

# An Analysis of a Indian Cement Manufacturing Firm form Quality Prospective

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**Abstract** - Quality has always been one of the most important aspects in manufacturing as well as service industry. In the competitive world each and every organization has to pay utmost attention to quality for its survival. In this paper quality prospective of An Indian cement manufacturing firm are being identified via the quality control techniques which it use in manufacturing. This cement manufacture uses one of the most advanced cement producers in India. But before analyzing the manufacturing process from the quality point of view, the fundamentals of Quality must be evaluated correctly. This article give an over view of quality and its definitions, quality control and quality inspection along with the quality tools used to control and inspect quality in the cement manufacturing firm.

**Keywords:** *Quality ,Cement manufacturing process, quality control, quality.*

## 1. INTRODUCTION

In the current era of tough competition a product can only be survive in market if it has a unique quality or it is one of the best quality product among other similar products. Either it is an Automobile company or cement manufacturing company quality should be build into the product at the early stage of the manufacturing process. Quality should be immersed into each process/step of manufacturing. In a cutthroat market of today, organizations can only be victorious if they can please the customers with their products and in this scenario quality of product is a big boon for that purpose. a Quality is a perceptual, conditional and somewhat subjective attribute and may be understood differently by different people. Consumers may focus on the specification quality of a product/service. Producers might measure the conformance quality, or degree to which the product/service was produced correctly. Support personnel may measure quality in the degree that a product is reliable, maintainable, or sustainable.

## 2. QUALITY DEFINITION AND ITS DIFFERENT ASPECTS

Quality is totality of characteristics of an entity that bears an ability to satisfy stated and implied needs. (According to ISO & BIS)

The definitions of the term 'Quality', provided by quality gurus are as follows:

- Quality is fitness for use (JURAN)
- Quality is conformance to requirements (CROSBY)[1]
- The efficient production of the quality that the market expects (DEMING)[2][3]
- Quality is the loss that a product costs to the society after being shipped to the customer (TAGUCHI)[4]

There may be Other definitions of quality such as User based- Quality is the capacity of satisfy the customer or user. Manufacturing based- Quality is conformation to the physical specifications such length, height, thickness, shape, finish or required integration. Product based- Quality is the conformation to the satisfaction of the user. Value based- Quality is the degree of excellence at the lowest price. Transcendental based- It is neither an absolute value nor a physical entity. It is the concept of perceived by mind only. Quality of a product must have its dimensions. Garvin has prescribed the eight dimensions of quality:

- Performance (will the product do the intended job?)
- Reliability (how often the product fails?)
- Durability (how long the product lasts?)
- Serviceability (how easy is to repair the product?)
- Aesthetics (what does the product look like?)
- Features (what does the product do?)
- Perceived quality (what is the reputation of a company or its products?)[5]

Similarly if an organization providing services to the society the quality of service must have its dimensions like Reliability, Responsiveness, Competence, Courtesy, Communication, Credibility, Security[6]

### 2.1 Statistical Process Control

Statistical Process Control (SPC) provides a disciplined approach [2] whereby statistical inference techniques are used to monitor and control process variation. The control concept utilizes statistical measurement of process variation to control & minimize defects. The implementation of SPC is achieved by providing-

Control system for defect detection.

Control system for error cause removal.

Control system for error analysis.[7]

### 2.2 Control

Control can be defined as a process by means of which we observe the actual performance and compare it with some standard. If there is a deviation between the observed performance and the standard performance then it is necessary to take corrective action.

### 2.3 Inspection

Inspection is the process of measuring the quality of a product or service in terms of established standard. The objective of inspection are-

- To separate defective components from non-defective components.
- To locate defect in raw materials and flows the processes which otherwise cause problems at the final stage.
- To make sure that the product works and it works without hurting anybody i.e. its operation is safe.
- To detect sources of weakness and trouble in the finished products and thus to check the work of designer.
- Inspection build up the reputation of concern as it helps to reducing the no. of complains from the customers.
- To prevent further work being done on semi-finished products which otherwise causes problem in final stage.

### 2.4 Quality control:

Quality control is a process that is used to ensure a certain level of quality in a product or service. It might include action of business deems necessary to provide for control and verification of certain characteristic of a product or service. It involves thoroughly examining and testing the quality of products or service. The basic goal of this process is to ensure that the product or services that are provided meet specific requirements and characteristic.

Quality control of a product can be viewed as a system which ensures

- Proper Planning
- Right Design
- Proper equipment
- Proper Inspection
- Corrective action

### 2.5 Two aspects of quality control

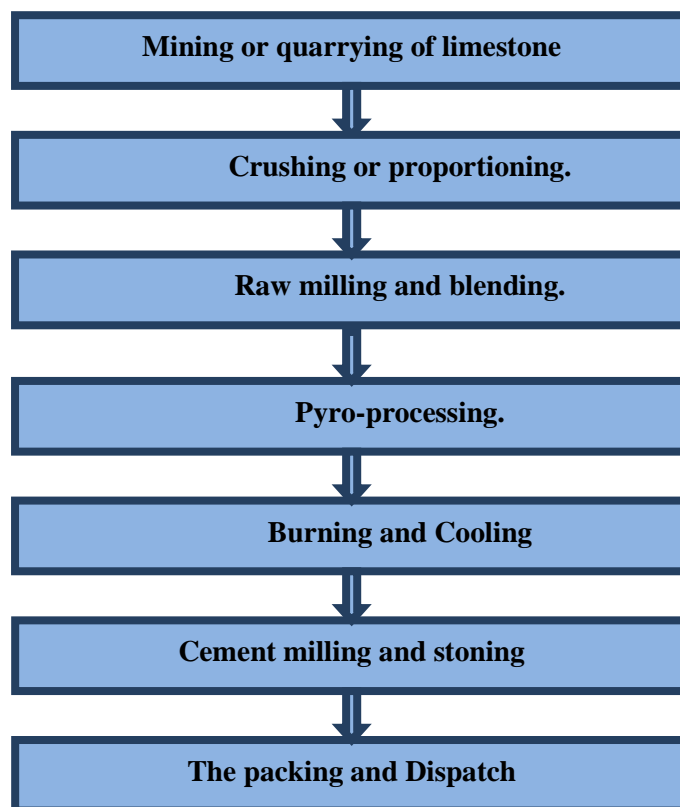
- Off-line quality control
- On-line quality control

Off-line quality control encompasses all those activities that are performed before the actual manufacturing of the product or service rendered.

On-line quality control activities start from the manufacturing of a product till it goes in the field and also after sale service. The quality tools used in the phase are Statistical Process control and Acceptance Sampling.[8]

## 3. CEMENT MANUFACTURING

The company has established the following manufacturing process of cement in its plant which is shown in the figure1.



A brief description of the above seven cement manufacturing stages is being given below including all the elementary steps.

### 3.1. Mining or quarrying of limestone

The initiation of cement manufacturing process takes place by the mining of limestone. For this purpose, a geological survey (prospecting) is conducted in order to demarcate the land rich in limestone and to classify them further as high grade and low grade limestone. The excavation process of limestone is tedious work but should be performed with extreme care as the limestone rock is the principal raw material used in cement manufacturing process.

### 3.2. Crushing and proportioning

First step after quarrying of the limestone its crushing in the hammer crusher. Limestone is fed into crusher capable of handling pieces as large as 1 to 1.5 meters. First crushing reduces it to a maximum size of about 150 mm. The rock then goes to secondary or hammers mills for reduction to about 100mm or smaller. After that the material is stacked with the stacker and reclaimed with the reclaimer in a cross-section so that the homogeneous limestone is fed further in the process, thus averaging the limestone quality.

### 3.3. Raw milling and Blending

The next step in the process is to grind the above particles to a size of 90 microns or less which is done in a closed circuit vertical roller mill equipped with high efficiency separator. After achieving the 90 microns size the fine material also known as raw meal is sent to the continuous blending silos for homogenization and external means of load cell hopper for the next step which is feeding to the kiln pre-heaters. The raw mill hopper receives feeding from the reclaimer as well as from the additive feeding point through conveyor belts.

### 3.4. Pyro Processing

The raw material is heated to exceeding 1450 degrees Celsius (2700 degrees F) in 5 or 6 stage pre-heater tower (about 120 meters in height) in the suspended form, then through a pre-calciner and finally in a huge cylindrical kiln lined with special firebrick. Kilns are frequently as much as 4.75 M in diameter, 80M large enough to accommodate an automobile and longer in many instances than the height of a 40 storey building. Kilns are suspended with the axis inclined slightly from the horizontal. The finely ground raw material or the slurry is fed into top end At the lower end is a roaring blast of flame, produced by precisely controlled burning of powdered coal under forced draft.

### 3.5. Burning and Cooling

As the material moves through the kiln, certain elements are driven off in the form of gases. The remaining elements unite to form a new substance with new physical and chemical characteristics. The new substance, called clinker is formed in pieces about the size of marbles. Clinker is discharged red-hot from the lower end of the kiln and

generally is brought down to handling temperature in Grate coolers. The heated air from the coolers is returned to the kilns, a process that saves fuel and enhances burning efficiency.

### 3.6. Cement Milling and Storage

Portland cement, the basic ingredient of concrete, is a closely controlled chemical combination of calcium, aluminum, iron and small amounts of other ingredients so as to regulate the setting time of the concrete. Lime and silica make up about 85% of the mass. Common materials used in its manufacture are limestone, shells and chalk or marl combined with shale, clay, furnace slag, silica sand and iron ore. The above mixture is stored in silos from where it is conveyed to the packing plant.

### 3.7. The Packing & Dispatch

In the packing plant, a certain quantity of the mixture that has been stored in the silos is transferred and then this quantity of mixture in turn is distributed in equal quantities among bags of specific sizes by a packing machine which is known as the 'Packer'. These bags are then loaded in the trucks or wagons through loading machines and transported to various regions.[12][13]

## 4. EXISTING QUALITY CONTROL SYSTEM

Daily basis: PCM (Problem and counter measure): There is a daily meeting to talk about the problem and then on the basis of severity of problem, following quality control methods are selected.

1. 8D method
2. 6 sigma method
3. Kaizen continuous improvement method
4. Quality circle
5. CAPA(Corrective action, Preventive action)
6. Process audit
7. PDI check sheet
8. Hourly sample collection & testing at Lab.

### 4.1. 8D Method

This method can easy understand by the following Steps:

- 1) Team making –The team member is related to the problem.
- 2) Define the problem – The definition of the problem should be very clear
- 3) Containment action – The immediate solution of the problem.
- 4) Find root cause – Find all possible cause by causes and effect diagram.
- 5) Potential permanent corrective action - Find the corrective action which is more potential out of the action.
- 6) Implemented permanent corrective action – The corrective action is implemented by the management section.

- 7) Action to prevent recurrence –The action required if the same problem is occurring again.
- 8) Lesson learnt –What are we learn from the solution.[14]

#### 4.2. 6 Sigma Method

6 sigma is the process in which the defects reduce to 3.4 parts per million. The different phase of 6 sigma are-

- Phase 1: Process Definition: *Define* the system, the voice of the customer and their requirements, and the project goals, specifically.
- Phase 2: Process Measurement: *Measure* key aspects of the current process and collect relevant data; calculate the 'as-is' Process Capability.
- Phase 3: Process Analysis: *Analyze* the data to investigate and verify cause-and-effect relationships. Determine what the relationships are, and attempt to ensure that all factors have been considered. Seek out root cause of the defect under investigation.
- Phase 4: Process Improvement: *Improve* or optimize the current process based upon data analysis using techniques such as design of experiment, or mistake proofing, and standard work to create a new, future state process. Set up pilot runs to establish process capability..
- Phase 5: Process Control:*Control* the future state process to ensure that any deviations from the target are corrected before they result in defects. Implement control system such as statistical process control, production boards, visual workplaces, and continuously monitor the process.[15]

#### 4.3. Quality Circle

Quality Circle consists of a group of members, who meet voluntarily and regularly to identify, analyze, discuss problems concerning their work. The members are related to the identifying problem, they are from same and different department. Sometimes member is also from supplier side. Quality circle mostly used to solve the problem by using 7QC tools.

A number of these groups located throughout the organization will discover ways to:-Cut costs, Speed up production, Improve quality, Reduce absenteeism [16]. And make the organization a safer and more pleasant place to work in.



Fig 3: Quality Circle

#### 4.4. Kaizen Continuous Improvement

In Japanese Kaizen stands for Continuous improvement in which everyone of the company is involved. In Chinese **Kaizen** is a word for "change for better". When used in the business sense and applied to the workplace, kaizen refers to activities that continually improve all functions and involve all employees from the higher management level to labor working on machines. In this company a team is always dedicated to observe any kind of waste activity and improve that by means of continues improvement.

Kaizen also applies to other different processes, such as purchasing and logistics, that cross organizational boundaries into the supply chain. By improving standardized activities and processes, kaizen aims to eliminate waste Kaizen was first implemented in several Japanese businesses after the Second World War, influenced in part by American business and quality management teachers who visited the country. It has since spread throughout the world and is now being implemented in environments outside of business and productivity[17].

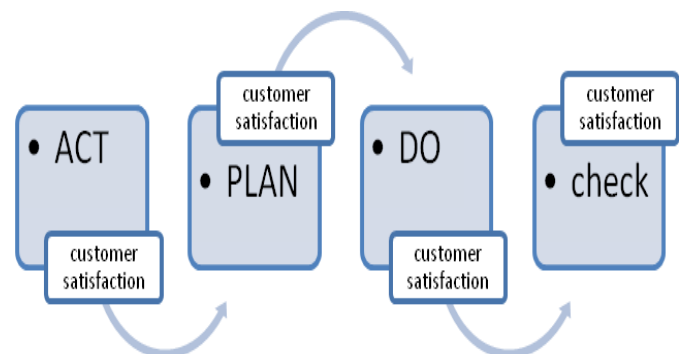


Fig 4: How kaizen works

#### 4.5. CAPA (Corrective action, Preventive action)

Without a CAPA process, focusing on quality improvement efforts may not improve customer satisfaction and in order to ensure customer satisfaction and continued growth, Effective corrective action and preventive action (CAPA) systems are a key component to continuous improvement. A key component of the ISO standard is having a Corrective Action and Preventive Action system in place (CCAPA)[18]. This is mostly used for less severity of problem. A team work a Brain-storming session where find what are the corrective and what are the preventive action of the problem.

#### 4.6. Process Audit

Manufacturing process audit is one of the many quality tools to assess the effectiveness of manufacturing process and quality performance. They are commonly used in the effort to diagnose, maintain and improve quality management system [19]. Manufacturing Process Audit thoroughly examine the acts and decisions by team with respect to quality in order to separately assess and report the degree of conformity to operational necessities of the quality plan. The audit makes sure to examine the accounts to confirm that they are in order. It assists as a process through which the content of products produced are evaluated to determine conformity to standards or strategy.

#### 4.7. PDI (Pre dispatch inspection) check sheet

From this check sheet we are able to find how much we produce RIGHT FIRST TIME?

### 5. CONCLUSION

Quality is one of the main parameter in the today's competitive business market for any industry be it manufacturing industry or service industry. So, Quality Control or Quality Assurance is very important. To understand the practical significance of quality in industry, The cement manufacturing company was selected. This paper through some light on the processes involved in cement manufacturing and the Quality control and quality inspection steps involved in those processes. How quality is immersed in those eight processes can easily be understand. The ultimate source of quantifying the product is customer satisfaction, which may very well forecast their potential of market success or failure. Consequently, products have to be manufactured in such an approach that Quality should be drawn into the product by the help of different quality tools which inspect and control the quality in a Product.

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