

IMPLEMENTATION AND EVALUATION OF WORLD CLASS MANUFACTURING AND 5'S ACTIVITIES

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Abstract: *The world class manufacturing offers a variety of economic development opportunities and plays a vital role in rapid economic changes, productivity improvement and international competitiveness enhancement for developing of companies. The major WCM areas in which it is required to work are quality, cost and delivery, and profitability and customer satisfaction. To become the world class manufacturer it needs to focus more on improving its performance in leadership and empowerment, system integration and manufacturing strategy and non – manufacturing support function.*

I. INTRODUCTION

World class manufacturing offers a variety of economic development opportunities and plays a vital role in rapid economic changes, productivity improvement and international competitiveness enhancement for developing of companies. In these days, the necessity of globalization is getting more important especially in manufacturing section, but in these model the study of world class manufacturing have been evaluated in 5 categories that are leadership and empowerment, result areas, system integration and manufacturing strategy, non-manufacturing support functions and profitability and customer satisfaction.

WORLD CLASS MANUFACTURING:

Reviewing the literature shows that WCM is a general and wide concept. In one approach, WCM is a production management philosophy that pays special attention to continuous improvement, production techniques and human resource. The common factor among the approaches is having a high performance organization. In WCM three responsibilities financial, manufacturing and customer desirability are connected to each other by representatives such as consultants, academic institutes and colleges, human resource unions and semi-governmental organization.

Leadership culture and substructure:

Supporting management team at high level is one of the most important factors that bring about the integration of traditional system with WCM executing plans. It is believed that employee participation in organization affairs is one of the necessary methods for becoming a world class manufacturer also to emphasizes on the necessity of reconstructing, elimination of departmental competitiveness and task participation in the issue of culture and structure.

System Integration and Construction Strategies:

The improvement in various fields is necessary for becoming world class manufacturer and choosing the correct strategy and organization performance measurement as the two most important ones. The fundamental constructing strategies are low cost, faster delivery and higher quality and flexibility. One of the most important issues relating to strategy is creating suitability among trade establishment strategies in order to gaining production goals.

Non – Manufacturing support Functions:

Non- manufacturing support functions can be included accounting, human resource, sale and marketing, primary materials, buying, quality, management information systems etc. the degree of integration among manufacturing units and other non-manufacturing units are first studied and then the effect of employed strategies and techniques on value stream is assigned, the continuous improvement as WCM strategic empowerment.

Cost Quality And Productivity:

For evaluating the output of business main systems or is designed for the techniques performance at world class. In terms of suitable training of quality section, it has the vital role in executing WCM. Total quality management, total productivity maintenance, lean production and total service management are the incidental tools for becoming a world class manufacturer.

Profitability and Customer Satisfaction:

The aim of each manufacturing company is creating stabilized profit. World class manufacturer refers to a company's capability in being successful in competition and being profitable. The purposes of studying the customer satisfaction are evaluating the qualitative output, cost, delivery and satisfying customer needs and business results.

II. METHADODOLOGY

WORLD CLASS MANUFACTURING is the single agenda including lean, tpm, six sigma, and kaizen- for all. The progress can be done by attacking the losses. Activities that consume resources but do not add value in the eyes of our customers. Variation makes our processes unpredictable. To improve our activities we must minimize variation.

There are three aspects to consider:

- 1) Loss Identification: find the potential, link the improvements to the P & I, have a clear plan of attack.

- 2) Loss eradication: eradicate the losses with a step by step” hands on” team approach.
- 3) Loss prevention: introduce a system to hold the gains and have a permanent culture change.

WCM Temple: foundations and pillars nurture each other

- 1) Its not necessary to wait for the entire foundation to be built before starting the pillars.
- 2) No need to start all pillars at once; they will be started and develop according to,
 - a) Strategic business objectives
 - b) Plant priorities
 - c) Organization availability
- 3) Pillars construction will help enlarge and strengthen foundations (pillars nurture foundations)
- 4) Foundations will support pillars construction(foundations support pillars)

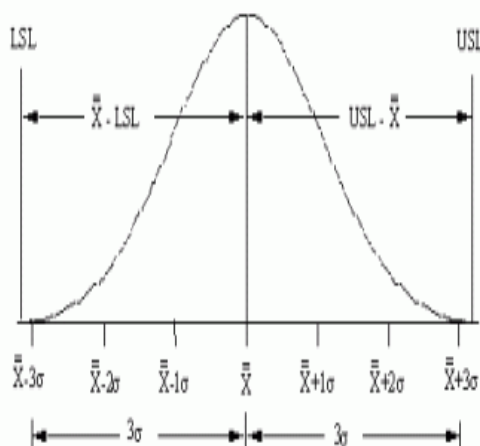
Foundation is the common tools that apply and support all the pillars. Standardization is one of the key tools of the WCM program - it must be restored or defined by improvement teams, it will remove variations from all processes, it is the basis for future improvements.

- a) **TPM (total productive maintenance):** The total productive maintenance is a system of maintaining and improving the production and quality with the help of machines, equipment's, process and employees.
- b) **Breakdown reduction:** The breakdowns can be reduced with the help of proper preventive maintenance and autonomous maintenance .the system of process is to be followed that if there is any abnormality comes then it is needed to be covered frequently.
- c) **Speed loss reduction:** speed loss reduction can be done with a proper mind-set of operator as well as corrective maintenance of machines. If there is unnecessary speed reduction due to some problem it is considered as a speed loss.
- d) **Operator checklist:** there is a prescribed operator checklist which is to be followed by operators while working on the shop floor also there are the specification decided for each and every product which will give the information about the material to be used and the load cell values.
- e) **SIX SIGMA:** it is a terminology of depending on the team effort to improve performance by systematically removing waste and reducing variation. The various kinds of waste which ae to be eliminated by six sigma are defects, over production, waiting, non-utilised talent, transportation, inventory, motion, extra processing.
- f) **Set up reduction:** set up time required for the changing different process or following the plans of production. If it is required to be followed different process from the current running process then the time taken is termed as setup time.
- g) **Hour / hour measures:** hour- hour measures are used for checking the per hour production details. For an example if the line is running at a particular speed of 45 meter per minutes then in 1 hour the estimated production should be 2700 meter of product. So every hour this ratio is verified if the production rate is getting reduced then it is required to do why - why analysis.
- h) **Abnormality response:** the abnormality response time should be rapid and fast . if any abnormality gets delayed in attacking then it leads to a big breakdown .
- i) **Scrap reduction:** reducing the scrap will improve the cleanliness in work area and decreases the confusion .
- j) **Cpk (process capability review) Improvement:** process capability is a measure of how well the process which is been followed meets the specification values.

$$C_{pk} = \text{Minimum}(C_{pu}, C_{pl})$$

$$C_{pu} = \frac{USL - \bar{X}}{3\sigma}$$

$$C_{pl} = \frac{\bar{X} - LSL}{3\sigma}$$



- k) **SPC (statistical process control):** this is the method to monitor and control a process. This helps to ensure the process is operated efficiently, producing more upgraded specification and conforming the product with less wastage. The SPC must be practised in 2 phases. The first phase is the initial establishment of the process, and the second phase is the regular production use of the process.
- l) **VSM (Value stream mapping):** it is a technique used to document, analyse, and improve the flow of information or material required to produce a product or service for a customer.

- m) **VOC (voice of customer)** : the term is used for describing the in depth process of capturing customer expectation , preferences and aversions. It is the market research technique which produces the detailed set of customer wants and needs.
- n) **Inventory / WIP (work in progress reduction)** : it is sometimes referred to as work in process, is the sum of all costs put into the production process to manufacture products that are partially completed
- o) **Lead time reduction**: it is the delay before a production begins between the initiation and execution of a process.

1) **VSM- Value Stream Mapping** is a visualization tool oriented to the Toyota version of lean manufacturing, it helps to understand and streamline work processes by using th tools and techniques of lean manufacturing, the goals of VSM is to identify to demonstrate and to decrease waste in the process. Waste is identified as any activity that does not add value to the final product, VSM can thus serve as a starting point to help management, engineers, production associates, schedulers, suppliers, and customers to recognize waste and identify its causes. As a result, value stream mapping is primarily a communication tool , but it can be used as a strategic planning tool. And as a change management tool .In order to do this , the value stream mapping method visually maps the flow of materials and information. From the moment that the products are entering the back door as raw material. Via all manufacturing process steps. Until the moment that the products leave the loading dock as finished products. Helps to visualize the current state of the process activities and guides towards the future desired state. The process usually includes mapping the current . state and future state. These then serve as the foundation for other lean manufacturing strategies. Identify the target product , product family, or service. Draw a current state value stream map, which is the current steps , delays , and information flows required to deliver the target product or services. This may be a production flow (raw materials to consumer) or a design flow(concept to launch) .Assess the current state value stream map in terms of creating flow by eliminating waste. Draw a future state value stream map. Implement the future state.

2) **Cost Deployment** is the process of identification and calculation of the losses which do not add value to the products or the evaluation of missed opportunities to increase benefits. Loss may be incurred in materials, machine, energy and inventory during the manufacturing process. The losses incurred during customer negotiation claims and lack of automation is non- manufacturing losses. The main focus includes- eliminate the cost elements without sacrificing the value and manage & monitor the costs to minimizing the value of the product.

- a) Cost deployment is the management tools used with VSM to define priorities and build a master plan
- b) Loss identification supports cost deployment for all pillars

Loss: loss is the difference between the amount of resources used in value added activities and the total resources used. The aim is to minimize loss and delivery value to the customers. There are four typical types of losses and they are related to the following resources- machine, material, labour, energy.

3) **WCM PILLARS**: A Pillar is the support of an operational excellence management system. It is driven by a team with a pillar owner. The mission is to support the organization to reach its targets using Kaizen and other Focused improvement activities while involving people from cross functional areas at all levels. Pillar Model:

- Pillar role
 - a) Aech pillar gives support to increase performance(KPI)
 - b) Performance is improved by attacking losses
 - c) Losses can be reduced through WCM methodologies
- Pillar structure
 - a) Mission
 - b) KPI
 - c) Losses
 - d) WCM methodologies
 - e) Path Road Map

Different pillars of WCM.

- 1) Health and safety: to ensure zero accidents and zero occupational illness with a consistent risk prevention system.
- 2) Environment and risk prevention: to ensure zero industrial incidents and zero non recycled waste with a consistent risk prevention system.
- 3) Reliability: to ensure reliability of the production system through planned activities at the minimum cost. The key performance parameters are overall equipment efficiency, number of breakdowns, planned to reaction maintenance ratio. Under reliability the losses are breakdowns and speed losses, the methodologies include TPM (total productive maintenance) breakdown reduction , speed loss reduction and operator checklist.
- 4) Industrial efficiency:: to support a zero defect system through control of the process, to minimize non quality cost and to improve customer satisfaction. The key performance parameters are overall equipment efficiency , set up time, manpower productivity, losses are set up time , transportation, waiting, the methodologies include leam sigma, set up reduction, hour- hour measures, abnormality response.
 - OEE (overall equipment efficiency)
 - Run hour =total quantity of product/ design speed
 - OEE = Run hour/ design hour
- 5) Quality and process control: to support a zero defect system through control of the process, to minimize non quality cost and to improve customer satisfaction. The key performance parameters include defect ratio, first pass yield, customer complaints, losses are defects ,over usage ,rework, and claims, the methodologies include cpk improvement , scrap reduction , spc, six-sigma.
- 6) Customer service and focus: to ensure consistent customer service at the minimum logistics cost through a lean culture (zero stock and zero delay). The key performance parameters are on time delivery , lead time, inventory, air freight, purchase price variances, the losses are missed shipments, inventory, air freight, purchase price variances, the methodologies include VSM , VOC, inventory/ work in progress reduction, lead time reduction.
- 7) People development:
 - a) To improve social, climate, and HR management efficiency

- b) To sustain skills evolution of the people and organizational development oriented on WCM approach(identify the skills gap and fill the gap)
- 8) Innovation development and growth: to insure a consistent process of business growth, new products, new equipment/ technologies and new market development.
- 4) 5 S
 - 1-S – segregate and discard (seiri)
 - 2-S - arrange and identify (seiton)
 - 3-S – clean and inspect daily (seiso)
 - 4-S – revisit frequently (seiketsu)
 - 5-S – motivate to sustain (shitsuke)

A process and method for creating and maintaining an organised, clean , high performance workplace. Autonomous and visual management is used for simplify the life in the plant, focused improvement and people involvement.

Kaizen event: team work for quick improvement on focused subjects from top- down (cost deployment or VSM) and bottom up (employee suggestions) initiative.

Team work: engineers, operators, supervisors, all the levels of the organization production, quality, maintenance, EHS, all the functions of the organization.

Benefits Of 5S

- a) Involvement of all people in support functions for focusing on better plant performance
- b) Reduction of administrative costs
- c) Reduced inventory carrying cost
- d) Better utilized work area
- e) Reduce repetitive work
- f) Motivate people in support areas
- g) Multi skilling in support

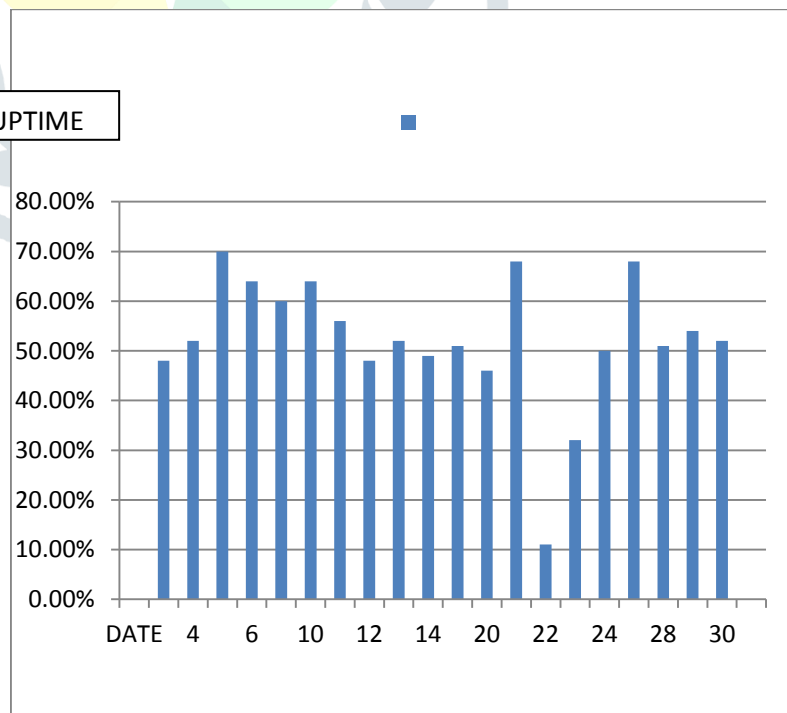
III) RESULTS

With keeping the continuous improvement activities and implementation of the above activities in the better way the results found in the increase of production of particular plant. Also the production rate increased 30% to 40% from the previous one in terms of overall equipment efficiency. After comparing the data from the previous record there is the increase in overall equipment efficiency from 50% to 75% and it is existing to the 75% continuously. In the below results it is shown that the performance of the existing system before implementation of World Class Manufacturing and 5S activities and its after implementation values.

1) PERFORMANCE OF THE EXISTING SYSTEM :

The performance of the existing system in the month of April is the existing values before the implementation of the World Class Manufacturing activities. Here the target uptime is designed to be 75% and the average uptime for the month is 52%. So it is 25% lesser uptime. For which the implementation of World Class Manufacturing and 5S activities are carried out.

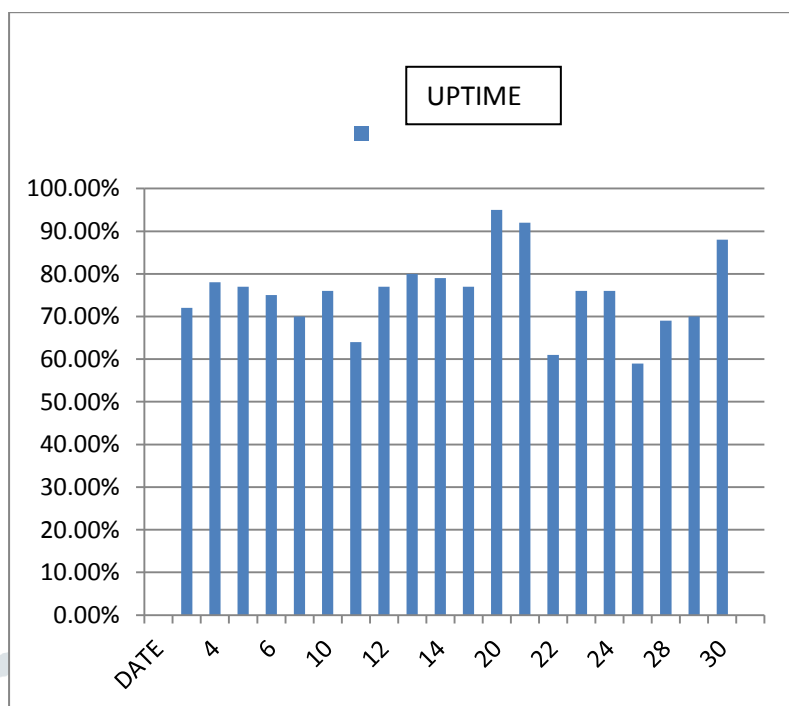
S.NO	DATE	UPTIME	TARGET
1	3	48%	75%
2	4	52%	75%
3	5	70%	75%
4	6	64%	75%
5	7	60%	75%
6	10	64%	75%
7	11	56%	75%
8	12	48%	75%
9	13	52%	75%
10	14	49%	75%
11	17	51%	75%
12	20	46%	75%
13	21	68%	75%
14	22	11%	75%
15	23	32%	75%
16	24	50%	75%
17	27	68%	75%
18	28	51%	75%
19	29	54%	75%
20	30	52%	75%



2) PERFORMANCE OF THE SYSTEM AFTER IMPLEMENTATION OF WORLD CLASS MANUFACTURING AND 5S ACTIVITIES:

The below data consists of the values of the month of October where it was required to reach the uptime of the particular machine to 75%. With the continuous efforts utilised in the activities of WCM and 5S the end result has shown the increase in the production with the cost deployment and people development. The major role is of people development and autonomous maintenance pillar of WCM by which there is reliability in the system. The target uptime for this particular month was 75% and the achieved average uptime for the month is 75.55%.

S.NO	DATE	UPTIME	TARGET
1	3	72%	75%
2	4	78%	75%
3	5	77%	75%
4	6	75%	75%
5	7	70%	75%
6	10	76%	75%
7	11	64%	75%
8	12	77%	75%
9	13	80%	75%
10	14	79%	75%
11	17	77%	75%
12	20	95%	75%
13	21	92%	75%
14	22	61%	75%
15	23	76%	75%
16	24	76%	75%
17	27	59%	75%
18	28	69%	75%
19	29	70%	75%
20	30	88%	75%



IV) CONCLUSION AND FUTURE SCOPE

The following are the conclusion drawn from the work

- As a continuous improvement process and implementation of pillars of world class manufacturing and 5S activity , there is rise in the uptime of the line by 30 % to 40 %.
- The comparison of months April and October shows in October month uptime is sustaining at 75.55 %.
- This particular uptime is been achieved from the uptime of 52%. The continuously existing uptime is 75.55%.

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