A Study on Total Quality Management on Steel Industry

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ABSTRACT

The objective of this study is to implement Total Quality Management in an organization, Innovation can be created from changing small things in our daily routine. Seiri, Seiton, Seiso, Seiketsu, and Shitsuke are the five Japanese words which helps in improving the efficiency of the company. Total Quality Management helps management to improve the quality of the product, improve discipline, reduce waste and increase productivity. This study made the innovation of TQM implementation which refers to 5S that applied on the production floor. Direct observation will take place on the basis of the methodology of this study. Without any record detail activity of 5S that should be done by the workers as a habit in their daily work.The SWOT analysis is a strategic planning tool which can be used to evaluate the Strengths, Weaknesses, Opportunities and Threats which are involved in an industry. It will be used to identify some areas of action which industry and policy-makers need to take to maintain the steel industry's competitiveness. This study aims to investigate all the possible way to improve the OEE of the company equipment facing theoretical aspects and reality issues. The tools involved in the process are part of the content, ought to support a company for the organizational changes required for improving effectiveness and performance.

Keywords: Total Quality Management, Quality, 5S, SWOT Analysis Overall Equipment Effectiveness, Availability, Performance.

1. INTRODUCTION

In a 'Total Quality Management' (TQM) concept, the word quality which means quality of output of every department and by every employee, cleanliness, orderliness, punctuality,

customer service, standardization of works and continuous efforts for their improvement are also part of the TQM. The needs of the customer are monitored to improve the products and processes to meet their requirements [1]. Thus, 5S will be used in the company to reduce the defective products [2]. And the wastage of the company can be reduced from SWOT Analysis to improve the quality of the product [3].The organization should represent alternate approaches to improving the effectiveness and efficiency of an organization from OEE of the equipment of the company [4]. TQM process, quality improvement projects, and provide cost justification to pessimists [5]. It has easily assembled costs of review, inspection, testing, scrap, and rework, one can convince management and others of the need for quality [6].

1.1 RESEARCH OBJECTIVES

1.1.1 PRIMARY OBJECTIVES

- To study the Total Quality Management in an organization.

1.1.2 SECONDARY OBJECTIVES

- To reduce and control the overall defects of the products.
- To improve the quality of the product.
- To increase the efficiencies by ensuring that the production process of the organization's finished products.

2. REVIEW OF LITERATURE

- **Dean and Bowen (1994)** TQM is a management idea, or a methodology characterized by principles, practices, and techniques. They confirmed that three principles, that most quality frameworks, had following commonality - customer focus, continuous improvement, and teamwork. Each principle is applied through established practices, and these practices, in turn, are reinforced by a wide set of techniques.
- **Ravinder Kumar Panchal (2012)** This study is focused on the implementation of 5S in the steel manufacturing industry. The 5S rules bring the great changes in the company, for example: process improvement by reduce in cost or increasing of effectiveness and efficiency of the process or maintenance and improvement of the equipment efficiency, safety increasing and reduction of the industry pollution and waste.
- **Yuksel and Dagdeviren, (2007)** SWOT analysis aims to develop plans and strategies for individuals or organizations to obtain maximum advantage of existing strengths and opportunities while minimizing the impact of potential threats and weaknesses by considering internal and external factors.
- **Huang et al.(2003)** report that the concept of OEE has been widely used as a quantitative tool essential for the measurement of productivity in manufacturing operations, because of extreme capacity constrained facility investment. They state that traditional metrics for measuring productivity and utilization, are insufficient for identifying the problems and underlying improvements needed to increase productivity.

3. RESEARCH METHODOLOGY

Research methodology is a techniques which helps to identify, select, process, and analyze information about the study. In a research paper, the methodology section explains and critically evaluate a study's overall validity and reliability. It helps to understand the study. It will helps to identify how the research has been done.

5S is useful approach for giving valuable foundation for the organization and help to improve communication, lead time, downtime, defect, inventory, injury and costs associated with them. Order, neatness and cleanliness are considered to give a continuous improvement. 5S is able to link total productive maintenance and other approaches also. There is no difference between ISO 9001 guidelines and formalities of 5S. From implementation of 5S, majority of routine problems can be resolved easily.

3.1 RESEARCH DESIGN

The research design used in this study is Total Quality Management and the procedure is use the researcher gather information already available, and analyze these to make an improvement of the performance.

3.2 SAMPLING TECHNIQUE

1. 5S
2. SWOT ANALYSIS
3. OEE

3.2.1 5S

5S stands for Sort, Set in Order, Shine, Standardize, Sustain which is useful approach for giving valuable foundation for the organization and help to improve communication, lead time, downtime, defect, inventory, injury and costs associated with them. Order, neatness and cleanliness are considered to give a continuous improvement.

3.2.2 SWOT ANALYSIS

SWOT analysis stands for Strengths, Weaknesses, Opportunities, and Threats is a framework used to evaluate a company's competitive position and to develop strategic planning and also assesses internal and external factors, as well as current and future potential.

3.2.3 OEE

OEE stands for Overall Equipment Effectiveness which that identifies the percentage of planned production time that is truly productive. An OEE score of 100% is perfect production.

3.3 SOURCE OF DATA COLLECTION

This research consist of both primary data and secondary data.

3.3.1 PRIMARY DATA

The process of collecting data can be long and tedious. In an effort to collect all the necessary, relevant information available at one time, professionals often lose sight of the purpose of the data collection process.

3.3.2 SECONDARY DATA

Data collections of sources are taken from the firm for the study and analysis. The source of the world class, international brands and standard values are taken from the INTERNET.

4 DATA COLLECTION INTERPRETATION

The analysis can be done by various statistical measures. For representation of the data used in Pie Charts and Bar Chart. After data analysis is done, the obtained information is interpreted and inferences are made and also conclusions are drawn related to the objectives.

4.1 5S

4.1.1 SEIRI (SORT)

Availability of material

1 mark will be given if fully available otherwise 0.

Defective finished goods

Consider A items which contains B items as defective then marks will be, [1-(B/A)]

Operating condition

If there is a proper flow, then the value 1 is given otherwise 0.

Relative information

Information about process guidelines, working conditions, material information, tool information takes place.1 mark for full information otherwise 0

Waste elimination

Let total C be number of wastage list, but only D number was removed, then marks will be as follows, [1-(D/C)].

Table 4.1.1 Seiri rating table

Weeks	Average of material	Operating condition	Defective finished goods	Relative information	Waste elimination	Total rating S1
1	1	1	0.15	1	0.15	3.3
2	1	1	0.2	1	0.2	3.4
3	1	1	0.3	1	0.35	3.65
4	1	1	0.45	1	0.4	3.85
5	1	1	0.5	1	0.55	4.05

4.1.2 SEITON (SET IN ORDER)

Sequence rating

Let M number of total tools and N number which aren't in sequence, then the rating will be [1-(N/M)].

Material arrangement

Let X be the lack of material and Y for material required,
then rating will be [1-(X/Y)].

Process arrangement

Let G be the number of total processes and H be number of irregular processes, rating [(1-H/G)]

Material arrangement consistency

Let U be arrangement of material and V be number that fails to achieve exact position. Then rating would be: [1-(V/U)].

Efficiency of work= total allotted time to process / working time for processing.

Table 4.1.2 Seiton rating table

Weeks	Sequence rating	Material arrangement	Material arrangement consistency	Process arrangement	Working efficiency	Total rating S2
1	0.3	0.5	0.5	0.4	0.85	2.55
2	0.3	0.5	0.5	0.4	0.85	2.55
3	0.35	0.5	0.5	0.5	0.85	2.7
4	0.4	0.5	0.5	0.5	0.85	2.75
5	0.5	0.85	0.8	0.6	0.85	3.6

4.1.3 SEISO (SHINE)

Cleaning workplace

Give 1 for cleaned machine and 0 for uncleaned.

Working conditions

Let J be the wrong arrangement and I for the total number of proper conditions, then rating would be [1-(J/I)]

Safety

Safety is given on scale means if there is chance rating will be 0 and if they feel safe, rating will be 1.

Cleaning consistency

Let Q be the total no. of time cleaning required and R be number of times the uncleaning, consistency rate will be [1-(R/Q)].

Path for movement of material

Let J be the total number of times hindrance and K be the total no. of movements. Then rating will be: [1-(K/J)].

Table 4.1.3 Seiso rating table

Weeks	Cleaning workplace	Machine Cleanliness	People Working conditions	Safety	Cleaning consistency	Total rating S3
1	1	1	0.4	0.9	0.4	3.7
2	1	1	0.4	0.9	0.4	3.7
3	1	1	0.65	0.9	0.4	3.95
4	1	1	0.65	0.9	0.4	3.95
5	1	1	0.8	0.9	0.6	4.3

4.1.4 SEIKETSU (STANDARDIZE)

By taking average of S1, S2 and S3, because standards of any system will fall & rise by factors of mean rate.

Rating of Seiketsu = (Rating of Seiri + Rating of Seiton + Rating of Seiso)/3

Table 4.1.4 Seiketsu rating table

Weeks	Total S4 = (S1+S2+S3)/3
1	3.1833
2	3.2167
3	3.4333
4	3.5167
5	3.9833

4.1.5 SHITSUKE (SUSTAIN)

Shitsuke rating can be calculated by S1, S2, S3 and S4 because without that regularity will not maintain.

Shitsuke Rating = (Rating of Seiri + Rating of Seiton +Rating of Seiso + Rating of Seiketsu)/4

Table 4.1.5 Shitsuke rating table

Weeks	Total S4 = [{(S1+S2+S3+S4)/4}*100/5]
1	63.6665
2	64.3333
3	68.6667
4	70.3333
5	79.6667

4.2 SWOT Analysis

Here the calculation can be done percentage wise bye analyzing the Strength, Weakness, Opportunities and Threats of the organization. Thus, it helps to improve the strategic planning in order to improving the quality of the product of the organization as well.

4.2.1 Strength

- Cheap
- Good Malleability & ductility properties
- Good Advertisement & publicity

- Customer trust & faith is good
- Good in sales technique &ability to customize
- Flexibility for expansion
- Availability of international market
- Good in share market
- Mechanical strength is good
- Scrap availability and ease of scrap transportation

4.2.2 Weakness

- Poor network in rural area
- Poor R & D wing
- International shares
- Lab facility
- Preparation is from its scrap
- Failure in furnace

4.2.3 Opportunities

- Good internal market
- High demand in Public sectors
- Expansion facility
- Flexibility in future expansion
- Good distribution network
- Resource Building capacity

4.2.4 Threats

- Global competition
- Availability of raw materials
- Availability of skilled person
- Internal market
- Dumping by competitors.
- Poor lab facility

Table 4.2.1 Percentage wise split up of factor Strength, Weakness, Opportunities and Threats

S.NO.	Strength	%	Weakness	%	Opportunities	%	Threats	%
1	7	1.75	15	1.75	22	5.5	19	4.75
2	11	2.75	11	2.75	16	4	17	4.25
3	15	3.75	21	5.25	13	3.25	16	4
4	9	2.25	12	3	16	4	16	4
5	12	3	18	4.5	18	4.5	18	4.5
6	13	3.25	23	5.75	13	3.25	14	3.5

7	5	1.25	-	-	-	-	-	-
8	12	3	-	-	-	-	-	-
9	9	2.25	-	-	-	-	-	-
10	7	1.75	-	-	-	-	-	-
Total	100	25	100	25	100	25	100	25

4.3 OEE - Overall Equipment Efficiency

1. Miss roll of TMT Bar.
2. Cooling Bed jam.
3. Jamming of material in the furnace.
4. Reduction Gear Box Problem (due to, oil contamination, low oil level, teeth damage).
5. Ejector jam.
6. Sprocket and chain fails.
7. V belts fail.
8. Guiding and transportation system.

Table 4.3.1 The Total Downtime and the amount of Scrap, Batch size and production/day

Days	Downtime (Min)	Scrap(Ton)	Batch Size(Ton)	Production/Day(Ton)
1	140	13.45	119.7	117.3
2	350	11.12	80.15	78.56
3	200	13.8	92.85	90.67
4	420	15.31	78.52	75.5
5	260	12.13	85.83	83.06
6	220	15.43	92.77	90.1
7	180	11.1	111.02	109.49
8	230	10.05	89.12	87.67
9	310	12.17	82.45	81.6
10	480	13.86	77.16	75.87
Total	2570	128.42	909.57	889.82

4.3.2 Calculating the Overall Equipment Efficiency

To measure the OEE which will gives an indication of where we may find the error or the weakness point. The study was taking during 10 days for the data collection.

As there are 3 shifts/day with 8 working hours per shift There was a stoppage of 30 min for each shift, Therefore for 10days

Available operating time = 10 days * 3 shift/day * 8 hours/shift = 240 hours.

which gives in total 22.30 hours, 240-22.30=217.7 hours.

The target for production of TMT Bar for each day is 120 tons and for each shift is equal to 40 tons

4.3.3 Availability Factor

Total time consumption to produce the batch for 10 days = Available operating time – Downtime

Therefore, downtime = 2570/60 = 42.833 = 217.7 = 174.867 hours

Therefore, the valuable operating time is 174.867 hours.

Availability = valuable operating time / available operating time

= 174.867 / 217.7 = 0.803

Availability factor =80.3%

4.3.4 Performance Factors

Therefore, the main factors Designed cycle time = 40/7.5 = 5.33 ton / hour

Total output = 889.82 ton

Performance rate = [(Design cycle time*Total Output) / Operating time]

= [{(60 / 5.33)*889.82)} / (174.867*60)] = 0.9547

Performance factors = 95.47%

4.3.5 Quality Factors

For calculating the quality factors we need

Total amount of defect = 128.42 ton

Production input, Total batch size = 909.57 ton

Quality rate = (production input – quality defects) / (production input)

= (909.57 – 128.42) / (909.57)

= 0.8588 Quality rate = 85.88 %

The Overall equipment effectiveness

OEE= Availability*Performance rate*Quality rate

= 0.803*0.9547*0.8588 = 0.6583

Therefore, the Overall equipment effectiveness is 65.83 %

It can seen from thetable 4.3.2 that the performance of the company as overall equipment effectiveness is 65.83%, where the availability of the line was 80.3% of the production time and the performance was 95.47% while the quality factor is 85.88%. And the

World Class OEE is 85%.

Table 4.3.2 Comparison between OEE of Company and OEE World Class

OEE Factors	OEE of Company (%)	OEE World Class (%)
Availability	80.3	90
Quality	85.88	95
Performance	95.47	99
OEE	65.83	85

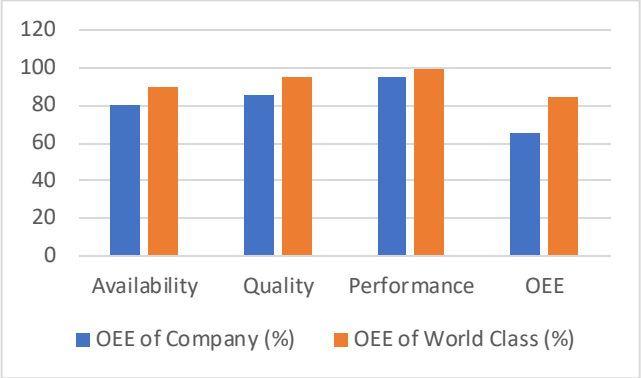

Fig 4.3.2 Comparison between OEE of Company and OEE World Class

5.CONCLUSION

Thus, the study shows the implementing the Total Quality Management in the firm through 5S, SWOT Analysis and Overall Equipment Effectiveness helps in improving the quality of the product, performance of the process and increase in the production of the firm. The wastages are also reduced by using 5S. The project has done in Ferron Steels for 2months and the data were taken from the firm. The employees were instructed keep workplace in a proper arrangement and clean.

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