International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 05 Issue: 07 | July 2018 www.irjet.net p-ISSN: 2395-0072

Implementing Lean Manufacturing Technique in Fabrication Process Planning – A Case Study

Shashi Kumar Ranjan[1], D. K. Shinde[2]

[1]M-Tech student, Department of Production Technology, VJTI, Mumbai, India-411019
[2]Asso. professor, Department of Production Technology, VJTI, Mumbai, India-411019

Abstract - *In competitive environment companies are facing the challenges because of competitive world in terms of high quality expectation, reduced cost of production, with better quality and increased productivity. Lean manufacturing is a standard tool of the present business environment. Due to rapid changing in business domain the organizations are forcing to face challenging and complexity. Any industries whether manufacturing firm or service oriented to stay because of its ability to persistently and systematically get back to any changes for improving the market share and product value. So therefore value addition process is required to achieve this excellence hence implementing a lean manufacturing system in fabrication is becoming a key capability for any type of organizations to stay in market. Lean manufacturing have so many synonyms like lean management, lean production, It is very useful tool for reducing the non-value added time. Lean manufacturing is an ideology to reduce the time between customer orders arrived to products or components is ready for the dispatch by eliminating all wastes. It is a consolidate sub-system that gives production of goods or services with minimizing capital or over all costs. And also develop about lean, what is lean manufacturing, what are the various lean tools, why it is needed, and what is the method of reducing waste by introducing lean tool.*

Keywords: Fabrication Process, Toyota Production System, Lean production system, gemba walk, Fabrication SIPOC Diagram, kaizen.

1. INTRODUCTION

The word lean manufacturing was first used in 1988 by Krafcik and it was taken from the famous book entitled The Machine that Changed the World: The Story of Lean Production. Lean production is used by TPS (Toyota production system) and primarily aims to eliminate the wastes (muda) from production environment. Waste "muda" define by Taiichi Ohno, it is a human activity, which consumed resources but does not create or add value in the final output.

Lean production is an approach to management that focuses on removing waste those are generated during processes, while ensuring quality. Lean production aims to reduce costs by making the business more efficient and highly responsive to the market needs. Lean manufacturing is the evidences that, what value added in the final output, by removing anything else (which are not added value). Toyota is esteemed for the focusing on the reduction of the original seven wastes (Muda) to improve overall customer's value, but there are varying perspectives on how this is best achieved. The steady growth of Toyota, from a small company to the world's largest automaker has focused attention on how it has achieved this success. [1] [8]

The lean approach to managing operations is really about:

1) To create a continuous flow

2) To reduce non value added activity

3) To Selective use of automation

4) To install a continuous improvement competence.

Gemba walk

In the manufacturing world, a gemba walk is the action of walking around a shopfloor with the aim to identify problems and improvement ideas. Gemba (also written "genba"): japanese word meaning "the actual place". In business, *Genba* refers where value creation happens, but also where most problems occurs. In lean manufacturing, the idea of *Genba* is that the problems are visible, and the best improvement ideas will come from going to the *Genba.* The gemba walk is very

important to sustain a company‟s continuous improvement culture. It represents the first step in a structured process that aims to systematically identify improvement opportunities and transform these ideas into improvement plans.

Taiichi ohno, an executive at Toyota, led the development of the concept of the Gemba walk. The Gemba walk is an opportunity for staff to stand back from their day-to-day tasks to walk the floor of their workplace to identify wasteful activities. Gemba walk is designed to allow leaders to identify existing safety hazards, observe machinery and equipment conditions, ask about the practiced standards, gain knowledge about the work status and build relationships with employees. The objective of Gemba walk is to understand the value stream and its problems rather than review results or make superficial comments. Along with Genchi genbutsu or "go, look, see", Gemba walk is one of the 5 lean guiding principles that should be practiced by Lean leaders on a daily basis. The *Gemba* walk is an activity that takes management to the front lines to look for waste and opportunities to practice *Gemba kaizen,* or practical shopfloor improvement. [7]

2. LITERATURE REVIEW

The purpose of this research is to develop a better plan for the fabrication and identify wastes on shop floor and make recommendations for improvement. It is also believe that the company uses this fabrication planning for the similar fabrication job manufacturing, in order to increase productivity and remove the non-value added activity from the process plan. And also improve the quality of goods produced by the company, while at the same time reducing costs, total cycle time, human effort.

The literature gives broad knowledge about the lean manufacturing tools and its applications at various business firms. The data collected from the various resources was very useful in measuring and analyzing the current production system and also gave useful knowledge about the modifications that must be made to the fabrication processes to achieve flow by continuous elimination of wastes from planning stage.

The company analyzes problems such as low productivity, and some manual gas cutting and marking on fabrication shop. There are a number of reasons for these problems including operation fatigue, wrong welding procedure, lot of time consuming in plate for setup, manual marking. The fabrication process absorbed smooth and sorted out during gemba on shop floor (actual place), but when studied closely and find out, much inefficient operation can be identified, all collectively adding to the problems named above. Form a ‘lean’ Six Sigma approach, many of these problems of the fabrication process can be corrected by changing the process planning of the fabrication. Close looks at the process planning demonstrate mostly three types of wastes that ‘lean’ manufacturing tries to eliminate, are present in the process planning. It is thus an ideal technique for a ‘lean’ manufacturing transformation.

2.1 Research Objective

I. Function involved in product design and fabrication process planning
II. Main task undertaken during process planning
III. Improve productivity
IV. Remove non value add activity

2.2 Types of Wastes

The elimination of waste is the goal of lean Toyota defined three broad types of waste 3Mus.

Muri (Strain) - all the unreasonable work that management impose on workers and machine because of poor organization like heavy weight, moving things around, dangerous tasks, even working significantly faster than usual. It is pushing a person or a machine beyond its natural limits. This may simply be asking a greater level of performance from a process than it can handle without taking shortcuts and informally modifying decision criteria.

Mura (Discrepancy) - it is the variation and inconsistency in quality and volume in both products and human conditions.

Muda (Waste) - it specific any human activity. According to tapping (2002) “the ultimate lean target is the total elimination of waste. Waste, or muda, is anything that adds cost to the product without adding value.

Wastes can be classified into seven categories-

Overproducing: Producing components that are neither intended for stock nor planned for sale immediately.

II. **Waiting:** Refers to the idle time between operations.

III. **Transport:** Moving material more than necessary.

IV. **Processing:** Doing more to the product than necessary and the customer is willing to pay.

V. **Inventory:** Excess of stock from raw materials to finished goods.

VI. **Motion:** Any motion that is not necessary to the completion of an operation.

VII. **Defects and spoilage:** Defective parts that are produced and need to be reworked [6]

3.0 Research Methodology

The project methodology adopted to conduct the investigation was the first three steps of the Lean Six Sigma DMAIC (define, measure, analyze, improve and control) process. In define step, define the problem or research goal are addressed. To have first knowledge of the production process and to be familiar with the each and every activities being performed at the floor shop, we went through Gemba technique the facility and identified each operation process involved from first stage to last stage, identified all the processes like cleaning, setup, welding, Grinding, Marking, cutting etc. And observed how the material flowed from one operation to another. The data is collected using an interview and questionnaire survey and Gemba walk, brain storming session were conducted only on bold word in SPIOC diagram to identify the problem. Because of very long cycle time of the job, fabrication operation is most important part and also it will take more cycle time. Because of more cycle time, non-value added activity is more.

The Measuring step involved Measure the problem or non-value activity and process from which it was

Fabrication SIPOC Diagram				
Supplier	input	process	output	customer
a) Machine Shop b) Steel Plate Suppliers c) Welding Consumable Suppliers d) Purchasing e) Warehouse f) Operations	a) Steel plate b) Man power c) Drawing d) Engineering e) Consumable wire f) Scheduling	a) Profile marking b) Profile cutting c) Rolling d) Weld Edge Prep. **e) Cleaning and Grinding** **f) Leveling and plumbing** **g) Manual Marking** **h) Set-up** **i) Welding** **j)** Bore Machining and Drilling, k) Facing l) Inspection	a) Fabricated b) Components c) Machine Shop	a) Office b) Site c) Construction d) Repair Shop e) Assembly f) Warehouse

produced and measuring time wastes in the process by using the time study. It helps to understand and streamline work processes using the lean tools and techniques of Lean Manufacturing.

The Analyze step produced bar charts of time usage. The Analysis step remained to be completed in order to identify all the root causes of unnecessary time used and operation. The Improve step, where gives solutions to root cause are tested, and the Control step, where improvement are introduced into the business operation to prevent problems recurring, also remained undone. Bar chart was used to verify the results. Return for investment was also calculated to check the feasibility. [4] [5]

1. Multiple Leveling And Plumbing
2. Manual Marking
3. Welding Procedure
4. Design Modification

3.2 Development of lean techniques

The tool SIPOC and Gemba walk was used for find out the improvement area and reduction of wastes scope. The SIPOC process map is essential for identifying the way processes occur currently and how those processes should be modified and improved throughout the remaining phases of DMAIC. To find the various causes and their remedies brainstorming session was conducted. SIPOC are useful for focusing a discussion and helping team members agree upon a common language and understanding of a process for continuous improvement. It was effective and creative thinking technique. It helps to get a large number of ideas from a group in short time. The following steps in a brainstorming session.

1. Announced the purpose of the meeting to everyone.

2. Encourage valuable ideas

Wrote all the ideas suggested once all the ideas have been mentioned and recorded, time was taken to answer to answer question and clarifies the suggestions.

3.3 **Methods to improve above problems**

1. **Process-** Automation adopted at various stages, provision of follow sequence of operation, CNC gas cutting and marking, and improving welding process.
2. **Design Modification**– modification in the design as per functional requirement of manufacturing.
3. **New Fixture**– Introducing new fixture as per requirement during fabrication of the job
4. **People**- training for new workers, proper work distribution of work.

Based on the SIPOC diagram and the output of brainstorming and gemba walk developed value added (VA), necessary non value added (NVA) and non-value added (NVA). Fabrication Process activity study is used to identify the waste or non-value added activity that occurs on each production process. By using the above method of improvement we identify the waste time and processing time were reduced which lead to reduction in cycle time.

Research Analysis

Below table shown that the reductions of man hours in some major operation in fabrication shop only. Our main research objective also focuses on fabrication process only. In the table shown that actual man hours required to manufacture the job given in current process sheet. After the measuring the current problem and analyze these and suggested to the improved hours for further manufacturing of these job, improvement hours given table below. All man hours detail in each operation Collected during gemba walk and brainstorming session. These tables consider man hours for only one type of job. But this analysis may be used to analyze for the further similar type of job also.

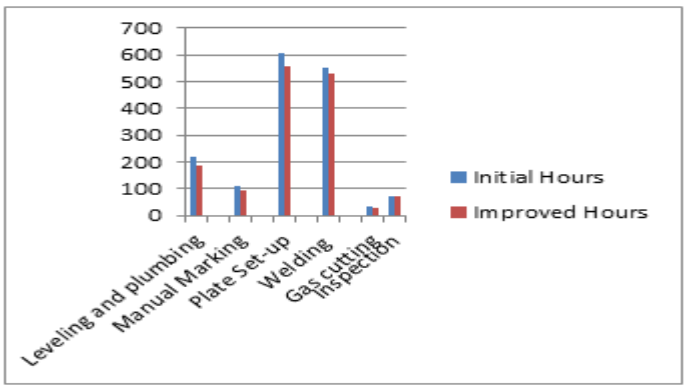


Figure no.1 Bar chart For Initial and Improved Hours

1.0 Calculation of return of investment

Total cost for implementing the techniques including Fixture cost (Approximated value) = RS.25, 000/-

Time saving by the new process in fitting = 100 hours

Time saving by the new process in welding = 20 hours

Standard Fitting Cost per Hours = Rs 330

Standard Welding Cost per Hours = Rs 600

Fitting cost consider (Cleaning and Grinding, leveling and plumbing, manual Marking, Set-up, gas cutting, correction and rework)

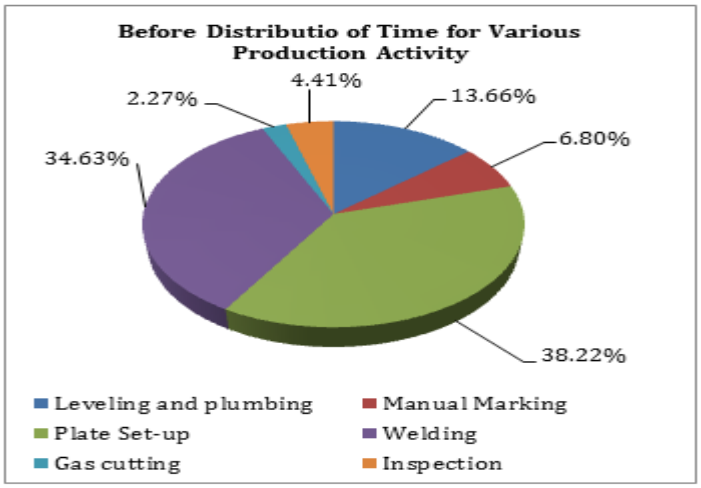
So, Expected saving per Job in fitting = Reduction hours X Fitting cost per hours = (100*X*330) = Rs 33000/-

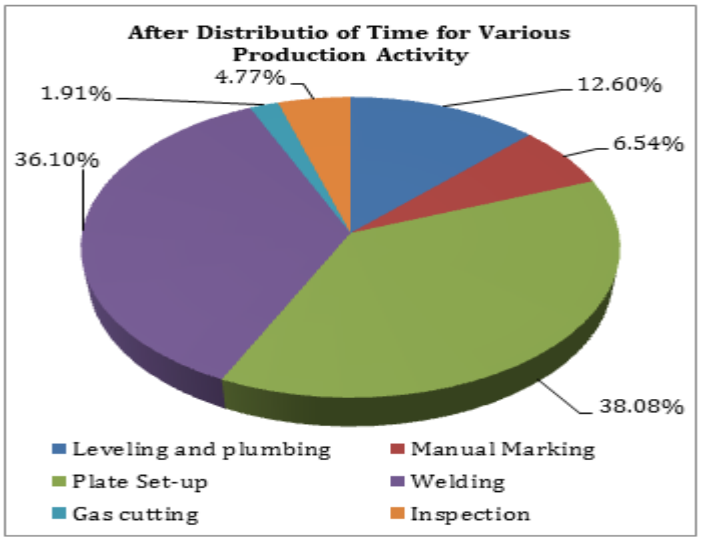
Expected saving per Job in fitting = Reduction hours X Welding cost per = (600*X*20) = Rs 12000/-

Total saving per job = Fitting + Welding = Rs 45000/-

Total time saved per job = 120 hrs.

The above calculated improved productivity and role shows the new method is valid and feasible one.





5.0 CONCLUSION

This paper presented a research work on Reduction in process cycle time in manufacturing industry. By implementing lean manufacturing principle the unnecessary time for performing the fabrication operation were reduce by 120 hours, which leads to cycle time reduction of the above fabrication process and productivity increased by 7.6%. This reduction in the cycle time has significant impact on company's productivity. The value stream map developed gave a good idea of the process and the changes to be done. So the improved productivity by using of new technique in current environment is valid and feasible.

REFERENCES

[1] Fawaz A. Abdulmalek, Jayant Rajgopal, Analyzing the benefits of lean manufacturing and value stream mapping via simulation: A process sector case study, Int. J. Production Economics 107 (2007) 223–236.

[2] McDonald T, Van Aken E.M, Rentes A.F, Utilizing simulation to enhance value stream mapping: a manufacturing, case application. International Journal of Logistics, Research and Applications 5 (2) 2002 213–232.

[3] Rahani AR, Muhammad al-Ashraf, Production Flow Analysis through Value Stream Mapping: A Lean Manufacturing Process Case Study, Procedia Engineering 41 (2012) 1727 – 1734.

[4] Kumar S, Satsangi P.S and Prajapati D.R (2011). "Six sigma an excellent tool for process improvement – a case study". International journal of scientific & engineering research, vol. 2, issue 9, 2229-5518.

[5] Kumar V. and Khandujar (2013). "Application of six sigma methodology in SSI: a case study" International Journal of Current Engineering and Technology, vol. 3, no.3, pp.971-976.

[6] Rother, M. & Shook, J. (1999), "Learning to See: Value Stream Mapping to Add Value and Eliminate Muda", Brookline, MA: Lean Enterprise Institute (www.lean.org)

[7] Feld, W.M. (2000). Lean Manufacturing: Tools, Techniques, and How to Use Them. London: The St. Lucie Press.

[8] Grewal, C.S. (2008). An initiative to implement lean manufacturing using value stream mapping. Int. J. Manuf. Technol. Manag. 15(3-4):404-417.

[9] Hines, P. and Rich, N. (1997). The seven value stream mapping tools. International Journal of Operations &Production Management 17(1): 46-64.

[10] Andrew Castle, Rachel Harvey (2009). "Lean information management: the use of observational data in health care". International Journal of Productivity and Performance Management, Vol. 58 Iss: 3, pp.280 299. ISSN 1741-040

[11] Jannis Angelis, Bruno Fernandes. International Journal of Lean Six Sigma Vol. 3 No. 1, 2012 pp. 74-84 *q* Emerald Group Publishing Limited 2040-4166 DOI 10.1108/20401461211223740

[12] Manimay Ghosh, Journal of Manufacturing Technology Management Vol. 24 No. 1, 2013 pp. 113-122 *q* Emerald Group Publishing Limited 1741-038X DOI10.1108 / 17410381311287517

[13] Horacio Soriano-Meier, Paul L. Forrester, Sibi Markose. Jose Arturo Garza-Reyes. International Journal of Lean Six Sigma Vol. 2 No. 3, 2011 pp. 254-269 *q* Emerald Group Publishing Limited 2040-4166 DOI 10.1108/20401461111157204.