ISSN (Online) : 2319 - 8753
ISSN (Print) : 2347 - 6710

International Journal of Innovative Research in Science, Engineering and Technology

Volume 3, Special Issue 3, March 2014

2014 International Conference on Innovations in Engineering and Technology (ICIET'14)
On 21st & 22nd March Organized by

K.L.N. College of Engineering and Technology, Madurai, Tamil Nadu, India

Process Planning Through Value Stream Mapping In Foundry

V. R. Muruganantha[1], K. Govindaraj[2], D.Sakthimurugan[3]
[1]Senior Associate Professor, Department of Mechanical Engineering, Kumaraguru College of Technology Coimbatore, India
[2]PG Industrial Engineering Scholar, Department of Mechanical Engineering, Kumaraguru College of Technology Coimbatore, India
[3]PG Industrial Engineering Scholar, Department of Mechanical Engineering, Kumaraguru College of Technology Coimbatore, India

ABSTRACT— A value stream is all the actions (both value added and non-value added) required to bring a product through the main flows essential to every product for the production flow from raw materials into the arms of the customer and to design the flow from concept to launch as a lean manufacturing tool. Taking a value stream perspective means working on the big picture, not just individual processes and improving the whole not just optimizing the parts. In this paper, in a casting foundry with results are considered with current state maps and future state maps after following the different steps starting from the detailed time study for mapping the processes from raw materials to final product. When we engage in true process improvement, we seek to learn what causes things to happen in a process and to use this knowledge to reduce variation, remove activities that contribute no value to the product or service produced, and improve customer satisfaction. Process improvement means examine all of the factors affecting the process, the materials used in the process, the methods and machines used the transform the materials into a product or service, and the people who perform the work. Lean production starts from the arguments that adding value and reducing waste. Value stream mapping is different than conventional recording techniques, as it captures the information at individuals stations about station cycle time, uptime or utilization of resources, setup time, WIP inventory, manpower requirement and the information flow from raw materials to finished goods. This paper details the use of the value stream mapping in reducing waste in manufacturing company. With a case study in a one of the casting industry, the production process path is visualized by mapping the current state value stream map. After tracking the entire process, wastage affecting the cycle time are identified and its causes analyzed. A future state value stream map is developed and improvement ideas are suggested. Value stream mapping is proved as a useful technique to minimize the cycle time and increase the productivity.

KEYWORDS— Lean manufacturing, 5S, Value Stream mapping.

I. INTRODUCTION

Casting Industry is Located in Coimbatore, India and have been dominant player in the manufacturer of Horn end other products like Castings and Industrial Cleaning Machines. Since its establishment in 1970, Company had a vision and commitment to produce and deliver products adhering to International standards.Casting Industry, a multi-faceted industrial conglomerate in this part of the country with a tradition, for over three decades of the excellence in automobile parts, industrial products and engineering that values and believes in the power of people much more than technology. It is a company that is built on the principles of ethics and human values on a solid footing. Its commitment to quality systems and society could be seen in the No.1 position it ranked in getting ISO, QS, ISO/TS 16949 and ISO 14001 in the regional, national and international levels.

II. LITERATURE REVIEW

Lean Manufacturing can be thought of as a systematic approach to reducing waste in the production process. In this sense, waste is anything (activities, processes, tools, materials, personnel) that does not add value to the product or service as viewed by the customer.

In the 1940s **Taiichi Ohio & Shigeo Shingo** improved upon previous manufacturing breakthroughs like interchangeable parts, time and motion measurement,

assembly lines-to create the Toyota Production System (TPS), the principles and practices of which eventually also became known as Just-in-Time manufacturing (JIT). This groundbreaking thinking catapulted Toyota into the global spotlight, and its processes became premier industry practices that everyone aspires to emulate. Because TPS pares manufacturing down to the bare essentials needed for high-quality production, the approach took on yet another telling name in the 1990s: Lean Manufacturing.

In an effort to better understand the true definition of waste, Lean divides the various types of waste into seven categories:

- Overproduction.
- Waiting.
- Transport.
- Over processing.
- Inventory.
- Movement.
- Scrap or defects.

Best thought of as symptoms of larger problems, the wastes are like the tips of icebergs. They indicate problems that are out of sight and that can run much deeper. Problems are compounded because, without TPS or Lean, manufacturers tend to treat symptoms only and rarely identify root causes. Original problems recur and new ones can even be created, because they just receive a quick fix and are not truly solved.
In a true Lean environment, inventory levels are reduced, hidden problems revealed, and solutions developed in a way that supports team concepts, collaboration, new ideas, and a common goal: satisfying the customer. This approach, and the results it produces, is one of the great differences between Henry Ford's breakthrough processes and Toyota's. Ford was very good at producing one specific type of automobile without variation. (He once famously said, customers could buy Ford cars in "any color so long as it's black.") Toyota's processes, on the other hand, allow quick changes that result in delivery of specifically what the customer wants.

This different viewpoint has led many services companies to benefit from implementing Lean methods and eliminating waste. Many companies have tried, unsuccessfully, to duplicate the success of Toyota, even though they have even named their efforts after the recognized Toyota Production System. The companies that do benefit from Lean Manufacturing succeed in creating an environment that is totally supportive of the entire continuous improvement effort. They understand a core principle of Lean: Success is not simply using tools and strategies but using all assets of a company, especially its people.

III. PROBLEM DEFINITION

- The current process flow takes more time for delivering the product.
- Decrease in Productivity due to increase in manufacturing lead time.
- Problems are identified in industry in terms of non value adding activities.
- Excessive movements and handlings allow damage and lead to reduction in quality.
- To reduce the lead time by using value stream mapping.

IV. METHODOLOGY

Step1: Detailed process study.

Step2: Data collection.
Step3: Analyzing the existing process flow.
Step4: Evaluate by using Value Stream Mapping tool.
Step5: Implement the new process flow.

Fig. 1 Flowchart of systematic approach

V. COMPANY DETAILS

The casting industry supplies casting not only for the automotive industry but also for a number of other industries including farming and public works machines, machining tools and public services. It is indeed the foundation of many industries. The automotive industry, however, is the primary customer for the casting industry. Demand for automobile casting worldwide is largest in Japan at about 50%, rising to about 40% in other major industrial countries. As world car production is predicted to increase by about 20% by 2010, so should the demand for casting. This large jump in demand and production is expected principally in Asia, excluding Japan, where the economy is growing rapidly. Thus, the 'motorization' of China and other countries will result in an increase in the global production of casting. On the other hand, the production volume of casting in the US, Europe and Japan may increase to some extend but a large increase is not expected in these regions. There is no doubt however that the global casting industry will continue to reply on the automotive industry, the biggest consumer of casting, for its success.

Data Collection

- Takt Time

Working shift per day = 2
Working hours per shift = 8 hours
Available time per shift = 480 minutes
Tea break per shift = 2breaks * 10 minutes
= 20 minutes
Lunch break per shift = 60 minutes
Down time per shift = 0
Net working time per shift = [available time-(breaks +break down)]
= 480-80
= 400 minutes
Net working time per day = 24000 * 1

= 24000

Customer demand per day = 535 Nos

Takt time = Available production time/

Total daily quantity required.

= 960/535

Takt time = 8 minutes

The Takt time required to meet the customer demand is Calculated & found to be 8 minutes.

C. Calculation

- **Uptime %**

Uptime % = (Actual production time of a machine – Value added time / Availability time) * 100

Actual production time of a machine:

For a month = 30 days * 24 hrs * 60 min

= 43200.

Value added time = 46 min (Calculated value)

Uptime % = [(43200 - 442) / 43200] * 100

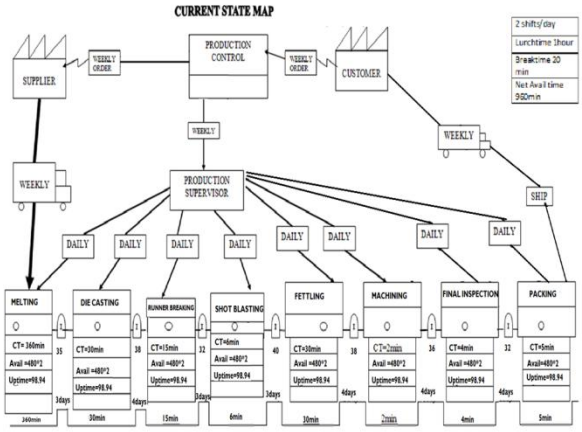
= 98.97 %

C. Current State Map

The production control information flow is shown to determine how the production processes are being scheduled and controlled. At the bottom of the Map, the total process time and lead time are calculated for a typical product family unit or order.

Fig. 3 Current state map

C. Current State Map



The daily demand for each parts & the cycle time and number of operators for every machine are noted. Then the productions of each machine are calculated. These are tabulated in fig.3

TABLE I
PRESENT MANUFACTURING

	Melting	Die Casting	Runner Breaking	Shot Blasting	Fettling	Machining	Final Inspection	Packing
Cycle Time	360 min	30 min	5 min	6 min	30 min	2 min	4 min	5 min
Operator	1	1	1	1	1	1	1	1
Up Time %	98.97	98.97	98.97	98.97	98.97	98.97	98.97	98.97
Availability	960 min	960 min	960 min	960 min	960 min	960 min	960 min	960 min

Calculation

- **Uptime %**

= [(43200 - 428) / 43200] * 100

= 99%

B. Future state map

The Future State Value Stream Map shows how the shop floor will operate after lean improvements have been implemented. The Current State Value Stream Map serves as the starting point for developing the Future State. The goal in developing the Future State Map is to make the flow continuous and to eliminate as much waste as possible. Lead time is shortened as much as possible by implementing lean techniques. The flow in the Future State Map is built around the takt time, or how frequently a unit must be completed to meet customer demand. Takt time is simply the available working time per shift divided by the rate of customer demand per shift.

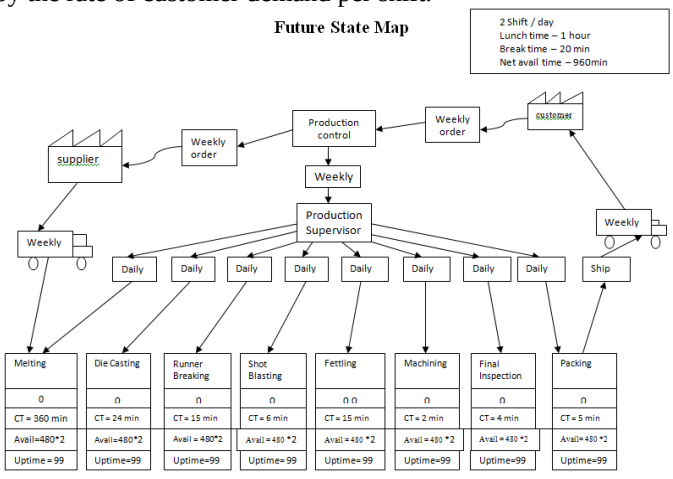


Fig. 4 Future state map

C. Case study after value stream mapping

The man power and machines are utilization is tabulated in table 2.

TABLE 2
CASE STUDY AFTER VALUE STREAM MAPPING

	Melting	Die Casting	Runner Breaking	Shot Blasting	Fettling	Machining	Final Inspection	Packing
Cycle Time	360 min	24 min	2 min	6 min	25 min	2 min	4 min	5 min
Operator	1	1	1	1	1	1	1	1
Up Time %	99	99	99	99	99	99	99	99
Availability	960min	960min	960min	960min	960min	960min	960min	960min

X. CONCLUSION

This paper delivers the evidence of valid advantage when applying lean principle to the Shopfloor. By applying 5s technique resulting effective organization of the workplace, reduction of work's environment, elimination of losses connected with failures and breaks, improvement of the quality and Safety of work. From VSM to remove the non-Valued activities during manufacturing and also to reduce manufacturing lead time. The Proposed process will overcome the drawbacks of the existing process with complete functionalities and quick respond time. This Process will be very effective and we hope that they will implement in future.

REFERENCES

[1] Sihn, W. & Pfeffer, M. ,(2013), "A method for a comprehensive value stream evaluation", CIRP Annals - Manufacturing Technology, Vol.62, pp. 427–430.

[2] Tabanli, R. M. and Ertay, T.,(2013), " Value stream mapping and benefit – cost analysis application for value visibility of a pilot project on RFID investment integrated to a manual production control system — a case study", Int . J. Adv Manuf Technol , Vol.66, pp. 987–1002.

[3] S.Harishankar and Dr.K.Natarajan, (2013),"Business process analysis through value stream mapping in a gear manufacturing industry", Proceedings of the National Conference on Manufacturing Innovation Strategies & Appealing Advancements MISAA2013,PSG College of Technology, Coimbatore, India MISAA2013-LM331.

[4] Rahani AR, Muhammad al-Ashraf Faculty,(2012), '"Production Flow Analysis through Value Stream Mapping: A Lean Manufacturing Process Case Study", International Symposium on Robotics and Intelligent Sensors, Vol.41, pp.1727-1734.

[5] Preetinder Singh Gill, (2012), "Application of Value Stream Mapping to Eliminate Waste in an Emergency Room", Global Journal of Medical Research,Vol.12, pp.50-56.

[6] Belokar, Vikas Kumar and Sandeep Singh Kharb, (2012), "An Application of Value Stream Mapping In Automotive Industry: A Case Study", International Journal of Innovative Technology and Exploring Engineering, Vol.1, pp.152-157.

[7] Claudia Paciarotti & Valentina Ciatteo and Giancarlo Giacchetta, (2011), "Value stream mapping implementation in the third sector", Oper Manag Res, Vol. 4, pp. 99–110.

[8] Patrick Schwarz & Klaus Dieter Pannes & Michel Nathan & Hans Jorg Reimer & Axel Kleespies & Nicole Kuhn & Anne Rupp and Nikolaus Peter Zügel,(2011),"Lean processes for optimizing OR capacity utilization: prospective analysis before and after implementation of value stream mapping (VSM)", Langenbecks Arch Surg Vol. 396, pp.1047–1053 .

[9] Silva, S.K.P.N,(2011), "Applicability of Value Stream Mapping (VSM) in the Apparel industry in Sri Lanka", Int. J.of lean thinking, Vol.3, pp.36-41.

[10] William M. Goriwondo, Samson Mhlanga and Alphonce Marecha, (2011), "Use of the value stream mapping tool for waste reduction in manufacturing. Case study for bread manufacturing in zimbabwe", Int. Conf. on Industrial Engineering and Operations Management Kuala Lumpur, Malaysia, Proceedings 2011 .

[11] Bhim Singh , Suresh K. Garg and Surrender K. Sharma,(2011), "Value stream mapping: literature review and implications for Indian industry", Int J Adv Manuftechnol.,Vol.53, pp. 799-809.

[12] Stephen L. Woehrle and Louay Abou-Shady, (2010), "Using Dynamic Value Stream Mapping and Lean Accounting Box Scores To Support Lean Implementation", American Journal of Business Education, Vol.3, pp. 67-76.

[13] Solding, P. and Gullander, P., (2009)" Concepts for simulation based value stream mapping", Proceedings of the 2009 Winter Simulation Conference pp.2231–2237.

[14] Ramesh, V., Prasad, K. V. S. and Srinivas, T. R.,(2008), " Implementation of a Lean Model for Carrying out Value Stream Mapping in a Manufacturing Industry", Journal of Industrial and Systems Engineering Vol. 2, No. 3, pp 180-196.

[15] Synthia Xin Shen and Chuan Feng Han,(2006), "China electrical manufacturing services industry value stream mapping collaboration", Int J Flex Manuf Syst, Vol.18,pp. 285-303.

[16] Fawaz A. Abdulmaleka and Jayant Rajgopal, (2007),"Analyzing the benefits of lean manufacturing and value stream mapping via simulation: A process sector case study", Int. J. Production Economics, Vol.107, pp.223-236.

[17] Lummus, R. R., Robert. J. V. and Rodeghiero, B.,(2006), "Improving Quality through Value Stream Mapping : A Case Study of a Physician ' s Clinic", Total Quality Management Vol.17**,** pp.1063–1075 .[18] Lian, Y. and Landeghem, H. Van.,(2002)," An application of simulation and value stream mapping in lean manufacturing" .Proceedings of Euro.Sim. Symposium.

[19] Lee, B. (2001),"Introduction to value stream", Lean Manufacturing pp.1-5.

[20] Mr.Girish.C.Pude1,Prof.G.R.Naik2, Dr.P.G.Naik3(2001), "Application of Value Stream Mapping Tools For Process Improvement a Case Study in Foundry ". IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) Vol.2278-1684, PP: 07-12.