CHAPTER 1 INTRODUCTION

1.1 INTRODUCTION

Quality is the buzz word in today’s world. It is a worldwide issue. It is aptly said that without quality one would not survive. Whether it is pertaining to the human or a product or a service, quality is must. In fact good quality is must. It is known that quality is a relative term and it has got everything to do with the satisfaction of the needs of the customers, moreover it becomes even more critical and difficult for the manufacturers or the service providers to meet with the expectations of all the customers.

It is not that it was not important before many years. Customers were at that point of time also happy, only when they were getting the products as per their desire. But then the options with them were limited and for most of the products, producers were enjoying monopoly, duopoly or in some cases oligopoly. The market was sellers’ market and as a result of the same, whatever was manufactured was getting sold without many difficulties and hence the producers were not worried about improvement and quality aspects. After liberalization of the industries took place in Mr. P.V. Narsimharao’s tenure as a Prime Minister and present Prime Minister Dr. Manmohan Singh who was then the Finance Minister, the scenario has changed completely. Local manufacturers were caught sleeping and their market share was eaten away by foreign companies. Survival was a question mark for all the companies. The boundaries between countries were broken with new policies. Trade across the globe became possible. This created two impacts, opportunities as well as threats.

At that point of time threats were more than opportunities. Only those who could understand and kept pace with the dynamism of the market could survive. Competition became very severe and with the emergence of more number of players in the market, product differentiation became the key to success. Customers no doubt had better days due to more options available for whatever products required by them, be it FMCG or durable or for industrial requirements. The market
got converted in buyers’ market. Producers were under pressure to improve upon
everything. The expectations of customers were also changing rapidly and they were
becoming more demanding. Producers were required to carry out in depth market
research to find out what the customers actually want. Prices were to be slashed to
stay in market and to retain profit margin costs were to be reduced. Other option
was to improve quality and thereby expecting premium on prices to increase profit.
The slogans in the companies found to be changing from production orientation to
customer and quality orientation.

Some of them are: ‘Quality is our motto’, ‘Customer is at the centre of our business’,
‘Customer is our God’, ‘Our focus is on Quality’, ‘Quality and customer satisfaction
are synonyms for us’, ‘We think about quality first and then rest of the things’,
‘Quality is the only tool for survival’, ‘Quality is way of life for us’.

1.2 QUALITY

All industries were to look in to the Quality aspect more closely and critically.
Different agencies have defined the term ‘Quality’ in different ways as under. [1]

‘Quality is the ongoing process of building and sustaining relationships by assessing,
anticipating, and fulfilling stated and implied needs.’- Quality digest

‘Quality is the customer’s perception of the value of the suppliers’ work output. –
ASQC Seventh National Quality Management Conference Transactions. American
Society for Quality

‘Quality is doing the right things right.’

1.2.1 Definitions

The totality of features and characteristics of a product or service that bears on its
capability to satisfy stated and implied needs. (ANSI/ASQ)

The common element of the business definitions is that the quality of a product or
service refers to the perception of the degree to which the product or service meets
the customer’s expectations. Quality has no specific meaning unless related to a
specific function and/or object. Quality is a perceptual, conditional and somewhat subjective attribute.

1.2.2 Some other definitions

- Quality is improvement through statistical control of all processes and the reduction in variability of these - Deming 1986

- Quality is the loss to the company and the total loss to society caused by the product. – Taguchi 1986

- Quality is the total composite product and service characteristics of marketing, engineering, manufacturing and maintenance through which the product and service in use will meet the expectation of the customer. – Armand V. Feigenbaum

- Fitness for use or purpose is a definition of quality that evaluates how well the product performs for its intended use. – Joseph Juran

- Quality is the conformance to requirements/specifications. It is to find out how well a product or service meets the targets and tolerances determined by its designers.- Philip Crosby

Nowadays, Quality is not only about meeting customer expectations but it is about exceeding the expectations and delighting the customers.

1.3 HISTORY OF QUALITY

Quality was looked into with different perspectives in different periods of time. Even mythological example of Shabri and Ram indicates the importance of quality or at least inspection. Leaving apart that ancient example, there is a tremendous evolution in the concept of quality. New tools and techniques with different approaches are entering the market every now and then. But the bottom line is the importance of quality and satisfaction of the customers when they use the product for the intended purpose.
1.3.1 Approaches of Quality Management

(A) Identify defective commodities from the manufactured lot and do not let them reach to the customers’ hands

(B) Prevent manufacturing defective goods all together

Approach ‘A’ seems to be easier when compared with ‘B’. But that doesn’t mean that the companies should follow it. As it is not guaranteeing defect free products. Why should one try to follow approach ‘B’? As more or less it gives guarantee that the customer won't be unhappy as the company is not producing products with defects.

What will go wrong when the customer gets a defective product? One may feel that there is no great harm in this. At the most this customer will not purchase the same commodity from the same supplier in future. But what actually may happen is something dangerous. This dissatisfied customer will spread negative word of mouth publicity in the market amongst the peer group which may lead to a negative impact on the turnover and thereby the profit of the company.

Even if the defective products are identified and not sold to the customers, while producing these products lot of expenditures might have incurred which adds to reduction in profit margin. Often reworking is possible, but even this will invite additional expenditures. Customers may ask for concessions or discounts while buying defective commodities which will compel the producers to compromise with the profit margin.

To avoid such problems today’s industries are striving to reach to the second approach. The companies are travelling through the following milestones to reach to the destination of producing defect free products. This is known as the hierarchy of quality management.

1. Inspection & test

2. Quality Control
3. Quality Assurance

4. Total Quality Management

1.3.2 Hierarchy of Quality Management

1.3.2.1 Inspection & test

This is a traditional system in the industry. Whatever is manufactured is getting inspected to find out whether the product is according to the customer’s requirements or not, or it is within the acceptable specification limits or not. Normally inspection will find out any mismatch between the expected and desired specifications. In some cases tests are to be carried out for arriving at a conclusion about the acceptability of the product manufactured. Inspection plan has to be designed systematically to tap the defect in the early stage so as to carry out rectification. The inspection & test procedures are not full proof and they have some limitations like faulty inspection devices, infeasibility of 100% inspection, flaw due to human involvement, improper selection of sample to represent the universe etc. As a result of this probability of either consumers’ risk or producers’ risk is present.

1.3.2.2 Quality Control

To add to the inspection, manufacturing processes are to be controlled. This is a three step process as under:

a. Define processes

b. Monitor processes

c. Control processes

After defining the processes they are monitored for any shortcomings which are then plugged by providing right kind of resources, thereby obtaining control over the processes. This will certainly reduce the chances of manufacturing defective goods to some extent.
1.3.2.3 Quality Assurance

Here the processes are not restricted to only production area. All the processes which are responsible for the quality of the product are to be taken in to consideration. Any activity in the company which has some bearing on the quality of product should be treated as an important one. For each process the flow has to be decided and input/output definitions are to be made clear. Not necessarily at each process manufacturing has to take place. Even information processing has to be treated as a process. All such processes are to be defined and controlled so as to further reduce the chances of manufacturing defective goods. Each department is treated as an important department or contributor towards quality of the product, whether it is sales, marketing, purchase, design, quality assurance, stores, maintenance, manufacturing or even human resource. It is not only about following procedures but one should be able to demonstrate that the system is followed. There are two options with the companies, one is making its own model and second using readily available model which is ISO 9000 certification.

1.3.2.4 Total Quality Management

The whole culture of the organization is to be changed. Everyone has to understand his/her own responsibility and become accountable for whatever one does. Management gives empowerment to employees to take decisions and to encourage them to give innovative suggestions. Throughout the company customer-supplier relationship should be developed, which is also known as Quality Chain. Each department works as a supplier and as a customer and each supplier should try to satisfy their customers. These customers are known as internal customers. If all the internal customers are satisfied, external customer (one who buys a product from the company) is bound to be satisfied. Systematic process management and continuous improvement are the other key elements of TQM. Following TQM principles one can claim that they may stop producing defective goods. It is also
perceived to be a journey towards excellence at the same time endless journey.

Following table (Table1.1) summarizes evolution of the quality management: [2]

### Table 1.1 Evolution of Quality Management

<table>
<thead>
<tr>
<th>Quality Management Stages</th>
<th>Areas of Focus</th>
<th>Scope</th>
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</table>
| Inspection                | Detection      | • Error detection  
                           |                | • Rectification       |
|                           |                | • Sorting, grading & reblanding |
|                           |                | • Decision about salvage and acceptance |
| Quality Control           | Manufacturing processes | • Quality standards     |
|                           |                | • Product testing       |
|                           |                | • Use of statistical methods |
|                           |                | • Process definition    |
|                           |                | • Process performance   |
|                           |                | • Process improvement   |
| Quality Assurance         | Prevention     | • Quality system (ISO 9000) |
|                           |                | • Quality costing       |
|                           |                | • Quality planning and policies |
|                           |                | • Problem solving       |
|                           |                | • Quality design        |
| Total Quality Management  | Quality as a strategy | • Quality strategy     |
|                           |                | • Customers, employees and suppliers involvement |
|                           |                | • Involve all operations |
|                           |                | • Empowerment and teamwork |
|                           |                | • Quality chain         |
|                           |                | • Process management    |
|                           |                | • Continuous improvement |

There is a paradigm shift in terms of the aspect of quality. One can say that firms are moving from old quality to new quality concept. The difference between old and new quality lies in the fact that old is the work of craftsmen, whereas the new is the work of a system. Old quality was created by few, for the few. New quality is the
work of many, for many. Table 1.2 indicates the differences between old quality and new quality. [2]

Table 1.2 Old versus New Quality Concepts

<table>
<thead>
<tr>
<th>Old Quality</th>
<th>New Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>About products</td>
<td>About organizations</td>
</tr>
<tr>
<td>Technical</td>
<td>Strategic</td>
</tr>
<tr>
<td>Led by experts</td>
<td>Led by management</td>
</tr>
<tr>
<td>High grade</td>
<td>The appropriate grade</td>
</tr>
<tr>
<td>About control</td>
<td>About improvement</td>
</tr>
</tbody>
</table>

According to the conventional view of quality, products are manufactured exactly to specifications and as per the new view of quality, products and services totally satisfy customer needs and expectations in every respect on a continuous basis. [2]

A statement of Ratan Tata, Chairman, Tata Company quoted here to indicate the new approach towards quality:

“While a top manager should be the ideal customer, he should also be the greatest critic of his company’s products. If the CEO compromises, or is only looking at the margins, then even if he is successful, the company’s success will be short lived”

This statement clearly states that the role of top management in today’s environment and it also emphasize the need for continuous improvement based on quality management in order to survive.

1.4 VIEWS OF QUALITY GURUS [3]

In the following paragraphs views of the Quality Gurus are given and the gist of the same has also been incorporated in the table that follows to get a quick overview of the same:

1.4.1 Philip Crosby

Crosby proposed four attributes of Quality.
Table 1.3  Crosby’s four attributes of Quality

<table>
<thead>
<tr>
<th>The Definition: Conformance with requirements</th>
<th>The System: Prevention not cure</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Measure: The Cost of Quality</td>
<td>The Target: Zero defects- right first time</td>
</tr>
</tbody>
</table>

1.4.2 Armand V. Feigenbaum

Stressed that quality means “Best for the customer’s use and selling price”

Emphasized on four aspects:

- Selling quality
- Appraising conformance to that standard
- Acting when standards are not met
- Planning for improvement to those standards

1.4.3 W. Edwards Deming

Focused on:

- Problems of variability in ‘quality’
- Identifying and separating ‘special causes’
- Segregating ‘common causes’
- Management responsibility ‘to promote use of S.P.C.’

1.4.4 Joseph M. Juran

He believed that quality does not happen by accident, it must be planned. He emphasized that: Quality requires specification to be analyzed (necessary tools, methods and training to be made available).
1.4.5 Kaoru Ishikawa

Ishikawa introduced cause and effect diagram for problem solving. He developed quality circle concept. He strongly opined that quality does not only mean quality of the product. Quality also means:

- After sales service
- Quality of management
- The company itself
- The human being

1.4.6 Taguchi

Taguchi defines quality as “the minimum loss imparted by the producer to the society from the time the product is hipped.”

The loss includes:

- Cost of rework
- Maintenance costs
- Warranty claims
- Product reliability
- Product performance
- Down-time due to equipment failure

He also gave a slogan: ‘Everyone to contribute to the quality of outputs’
Contributions of Quality Gurus are indicated in the table 1.4: [2]

**Table 1.4 Contributions of Quality Gurus**

<table>
<thead>
<tr>
<th>Quality Guru</th>
<th>Major Contribution</th>
</tr>
</thead>
</table>
| Walter Shewhart      | ● Contributed to the understanding of process variability  
|                      | ● Developed the concept of statistical control charts                                                                                           |
| W. Edwards Deming    | ● Stressed management’s responsibility for quality  
|                      | ● Developed ’14 points’ to guide companies in quality improvement                                                                              |
| Joseph M. Juran      | ● Defined quality as “fitness for use”  
|                      | ● Developed the concept of cost of quality  
|                      | ● Introduced the quality trilogy                                                                                                                |
| Armand V. Feigenbaum | ● Introduced the concept of total quality control                                                                                                |
| Philip B. Crosby     | ● Coined the phrase “quality is free”  
|                      | ● Introduced the concept of zero defects  
|                      | ● Four absolutes of quality management                                                                                                         |
| Kaoru Ishikawa      | ● Developed the cause and effect diagram  
|                      | ● Proponent of the implementation of quality circles  
|                      | ● Identified the concept of “internal customer”                                                                                                 |
| Genichi Taguchi      | ● Focused on robust design by applying a concept called design of experiments  
|                      | ● Developed the Taguchi loss function                                                                                                          |
| Shigeo Shingo        | ● Just in time  
|                      | ● Single minute exchange of dies  
|                      | ● Zero quality control                                                                                                                        |
| Massaki Imai         | ● Kaizen (change for good)                                                                                                                       |

1.5 COST OF QUALITY (COQ) [4] [5] [6]

A product that meets or exceeds its design specifications and is free of defects that mar its appearance or degrade its performance is said to have high quality of conformance. Note that if an economy car is free of defects, it can have a quality of conformance that is just as high as defect-free luxury car. The purchasers of
economy cars cannot expect their cars to be as opulently as luxury cars, but they can and do expect to be free of defects. [6]

With the increase in efforts towards quality control, more and more resources were allocated to the quality function and it became necessary to account for them separately. The heads of quality departments also had to sell their activities to the top management. Since the management understands only one language, money, there was the emergence of the concept of studying quality related costs.

Cost of quality is an approach to measure and track financial impact of various quality activities. Until 1950s, the concept did not explicitly extend to the quality function and the activities related to inspection, testing and audits were merely categorized as ‘overheads’. In the 1950s Dr. Armand Feigenbaum suggested to consider reporting systems focusing on quality costs. Dr. Joseph Juran also started emphasizing the need to speak of the language of upper management which is money. [4]

"The cost of quality" is a term that is widely used – and widely misunderstood.

The "cost of quality" is not the price of creating a quality product or service. It is the cost of NOT creating a quality product or service.

Every time work is redone, the cost of quality increases. Obvious examples include:

- The reworking of a manufactured item.
- The retesting of an assembly.
- The rebuilding of a tool.
- The correction of a bank statement.
- The reworking of a service, such as the reprocessing of a loan operation or the replacement of a food order in a restaurant.

In short, any cost that would not have been expended if quality were perfect contributes to the cost of quality. [5]
Quality costs can be broken down into four broad groups. These four groups are also termed as four types of quality costs. Two of these groups are known as prevention costs and appraisal costs. These are incurred in an effort to keep defective products from falling into the hands of customers. The other two groups of costs are known as internal failure costs and external failure costs. Internal and external failure costs are incurred because defects are produced despite efforts to prevent them therefore these costs are also known as costs of poor quality.

The quality costs do not just relate to just manufacturing; rather, they relate to all the activities in a company from initial research and development (R & D) through customer service. Total quality cost can be quite high unless management gives this area special attention. [6]

Four types of quality cost are briefly explained below: [6]

1.5.1 Quality costs—general description

1.5.1.1 Prevention Costs

Generally the most effective way to manage quality costs is to avoid having defects in the first place. It is much less costly to prevent a problem from ever happening than it is to find and correct the problem after it has occurred. Prevention costs support activities whose purpose is to reduce the number of defects. Companies employ many techniques to prevent defects for example statistical process control, quality engineering, training, and a variety of tools from total quality management (TQM).

Basically, the costs of all activities specifically designed to prevent poor quality in products or services are prevention costs.

Prevention costs include activities relating to quality circles and statistical process control. Quality circles consist of small groups of employees that meet on a regular basis to discuss ways to improve quality. Both management and workers are included in these circles.
Statistical process control is a technique that is used to detect whether a process is in or out of control. An out of control process results in defective units and may be caused by a miscalibrated machine or some other factor. In statistical process control, workers use charts to monitor the quality of units that pass through their workstations. With these charts, workers can quickly spot processes that are out of control and that are creating defects. Problems can be immediately corrected and further defects prevented rather than waiting for an inspector to catch the defect later.

Some companies provide technical support to their suppliers as a way of preventing defects. Particularly in just in time (JIT) systems, such support to suppliers is vital. In a JIT system, parts are delivered from suppliers just in time and in just the correct quantity to fill customer orders. There are no stockpiles of parts. If a defective part is received from a supplier, the part cannot be used and the order for the ultimate customer cannot be filled in time. Hence every part received from suppliers must be free from defects. Consequently, companies that use just in time (JIT) often require that their supplier use sophisticated quality control programs such as statistical process control and that their suppliers certify that they will deliver parts and materials that are free of defects.

Examples are the costs of:

- New product review
- Quality planning
- Supplier capability surveys
- Process capability evaluations
- Quality improvement team meetings
- Quality improvement projects
- Quality education and training
1.5.1.2 Appraisal Costs

Any defective parts and products should be caught as early as possible in the production process. Appraisal costs, which are sometimes called inspection costs, are incurred to identify defective products before the products are shipped to customers. Unfortunately performing appraisal activates doesn't keep defects from happening again and most managers realize now that maintaining an army of inspectors is a costly and ineffective approach to quality control.

Employees are increasingly being asked to be responsible for their own quality control. This approach along with designing products to be easy to manufacture properly, allows quality to be built into products rather than relying on inspections to get the defects out.

In short, the costs associated with measuring, evaluating or auditing products or services to assure conformance to quality standards and performance requirements are the appraisal costs.

These include the costs of:

- Incoming and source inspection/test of purchased material
- In-process and final inspection/test
- Product, process or service audits
- Calibration of measuring and test equipment
- Associated supplies and materials

1.5.1.3 Failure Costs

The costs resulting from products or services, not conforming to requirements or customer/user needs. Failure costs are divided into internal and external failure categories.
1.5.1.3.1 Internal Failure Costs

Failure costs are incurred when a product fails to conform to its design specifications. Failure costs can be either internal or external. Internal failure costs result from identification of defects before they are shipped to customers. These costs include scrap, rejected products, reworking of defective units, and downtime caused by quality problem. The more effective a company's appraisal activities the greater the chance of catching defects internally and the greater the level of internal failure costs. This is the price that is paid to avoid incurring external failure costs, which can be devastating.

Failure costs occurring prior to delivery or shipment of the product, or the furnishing of a service, to the customer.

Examples are the costs of:

- Scrap
- Rework
- Re-inspection
- Re-testing
- Material review
- Downgrading

1.5.1.3.2 External Failure Costs

When a defective product is delivered to customer, external failure cost is the result. External failure costs include warranty, repairs and replacements, product recalls, liability arising from legal actions against a company, and lost sales arising from a reputation for poor quality. Such costs can decimate profits.

In the past, some managers have taken the attitude, "Let's go ahead and ship everything to customers, and we'll take care of any problems under the warranty."
This attitude generally results in high external failure costs, customer ill will, and declining market share and profits.

External failure costs usually give rise to another intangible cost. These intangible costs are hidden costs that involve the company's image. They can be three or four times greater than tangible costs. Missing a deadline or other quality problems can be intangible costs of quality.

Failure costs occurring after delivery or shipment of the product — and during or after furnishing of a service — to the customer.

Examples are the costs of:

- Processing customer complaints
- Customer returns
- Warranty claims
- Product recalls

Internal failure costs, external failure costs and intangible costs that impair the goodwill of the company occur due to a poor quality so these costs are also known as costs of poor quality by some persons. [6]

1.5.2 Few more examples of the various types of quality costs [4]

Prevention cost:

- Staff training
- Product quality planning
- Design and process FMEA
- Tolerance analysis before design release
- Computer aided design and analysis
- Process capability study for process qualification
• Part selection for better reliability
• Designed experiment for optimum settings of the product]

Appraisal cost:
• Design reviews
• Software testing
• Set-up inspection
• Performance testing by customer
• Calibration of gauges
• Calibration of testing facility
• Receiving inspection of purchased parts

Internal failure cost:
• Rework, fixing of bugs detected in internal testing of software
• Premium freight due to late delivery
• Internal scrap
• Engineering and drawing changes to correct errors
• Energy cost for re-melting of rejected casting

External failure cost:
• Complaints from customers including field services
• Warranty claims including recall of products for defects, costs involved in repairs or replacement of product during warranty period,
• Retrofit and recall cost like costs involved in modifying or updating the product in order to incorporate new design changes in order to overcome design deficiencies.

• Liabilities and penalties: insurance claim and contractual obligatory claims

• Allowances and customer goodwill: concessions offered to the customer due to substandard product, poor quality or costs incurred because his expectations were higher than those delivered to him by the product

• Lost sales and loss of goodwill (difficulty to measure it actually)

1.6 MOTIVATION BEHIND SELECTION OF THE TOPIC

In the business world of competitiveness, expectations of quality products by the customers are increasing, a paradigm shift has taken place in the thought process of the customers which has led the management of organizations to change their approach towards business. Since, the beginning of 1990s, the term ISO 9000 is being discussed for quality and reliability. It is one of the most widely used and recognized quality management tools to develop a system in an organization. In this context and as a result of primary and practical knowledge and exposure about ISO 9000 systems, it was felt interesting to study the quality management approach through ISO 9000. What factors are motivating the organizations to go for certifications? What benefits the firms are deriving as a result of certification? The answers to these questions were to be found. It would be easier for the bigger companies to devise system and then to follow it. Small and Medium scale Enterprises (SMEs) due to limited infrastructure may have difficulties to go for such certifications. It was felt that a systematic study should be carried out to find out the impact of ISO 9000 certification on the SMEs.

TQM is a step forward in the same direction. Hence, it was also thought to include the same in the study. The present study is an attempt to know about the quality engineering approach in the small and medium scale manufacturing companies through ISO 9000 and / or TQM. It was also felt that the companies without ISO and
TQM must also be working with a systematic approach and which must be helping them to survive in this competitive scenario and hence it was decided to include such companies in the present study.