ISSN: 2319-8753

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 3, Issue 6, June 2014

On-Time Delivery Improvement Using Lean Concepts - A Case Study of Norglide Bearings

Ranjan Raj Urs S [1], Dr. B.P.Mahesh [2], Sandesh S [3]

P.G. Student, Dept of IEM, JSS Academy of Technical Education, Bangalore, Karnataka, India[1]

Professor, Dept of IEM, JSS Academy of Technical Education, Bangalore, Karnataka, India[2]

Manager, Saint-Gobain, Performance Plastics, Devanahalli road, Bangalore, Karnataka, India[3]

ABSTRACT: The paper outlines how On-Time Delivery is to be improved by using Lean concepts. For this purpose lean tools are used because lean focus on the continuous improvement of a company towards the ideal through the relentless reduction of waste. Lean tool such as Value Stream Mapping are used to reduce Lead time. We have studied production process of one product and drawn the current state value stream map. From the current data analysis we found out the problems as high Lead time and Inventory. We implemented Kanban system to reduce the lead time, Inventory and provide a future state value stream map. Production schedule is fixed and by this On-time Delivery is Improved.

KEYWORDS: Lean, On-Time Delivery, Value Stream Mapping, Lead Time, Kanban.

I. INTRODUCTION

A. Lean

The core idea is to maximize customer value while minimizing waste. Simply, lean means creating more value for customers with fewer resources. A lean organization understands customer value and focuses its key processes to continuously increase it. The ultimate goal is to provide perfect value to the customer through a perfect value creation process that has zero waste.

B. On-Time Delivery (OTD)

On time delivery is a measure of process and supply chain efficiency which measures the amount of finish goods or services delivered to customers on time and in full. It helps determine how efficiently we are meeting our customer's or agreed deadlines. If the figure is too low or below the benchmark it could be used as a signal that somewhere along the supply chain there are bottlenecks, inefficient or time consuming processes which are not adding value and warrant further investigation or a slower delivery method is being employed.

C. Value Stream Mapping

Value stream mapping, a lean manufacturing tool, which originated from the TPS, is known as “material and information flow mapping.”This mapping tool uses the techniques of lean manufacturing to analyze and evaluate certain work processes in a manufacturing operation. This tool is used primarily to identify, demonstrate and decrease waste, as well as create flow in the manufacturing process.

D. Lead Time

Lead time can be defined as total time required to manufacture an item, including order preparation time, queue time, setup time, run time, move time, inspection time, and put away time. It is the time interval between the initiation and the completion of a production process.

ISSN: 2319-8753

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 3, Issue 6, June 2014

E. Kanban

Kanban, a technique for work and inventory release, is a major component of Just in Time and Lean Manufacturing philosophy. Kanban stands for Kan- card, Ban- signal. It is used in manufacturing to mean a visual signal that tells when it is time to get or make more of something. Within this system, workstations located along production lines only produce/deliver desired components when they receive a card and an empty container, indicating that more parts will be needed in production.

II. LITERATURE REVIEW

P.R.Thyla and D.Rajenthirakumar in their study titled "Transformation to Lean Manufacturing" explains that Lean manufacturing is an applied methodology of scientific, objective techniques that cause work tasks in a process to be performed with a minimum of non-value adding activities. It has been increasingly adopted as a potential solution for many organizations, particularly within the automotive and aerospace manufacturing industries.

Lean manufacturing is one of the initiatives that many major businesses have been trying to adopt in order to remain competitive in an increasingly global market. The focus of the approach is on cost reduction by eliminating non-value added activities. Originating from the Toyota Production System, many of the tools and techniques of lean manufacturing have been widely used in discrete manufacturing.

B.Vijaya Ramnath,C.Elanchezhian and R.Kesavan in their study titled "Application of Kanban system for implementing lean Manufacturing" explained that the aim of Lean Manufacturing is the elimination of waste in every area of production including customer relations, product design, supplier networks, and factory management Its goal is to incorporate less human effort, less inventory, less time to develop products, and less space to become highly responsive to customer demand while producing top quality products in the most efficient and economical manner possible.

III. OBJECTIVE

The Objectives of the project are

- To improve the On-Time Delivery (76%) of Norglide Bearings by reducing the Lead Time (26days) by using Lean concepts such as Value Stream Mapping Technique.
- To reduce Inventory (1,088,117 Rs in terms of money) by implementing Kanban System.

IV. METHODOLOGY

The current work is expected to proceed as per the following methodology:-

1. Define the value streams and KPI's, set targets & priorities.
2. Map the Value Stream, find the waste and deploy the Losses.
3. Define Value Stream Future State.
4. Restore & improve the Value Stream.
5. Optimize the material flow.
6. Optimize the planning and information flow.
7. Expand to customers & suppliers.

ISSN: 2319-8753

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 3, Issue 6, June 2014

Value Stream Mapping

It includes following process:

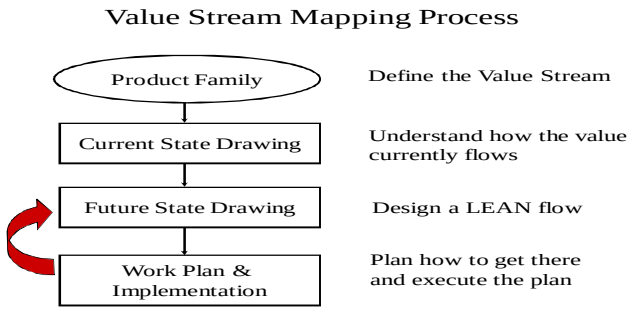

Fig 1: Steps in Value Stream Mapping

Product Family

		METALLEX	FORMING-GNO	FORMING UNI/KRY	PLATING
GROUP 1	67	Y		Y	
GROUP 2	39	Y	Y		
GROUP 3	29	Y	Y		Y
GROUP 4	10	Y		Y	Y
	145				

Table 1: Product family

In this four product family one product family which has high process is selected. Group 3 is selected. In this group 3 five parts are selected. These parts have regular demand and it is high volume production. The five parts are PP16, PP244, PP59, PP61 and PP509. In this 5 part pp16 selected which is high volume of production around 11 lakhs per month.

Current State Map

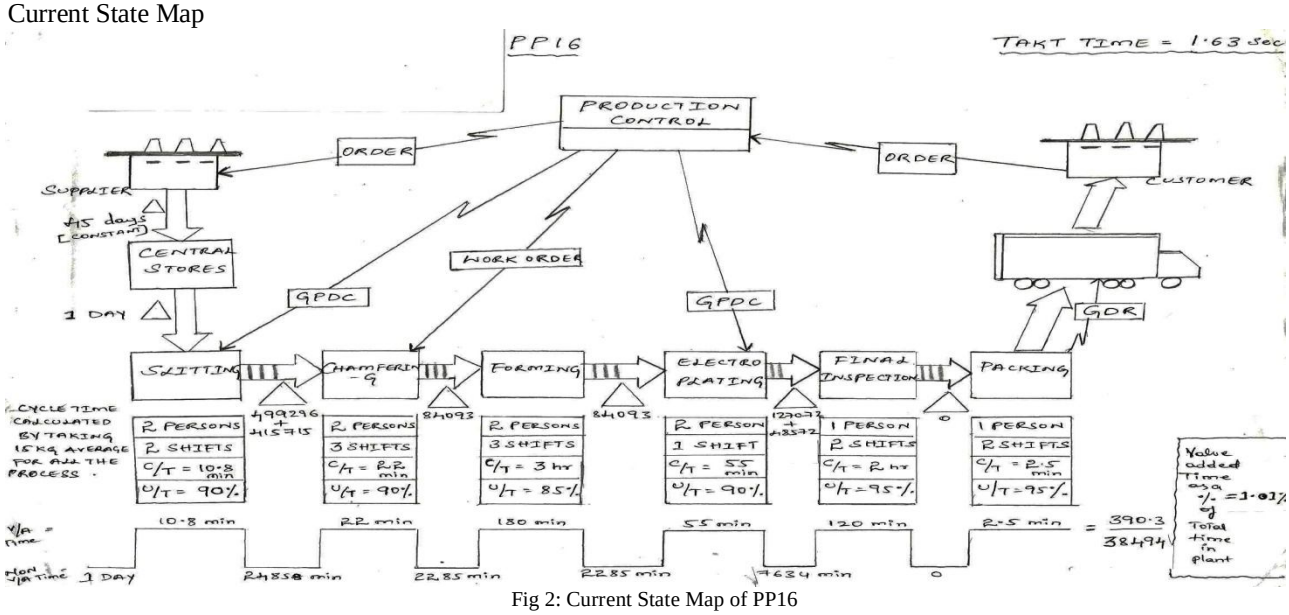

Fig 2: Current State Map of PP16

ISSN: 2319-8753

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 3, Issue 6, June 2014

Figure 2 shows the current state map of pp16. By doing value stream mapping we can easily find out the value added and non value added activities. To know the non value added time and to understand the entire process VSM is done.

Takt Time

Takt time is the rate at which product is required by the customer. Takt time should be calculated for all the parts.

$$\text{Takt time for PP16} = \frac{\text{Effective working time per shift}}{\text{Customer requirement per shift}} = \frac{20 \text{ days} * 24 \text{ hrs} * 60 \text{ min} * 60 \text{ sec}}{1055543} = 1.63\text{sec}$$

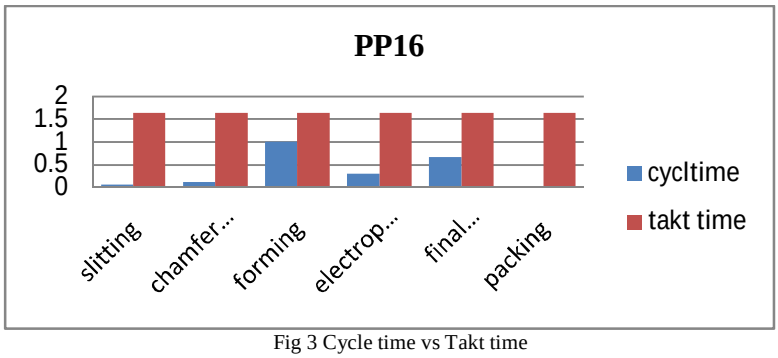

Fig 3 Cycle time vs Takt time

Figure 3 shows that the line is not balanced with all the cycle times for processes less than the Takt time. This means that the line is capable of making more products but there is need to have the line balanced. Using lean manufacturing tools, all waste in the lines were identified and mitigated to produce a more balanced line.

Kanban system

Kanban is Japanese for sign or designated place. It is used in manufacturing to mean a visual signal that tells when it is time to get or make more of something. Kanban system implemented for all the parts. Kanban is a schedule system.

Calculation of Kanban size for pp16

$$K = \frac{DL + SS}{CS} = \frac{959584 + 95959}{25000} = 43 \text{ Containers}$$

K = Kanban size, DL = Average demand during lead time, SS = Safety stock, CS = Container size.

Production schedule is fixed for all the parts. By doing this there must be a continuous flow. By adopting this production Schedule, Company reach the customer expectation within the given period and on-time delivery will be improved and Lead Time will be reduced.

WEEKS	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
1	PP16 (75000)	PP16 (75000)	PP16 (75000)	PP16 (75000)	PP16 (75000)
2	PP16 (75000)	PP16 (75000)	PP16 (75000)	PP16 (75000)	PP16 (75000)
3	PP16 (75000)	PP16 (75000)	PP16 (75000)	PP16 (75000)	PP16 (75000)

Table 2 Production schedule for part pp16 produced in 60-ton press 1 machine.

ISSN: 2319-8753

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 3, Issue 6, June 2014

Future State Map

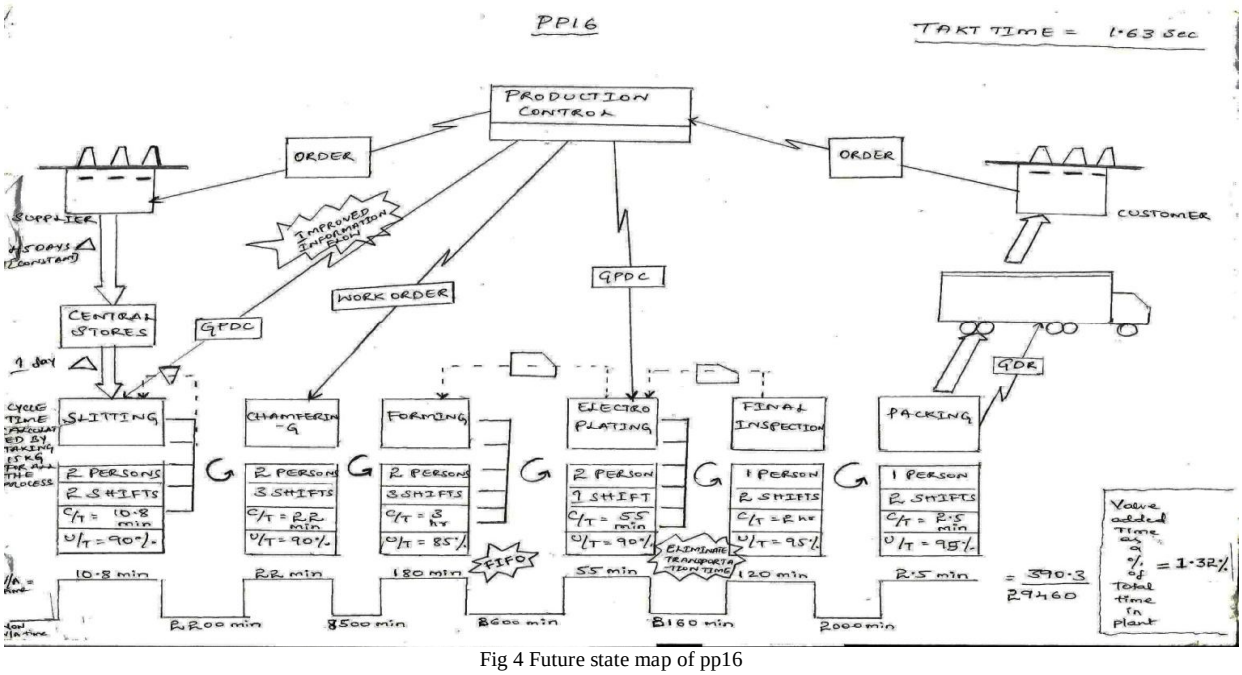

Fig 4 Future state map of pp16

Figure 4 shows the future state map of pp16. After current state map the improvement is made and Kanban system is implemented to reduce the inventory and lead time. Information flow is improved. Entire system is converted from push system to pull system.

V. EXPERIMENTAL RESULTS

After implementing the lean concepts on-time delivery is improved. By using VSM we can easily identified the seven types of wastes. By implementing Kanban system inventory is reduced. By improving the material flow and information flow lead time is reduced. Based on average demand production schedule is fixed for all parts. By doing all these company reach the customer demand within in the specified time.

1. On-time delivery is improved from 76% to 99%.
2. Lead time reduced from 26 days to 21 days.
3. Inventory reduced from 1,088,117rs to 273,819rs (in terms of money).
4. Process ratio increased from 1.01% to 1.32%.

VI. CONCLUSION

Our main objective was to improve the on-time delivery as much as possible. For this purpose Lead time is reduced by using Value stream mapping and Inventory reduced by implementing Kanban system. VSM helps to reduce the non value added activities. Improved the information flow and process ratio. Converted all process from push system to pull system. Production schedule is fixed and by this on-time Delivery is improved.

ISSN: 2319-8753

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 3, Issue 6, June 2014

REFERENCES

[1] B.Vijaya Ramnath,C.Elanchezhian and R.Kesavan, "*Application of kanban system for implementing lean manufacturing"*, Journal of Engineering Research and Studies, Vol. I, Issue I, July-Sept, p138-151, 2010.
[2] Ibon Serrano Lasa, Carlos Ochoa Laburu, Rodolfo de Castro Vila, "*An evaluation of the value stream mapping tool, Business Process Management"*, Journal, Emerald Group Publishing Limited, Vol. 14 No. 1, 2008 pp. 39-52, 2008.
[3] Agarwal N, "Review on just in time techniques in manufacturing systems, advances in production engineering and management scientific paper", Vol. 2, Issue 2, p101-110, 2010.
[4] Harwinder Singh, Amandeep Singh, (2013) "Application of lean manufacturing using value stream mapping in an auto-parts manufacturing unit", Journal of Advances in Management Research, Vol. 10 Iss: 1, pp.72 – 84.
[5] Bhim Singh, S.K. Sharma, (2009) "Value stream mapping as a versatile tool for lean implementation: an Indian case study of a manufacturing firm", Measuring Business Excellence, Vol. 13 Iss: 3, pp.58 – 68.
[6] Renu Yadav, Ashish Shastri, Mithlesh Rathore "Increasing Productivity by Reducing Manufacturing Lead Time through Value Stream Mapping" International Journal of Mechanical and Industrial Engineering (IJMIE), ISSN No. 2231 –6477, Volume-1, Issue-3, 2012.
[7] Silva, S.K.P.N "Applicability of Value Stream Mapping (VSM) in the apparel Industry in Srilanka" International Journal of Lean Thinking volume 3, issue 1 (June 2012).
[8] Shivani Joshi, "Automating Value Stream Mapping in Lean Environment by Using RFID Tool" International Journal of Applied Research & Studies ISSN 2278 – 9480 iJARS/ Vol. I / Issue II /Sept-Nov, 2012/181.
[9] Rumbidzayi Muvunzi, Catherine Maware, Simon Chinguwa, MwodzaCaspah, "Application Of Lean Value Stream Mapping To Reduce Waste And Improve Productivity: A CASE OF TILE MANUFACTURING COMPANY IN ZIMBABWE International Journal of Application or Innovation in Engineering & Management (IJAIEM) Volume 2, Issue 7, July 2013 ISSN 2319 – 4847.
[10] Pavnaskar, SX, Gershenson, J.K. and Jambekar, A.B. (2003), Classification scheme for lean manufacturing tools. International Journal of Production Research, 41, 3075-3090.
[11] Abdulmaleka, F. A., and Rajgopalb, J. (2007). Analyzing the benefits of lean manufacturing and value stream mapping via simulation: A process sector case study. International Journal of Production Economics, 107(1), 223-236.
[12] Hines P., Rich N., Bicheno J., Brunt D., Taylor D., Butterworth C. and Sullivan J., (1998); Value Stream Management, International Journal of Logistics Management, 9(1), pp 25-42.
[13] Andrew Lee-Mortimer, "A continuing lean journey: an electronic Manufacturer's adopting of Kanban, Assembly Automation", Emerald Group Publishing Limited, Volume 28, Number 2, p103-112, 2008.
[14] Anonymous, Manufacturing Lead time, http://www.businessdictionary.com/definition/manufacturing-lead time.html#ixzz25yFudpnc, Date of retrieval: 29/09/2011
[15] Tinoco, J. (2004 – a research paper), Implementation of Lean Manufacturing, Wisconsin: University of Wisconsin-Stout.
[16] Rother, M., & Shook, J. (2003). Learning to See – Value Stream Mapping to Create Value and Eliminate Muda, 2nd Edition, Brookline, Massachusetts: The Lean Enterprise Institute
[17] R.M. Belokar, Sandeep Singh Kharb, Vikas Kumar (2012), "An Application of Value Stream Mapping In Automobile Industry: A Case Study", International Journal of Innovative Technology and Exploring Engineering (IJITEE), Volume-1, ISSN: 2278-3075.
[18] "VALUE STREAM MAPPING TO REDUCE MANUFACTURING LEAD TIME IN A SEMI-AUTOMATED FACTORY" published in Asian Transactions on Engineering (ATE ISSN: 2221-4267) Volume 02 Issue 06 in January 2013.
[19] Ohno, T. (1988), Toyota Production System, Productivity Press, Cambridge, MA, pp. 1-44. Cited in Chowdary and George (2012).
[20] Womack, J.P., Jones, D.T, and Roos, D., 1991, The Machine That Changed The World:The Story of Lean Production, New York:Happercollins.