available for
solving process quality problems.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Remedial Tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variation</td>
<td>SPC, TPM, Six Sigma</td>
</tr>
<tr>
<td>Rejection</td>
<td>SPC, Poka Yoke, Continuous Improvement, Kaizen, TPM</td>
</tr>
<tr>
<td>Rework</td>
<td>Right First Time Every Time, Poka Yoke, Training</td>
</tr>
<tr>
<td>Inefficiency</td>
<td>Multiskilling, single piece flow, Poka Yoke, TPM, MOST</td>
</tr>
<tr>
<td>Poor Productivity</td>
<td>JIT, Kanban, 5S, SMED, CIM, JIDOKA, TPM, MOST</td>
</tr>
<tr>
<td>Delayed Delivery</td>
<td>JIT, Kanban, SMED, Right First Time, TPM, Kaizen, ERP</td>
</tr>
</tbody>
</table>

Legend:
SPC - Statistical Process Control
TPM - Total Productivity Maintenance
MOST - Maynard Operations Sequence Techniques
JIT - Just In Time
5S - Seiri, Seiton, Seiso, Seiketsu, Shitsuke
SMED - Single Minute Exchange of Dies
CIM - Computer Integrated Manufacture
POKA YOKE - Fool Proofing
Kaizen - Small Incremental Continuous Improvement
Kanban - Display Card
JIDOKA - Autonomous Control
ERP - Enterprise Resource Planning
4.5.3 Business Strategy and Quality:
Since the globalization movement in the 90's, the market changes are in favour of customer driven environment, while the domestic markets have become saturated, the export based growth possibilities have mushroomed. This has made quality a strategic choice for many businesses. Rising expectations worldwide and open market economies are now forcing businesses to compete with each other on the basis of quality. Changing demands of global customers has accelerated the process of adapting quality practices furiously. Quality being an unseparable part of business, quality management involves long-term planning which involves recognition and diagnosis of the problem, setting corporate objectives and goals, choosing strategy and execute it by suitable action plan. Strengths, weaknesses, opportunities and threats (SWOT) analysis comes handy for this action plan.

As a business strategy, total quality focuses first and foremost on consistently satisfying customers and their needs. The primary focus is the customer not the competitors, as in the competitive strategy. This is a major mind-set difference between customer-value strategy and competitive strategy. By delivering superior value to customers, the competitors are left behind.

4.5.4 The Lean Approach:
A number of companies claim of implementing 'Lean', however confusion exists on the understanding of lean. Liker\textsuperscript{18} says "it is the end result of applying the Toyota Production System (TPS) to all areas of our business.

Lean Manufacturing is:
An uninterrupted production flow with value addition, supplying and procuring only what customer wants through pull system and creating a culture such that every one is continuously improving.
Taiichi Ohno, founder of TPS said
"All we are doing is looking at the time line from the moment the customer
gives us an order to the point when we collect the cash. And we are reducing
that time line by removing the non-value-added wastes (Ohno 1988)"

A focus on "flow" is a foundation for Toyota's success.
The lean business is 'customer centric' by asking "what value are we adding
from the customer's perspective? The only thing that adds value in any type
of process - either in manufacturing or marketing or a development process -
is the physical or information transformation of that product, service or
activity into something the customer wants.

Lean production means Single Minute Exchange of Dies (SMED) i.e. quick
change over of dies (tools) as per market demand reducing changeover time
from couple of days to a few minutes, thus avoiding loss of production time
on important and expensive machines besides enabling to make more
frequent changes as per market needs.

Western carmakers were trying their best to understand secret of Japanese
success. What they could not understand was the operational costs
drastically reduced by Toyota’s Just In Time (JIT) systems for lean
manufacturing as instituted by, Taiichi Ohno. What Ohno sought was "the
right part in the right place at the right time". Nothing should be idle. Not
tools, not materials not workers. Therefore, no inventory costs anywhere
along the supply chain, to the extent possible. This is a lean approach.
4.6 VENDOR QUALITY:
Most of the modern products have a sizeable contents of vendor items. Management of timely supply of raw materials and components can be a very challenging job. However, it is the one least understood and appreciated by concerned.

Womac\textsuperscript{95} says "the key to a competitive parts supply system is the way the assembler (for example Ford, Renault or Toyota) works with its suppliers. The organization must share as much information, knowledge and technology as possible in order that the vendor can utilize the same in forming out the components invested in some of its key vendors' businesses in terms of land, equipment, finance etc". Having partnership with the vendor means an organization can have say in the planning, management, operations and costing of the product in the supplier's business giving substantial benefits in terms of scheduling and deliveries, assured quality and fair price.

The vendor on his part has to offer the most competitive price in order to get the order and remain in business. The buyer-seller relationship should be such as both the parties can exchange and share information on cost, quality, rejections planning and all such difficulties which might affect the supply and hence business. Many suppliers are small time vendors and consider that the new concepts like Poka Yoke, S.P.C. etc are not within their reach. They think that these "fancy" Jargons are only for those who are really large and can support the "extra burden" of such fads. In view of this, it is necessary for the organization to change the mindset of the vendors and take them into confidence and inculcate the attitude of "ownership". This can be done by continuous training and counselling.

Most important is continuous improvement activities in such areas as machines, layout, schedule, production control and job rotation. Manufacturers and suppliers should work together to develop an integrated
manufacturing system by eliminating wastes that are typically accumulated between these organizational boundaries.

Some important aspects can be enumerated as follows:
1. Manufacturers being the customers, vendors should not fail in commitment for quality, cost and delivery. Manufacturer’s requirements must be carefully understood and complied with.
2. Delivery should be effected for a steady flow of materials in small lots on-time, to suit manufacturer’s just-in-time needs.

The vendor can improve delivery by relaying machine layouts and employing dedicated machines to improve the flow. To reduce confusion and improve communication dedicated or single sourcing is very effective. This is compared with conventional practice of multiple-sourcing in Fig. 4.13

**Figure 4.13**

*Multiple and Single Sourcing of Vendors*

*Ref: The New Manufacturing Challenge* - Kiyoshi Suzaki pp 198
Single sourcing vendors are selected who are, by experience, found dependable in terms of quality, delivery, cost and co-operation. These vendors are actually, as Suzaki\textsuperscript{87} says, "extended factories". The advantages of single sources are many. It improves the production quantity as regards the vendor, which helps him to reduce fixed costs in product costing due to larger batch quantity. It also gives him confidence that he can think of long-term investments so necessary for continuous improvement. The manufacturer gains by saving time, energy and costs in dealing and following with single vendor. The cost per piece increases if a batch quantity is divided amongst more than one vendor. Manufacturer cannot pursue a single strategy, instead, he has to bend the policy to suit individual vendor. Cost of follow-up in case of multiple vendors is substantially high and is not appreciated by many and usually these go unnoticed as "hidden costs".

The competitiveness of supply chain depends on speed at which material from raw material manufacturer reaches to the end customer. This in turn, depends on sharing of information between supply chain members like transporters, warehouse operators, distributors, retailers etc. Co-operative behaviour of members of supply chain reduces risk and greatly improves efficiency of the overall logistical process. Apart from information sharing, equally or more important is willingness to share strategic information for jointly planning the best ways in a situation.

Supply chain members have to practice elimination of waste and duplicate efforts. Inventory should be kept minimum but inventory deployment should result from economic and service necessities. As Donald J. Bowersox\textsuperscript{70} et. al. say "The goal of the enlightened firm is to do more and more with less and less until it does everything with nothing".
4.7 HUMAN ASPECTS OF QUALITY:

4.7.1 Organizational Culture and Quality:

The organizational culture conducive for TQM to flourish will be such where:

- people are empowered to take decisions within their sphere of activities.
- people can work together as a team
- teams work with teams
- Mistakes are freely admitted instead of mutual accusations
- People are involved in the business through decision-making
- Departmental boundaries do not exist
- Organizational structure is flat conducive for quick and direct communication
- Creativity is encouraged and ideas are actively sought from everyone
- People development is a priority
- Problems are solved for permanent solutions
- People have developed ownership attitude
- Employee Satisfaction is assigned its due importance

The extent to which employee satisfaction exists in units in the sample is surveyed and stated at 5.2.38 in the section on Analysis and Interpretations.

Even when some key people leave and the process of quality improvement continues without interruption, then it is an indication that an organization culture conducive for TQM is firmly established. However TQM is a long term cultural change taking at least ten years to firmly establish. It is the responsibility of CEO and senior management to create the right organizational environment, values, behavior and culture in which TQM can achieve its potential. It is not easy to create an organizational culture in which each employee is committed to improve his own performance and is dedicated to satisfy internal customers. To build cultural change into all the
company's processes is a time-consuming and a continuous activity. To change company and also run a day-to-day operations is really challenging.

Distinct organizational beliefs and values belong to a TQM culture changing from non-TQM culture (customer value, continuous improvement cross-functional teamwork) into a TQM culture takes years. The philosophy of commitment to continuous improvement must become a part of TQM culture. Commitment to continuous improvement by the units in the sample has been surveyed and stated at 5.2.17 in the section on Analysis and Interpretations. Changing environments or crisis situation demand cultural change to be adapted but usually organizations are very slow to change. Commenting on the poor quality of public services in India Arun Maira \(^{92}\) in his write-up on "Changing the culture of indiscipline" says "A fundamental problem affecting the quality of public services in India is indiscipline amongst both providers and users. The culture of indiscipline begins at the top when important people feel they are above the rules. Culture is not hardware - it is about software - attitudes and behaviour of people. Money is not required to change culture: leadership is"

Subhash D. Chowdhari \(^{93}\) has very convincing views on attitudes and culture. He says "Families, organizations and entire nations possess cultures:- In a family, parents and elderly persons perform the act of developing children by caring for and educating them and setting certain standards for excellent behavior. In an organization, each employee possesses valued traits, which are passed along succeeding generations to perpetuate the organization's culture. The Japanese have their unique culture in their business organizations. Cradle-to-grave employment, quality circles and tremendous family loyalty have created strong Japanese corporate cultures that have made them leaders in the world economy."
4.7.2 Organizational Change:

Any change in an organization takes energy, time and resources due to the system inertia of an organization. With reference to TQM, B. Dale\textsuperscript{73} says "six change forces can be identified as follows:

- The CEO
- Demanding Customers
- Competition
- Need to reduce costs
- A restart situation venture
- A green field venture

Demanding customers are the key external change agents and the CEO the key internal change agent."

In order that everyone participates in quality improvement programme suitable organizational culture must be created. This can be done by changing employees' behaviour, attitudes and practices. It is necessary that everyone must accept that there is always room for improvement. Everyone must try to ensure internal customers satisfaction. Mistakes to be taken as an improvement opportunity.

Any organizational change is successful if it is initiated at the top. Workers are better convinced by demonstration by seniors.

One of the reasons for slow implementation of a change is that the people concerned have an apprehension about the change. Many times they are not fully aware of the exact nature of the change or they are not taken into confidence while implementing a change. Thus, there is a resistance to a change. The main reason for resistance is people feel insecure and prefer status quo. Best way to reduce resistance to a change is to involve those who will be affected in the decision making process. Dinesh Kumar\textsuperscript{94}, a consultant on TQM says "The middle management's resistance to change is not different in India from what other nations have experienced. Two main
reasons have been identified. First, the top management spends little time in explaining to the middle managers how their work will become easier and richer. Second, the decisions are implemented without fully explaining the reason and therefore their resistance is only natural."

4.7.3 Attitude / Mindset:
Oxford Advanced Learner's Dictionary defines Attitude as - "the way that you behave towards somebody / something that shows how you think and feel."
As regards Mindset it defines as - "a set of attitudes or fixed ideas that somebody has and that are often difficult to change".

Changing people's behaviour and attitude is one of the most difficult tasks facing managements. Rigid attitudes are the source of resistance to change blocking the improvement process. With an increase in age of an individual the attitudes become more and more rigid. Sundhindar Khanna of Arthur Anderson\(^96\) says "the new breed of CEOs in their 30s or 40s have the right attitude, they are amenable to change and are willing to do so. They know the value of speed, which is missing in Indian Companies". Attitudes are important. In addition to the best technology and systems pressure to perform, is necessary. And to mould attitudes, a public education programme is required. Many companies in the Indian industry are installing TQM and ISO-9000 procedures but the results do not appear to be proportionate to the efforts involved.

For a success in overall quality of the organizational performance it is necessary that the attitudes of individuals have to be tuned to the organizational goals. This, being a long drawn affair, continuous training of employees is necessary. Top management must be able to impress upon employees the values and disciplined approach by demonstrating through their own actions in any given situation.
The first step towards bringing about "Attitudinal Change" in groups of people in an organization for effective performance is to inculcate in them a willingness to change. Following five steps are catalyst and accelerators for bringing about attitudinal change:

1) Creating and sustaining a corporate environment that values better performance of people above everything else.

2) Structuring the organization to permit effective and innovative ideas of people to rise above the demands of day to day working. The extent to which the organization structure is conducive for continuous improvement and customer satisfaction has been surveyed and stated at 5.2.27 in the chapter for Analysis and Interpretations.

3) Clearly defining a strategic focus for people to develop their innovative efforts in strict discipline in ways that will pay off in terms of efficiency and productivity.

4) Encouraging and helping the groups to look for good ideas and how to implement them once they are found.

5) Assisting in implementation of good ideas of people at full speed, with all the company's resources.
4.8 WORLD CLASS MANUFACTURING (WCM):

WCM refers to tremendous changes in running of larger manufacturing companies which have happened in 80's and 90's and which still continue to change owing to the intense global competition as a result of globalization. A full range of following elements are affected:

<table>
<thead>
<tr>
<th>Quality Management</th>
<th>Job Classifications</th>
<th>Labour Relations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training</td>
<td>Middle Management</td>
<td>Source Development</td>
</tr>
<tr>
<td>Customer Relationship Management (CRM)</td>
<td>Supplier Relationship Management (SRM)</td>
<td>Product Design</td>
</tr>
<tr>
<td>Shopfloor Organization</td>
<td>Planning and Scheduling</td>
<td>Inventory Management</td>
</tr>
<tr>
<td>Logistics Management</td>
<td>Equipment Selection and Maintenance</td>
<td>Cost Accounting</td>
</tr>
<tr>
<td>MRP-I, MRP-II</td>
<td>ERP</td>
<td>Automation</td>
</tr>
<tr>
<td>Just in Time</td>
<td>Activity Based Management</td>
<td>Lead Time</td>
</tr>
</tbody>
</table>

The whole purpose of all these elements is faster, higher, neater and stronger manufacturing management. World class manufacturing therefore demands a continual excellence and rapid movement of products / services for competitive advantage in global markets. It means focus on product quality, work force management, JIT (Just-in-time) technique and flexibility. Some of the features of WCM are:
- High quality and Low cost of products
- Simultaneous gain of economics of scale, (volume)
- Variety (scope)
- High speed operations
- Shortened product life cycles
- Faster product development
- Fragmented markets in terms of variety of products offered and radical change in products, processes production costs, quality, variety, timing techniques and volume.

The term 'World Class' was introduced by Hayes and Wheel Wright\(^5\) (1984) to describe the capabilities developed by Japanese and German companies in export markets. WCM is "less of everything in production - half the human efforts, half the investments in tools, half the engineering hours for product development i.e. 'lean' production. It is predicated that Lean Production (LP) will become a standard global production system of 21\(^{st}\) century and will be applied to both, mass production and batch production equally well".

WCM is defined as "those organizations are TQM and learning organizations and are recognized as the best overall in following important areas..

1) Work environment (5-S)
2) Total productive maintenance (TPM)
3) Continuous Improvement
4) Elimination of Waste (MUDA)
5) Market driven and customer delight
6) Strategic Quality Management (SQM)
7) Liaison and understanding
8) Information, Systems, technology and Cash flows
4.1 Bibliography


4.2


74 Total Quality Management – Dale H. Besterfield et. al Pearson Education (Pte) Ltd. (Singapore) 2001 pp 6

4.3

39. “India is at the bottom of the quality ladder” – Indian Express 25-11-1996

4.4

45. ISO 9001-2000 Quality Management System -Requirements (Second Revision) Bureau of Indian Standards Institute pp 13


88. “Leaders on Leadership” – Kaven Bomowski, Associate Editor Quality Progress, January 1996 – American Society for Quality Control pp 43-45


4.5


4.6


95. The Machine That Changed the World – James P. Womack, Daniel T. Jones and Daniel Roos (pp – 140)
4.7

93. Attitudinal Changes – Subhash D. Choudhari ASCENT Times of India 29-03-1994

4.8

4.1 Foot Notes

55. Juran has defined quality as "Customer Satisfaction" as a short definition. The alternate definition is "Fitness for Purpose"

- Juran elaborates on the scope and definition of internal and external customer.

71. ISO 8402-1994 has emphasized on implied and stated needs while defining quality
- It has also endorsed on the definition of Juran i.e. "Quality is Customer Satisfaction and Fitness for Purpose".

73. Dale has given example of Ford’s definition of quality as well as definition by Philips.
- He has mentioned about superior performing companies like Ford, Philips that they listen closely to their customers to gain a clearer perspective of customer experience.
- Another definition by Phil. Crosby has been reproduced by Dale saying that quality is an attribute and not a variable.

74. Loss to the society concept by Taguchi has been integrated into the definition of quality – as written by Besterfield et al.
- Besterfield has attempted to quantify quality by an expression which includes quality, performance and expectations. He has further elaborated on nine different dimensions of quality illustrated in Table 4.1
- Besterfield et al. under "Historical Review" of quality control mentions about development of statistical control chart first time in 1924.
- He has also mentioned about formation of American Society for Quality Control in 1946.
3. Chase et al. have given history of operations management most of which concerns with quality and productivity starting from F.W. Taylor era upto e-commerce.

- Moving Assly line for T-Ford was first developed by Henry Ford in 1913.
- McDonald’s service quality has remained a benchmark in delivering high volume standardized services.
- Baldrige award criteria updated in 2000 is presented in Table 4.3.

4. Michael J. Stahl has stated concept of Henri Fayol about Job Specialization. He argued that division of labour increased total production.

- American scientist F. W. Taylor conducted time and motion studies which led to dramatic improvement in productivity.

45. Measurement of customer satisfaction is mandatory as per clause 8.2.1 in ISO 9001-2000.

55. Concurrent / Simultaneous engineering has been explained comparing traditional approach and concurrent engineering approach claiming 75% fewer engineering chances, 55% less time from concept to market.

67. JIT works as per pull of market demand. JIT refers to producing only what is needed, when it is needed in just the amount needed.

- Total means “involving all”, in all the areas of operations, including all processes and products (TQC)
- Kanban means display or instruction card.
- Poka Yoke is "fool proof – or Mistake Proof" Preventive actions to avoid operator mistakes.

74. American Society for Quality Works for the cause of quality. It has a worldwide membership. Its activities include publications, conferences, training etc.

77. Ronald G. Day has described QFD (Quality Function Deployment) as linking a company with its customers. It is not good enough to meet only the initial needs of a customer. It must remain constantly alert and responsive to its customers' continuing wants and needs. QFD helps to achieve this.

4.3

4. Deming's 14 points are widely appreciated as directive for new way to manage. Apart from improvement in product or service quality and improved business efficiency these points also give industry a human face.

20. End result of Juran's Trilogy process with reference to three phases of trilogy is shown at Table 4.5. – Table 4.6 shows the weakness and strength of a manager want trilogy phases. It reveals assigning better priority is necessary for continuous improvement.

22. To prevent defects happening a management discipline and a system is required. Phil Crosby has urged that the sooner your act on this issue is better.

35. Phil Crosby during his visit to India in January 1996 talked to Economic Times reporters that it is time for India to concentrate on quality. The system of quality is prevention, not detection.
He mentioned that what people have been taught in business schools or through text books is all wrong. The only remedy is activities to be right first time and every time.

39. Philip Crosby’s interview in the article “Business Inc. Interview” Phil Crosby emphasizes the need for Indian companies to become more quality conscious.


4.4

4. Interrelationship of channel richness, message complexity and choice of communication medium is illustrated in Fig. 4.7 It illustrates that more complex messages require more channel rich mediums like face-to-face meetings.

- Channels contain noise, which is any disturbance or interference that reduces the clarity of communication.
- Leadership is important in TQM organization as improvement change is to be done through people. Influential leaders cause followers to change.
- Several people have attempted to explain leadership by observing leadership style. Leadership continuum is a usually cited model of leadership behavior.

18. Toyota has built a reliable and dependable network of highly capable suppliers who are loyal and satisfied for working with Toyota.
19. Cutting down unnecessary costs by treating recession as an opportunity and partnering with vendors is the strategy adopted by Maruti Udyog to maintain the market leadership.

20. Talking on quality for profit IBM's Moir vouched quality as single most important factor for success or failure of a company.

The mindset must be tuned to achieve perfection even if one may not achieve so as explained in Fig. 4.11 by Watson, founder of IBM.

45. Continuous improvement is the soul of ISO 9001-2000 and is essential to maintain cutting edge.

46. Measurement system error can be classified into five categories – bias, repeatability, reproducibility, stability and linearity. Bias-is difference between observed average of measurement value and reference value.

Repeatability – is variation in measurements using same instrument, several times by an inspector on the same part.

Reproducibility – is variation in average of measurements by different inspectors using same instrument on the same part.

Stability – is a drift – a total variation over a period on the same part.

Linearity – Difference in bias values through expected range of gauge.

55. While analyzing purchasing system with a view to achieve overall quality objectives, Juran has identified three key activities: specification of requirements, supplier selection and contract
management. For this he has illustrated a responsibility matrix usually followed for participating departments.

73. Dale and Cooper have emphasized that TQM is a strategic weapon and the decision in this respect can be taken by CEO only. Hence CEO must become personally involved in TQM and quality improvement process and demonstrate visible commitment to it by leading new way of thinking.

74. While emphasizing the importance of involvement of all, especially the CEO, in TQM implementation activities Besterfield has strongly advocated that the CEO should get out of his office and visit customers, departments / plants within the organization and suppliers – talk to people. This way he can get first hand information on all issues of importance.

- Employee involvement is a means to better meet organization’s goals for quality and productivity at all levels of an organization. Knowledge of motivation helps to understand the utilization of employee involvement to achieve process improvement. Everyone irrespective of seniority and position needs to be motivated to satisfy his hierarchy of needs.

- Partnering is a long-term commitment between two or more organizations for the purpose of achieving specific business goals. Besterfield suggests three key elements to a partnering relationship: long-term commitment, trust and shared vision.

82. To ensure continuous improvement in an already established system, it is necessary to develop general systems knowledge and specifically how continuous improvement efforts can be made more effective through the use of systems modeling.
A tree diagram when completed provides a systems model for continuous improvement. In this diagram the interrelated systems are organized into three major groupings: Organizational systems to provide needed support, capability systems to provide individuals the necessary skills and knowledge and operable processes needed to actually implement continuous improvement.

85. Personal leadership of the employees ultimately leads to the growth and development of a business corporation showing new leadership at work will give better respect and a more positive experience of work says Robin Sharma, the world famous author of the highly successful book – "The Monk who sold his Ferrari".

86. To lead and operate an organization successfully ISO 9004-2000 is based on eight quality management principles of which, Leadership is an important principle to ensure involvement of all.

87. John Chambers, CEO of CISCO has had both, good and bad experiences of running an MNC. His emphasis is that “you learn more about leader and a company during tough times than you do in good times. We are staying customer focused and a best of teamwork”.

88. Dynamic and effective leadership involves fulfilling four roles: Studio executive, executive procedure, director and actor like in a theater. In these capacities leaders must create and articulate a vision and plan make sure that the company is focused on customer and create necessary environment in which employees can do their best work and be innovative.
18. Toyota Production System is a unique approach to manufacturing. This is the basis for lean six sigma i.e. the activities that cause the customer’s critical-to-quality issues and create the longest time delays in any process offer the greatest opportunity for improvement in cost, quality and lead time.

Taiichi Ohno also says how every activity is being observed for reduction of time and elimination if it is Non-Value-Adding activity.

62. To investigate the root cause, asking why five times usually locates the real cause. This is at the instance of Taiichi Ohno former vice president of Toyota.

72. Definition of Business as made in Oxford Advanced Learner’s Dictionary. The little Oxford Dictionary defines as: One’s occupation or affairs, one’s province or duty, work employment, commercial transactions.

4.6

67. Dedicated supplier is like ‘extended factory’. Single source suppliers improves communication, operational linkage and improve efficiency.

70. Inventory deployment should result from economic and service necessities and not from tradition and anticipatory practices. The key to improved performance is to do right things more often and do them faster.

95. A very close relationship with vendors or partnership is the necessity in days of global competition of cost, availability, delivery and quality.
92. A comparison of Swedish bureaucrats and Indian counterparts on culture of indiscipline amongst the top has been made. Arun Maira says "culture is not about hardware, it is about software – the attitudes and behavior of people. Money is not required to change culture, leadership is".

93. The author, Chowdhuri, talks about three opportunities which foster culture – family, the organization and the nation. He gives special reference to Japanese who have always fostered culture as a nation.

73. In the process of organizational change the author has listed six forces, which trigger a change. The external customer and the CEO are the biggest change agents.

94. Though launched with much fanfare, TQM is not doing well in India. It is not a cultural but a managerial problem as it demands holistic approach and consistent support from the CEO.

96. Khanna talking on changing mindset feels that the young executives knowing the value of speed are amenable to change. He compares China, Korea for performance, which comes through attitudes and pressures. Laid-back attitude need to be changed.

4.8

51. World Class Manufacturing implies manufacturing for competitive advantage in global market. Its features are: high quality and low cost products, simultaneous gain of economics of scale (volumes), scope (variety) and high speed of work operations.