A Literature Review on Lead Time Reduction Using the Value Stream Mapping

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Abstract

Value Stream Mapping has the reputation of uncovering waste in manufacturing, production and business processes by identifying and removing or streamlining value-added steps and eliminating non-value-added steps.The non-value actions are identified in each step and between each step by their waste of time and resources. The Manufacturer goal is to satisfy the customer with the exact product, quality, quantity, and price in the shortest amount of time. It can only be achieved if the company is able to create and to implement effective and efficient processes in each of its line of their business. 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. Value Stream Mapping is a powerful lean tool for identifying the waste and this paper defines concept of Value Stream Mapping and various literatures related on VSM and will be useful for new research in current field. The reengineered process is flow charted in its future state with process steps and information flows redesigned, simplified and made less expensive. This paper addresses the application of lean manufacturing concepts to the manufacturing industry.
Keywords*-Lean manufacturing, lead time, Value stream mapping etc.*

I. INTRODUCTION

Shortage of materials, finances, and human resources were faced by Manufacturers in japan. The problems that Japanese manufacturers were faced with differed from those of their Western counterparts. These conditions resulted in the birth of the lean manufacturing concept. Toyota Motor Company, led by its president Toyoda recognized that American automakers of that era were out-producing their Japanese counterparts; in the mid-1940s' American companies were outperforming their Japanese counterparts by a factor of ten. In order to make a move toward improvement early Japanese leaders such as Toyoda Kiichiro, and Taiichi Ohno devised a new, disciplined, process-oriented system, which is known today as the Toyota Production System, or Lean Manufacturing. After some experimentation, the Toyota Production System was developed and refined between 1945 and 1970, and is still growing today all over the world. The basic underlying idea of this system is to minimize the consumption of resources that add no value to a product.

G Saranyal, Mr S B Nithyanath [3] suggested that Japanese quality concepts like Toyota Quality System prove their efficiency by implementation in manufacturing companies leading to time-saving, no stocks production, optimum cost, high quality products. In this sense, Value Stream Map – VSM – represents one of the tools that detects the cause of failure and has the capacity to prevent the effect of this failure on the whole manufacturing chain.

The advantage of using this method allows anybody to "see" both process flow and communications flow within the process or value stream . Because of this ability to gather, analyze and present information in short period of time, this method has rapidly gained popularity in the process of continuous improvement. The most important goal of Value Stream Mapping method is that identifies opportunities for improvement for future periods of Time.
VSM is an analytical method, and is based on details, depending on the level of details, the VSM can address only to a process step, to one or the production lines, or to the entire factory. Value Stream Map is a collection of all the actions, the add-value ones, as well as the non value actions, which are necessary for a full process of a product through the technological flow, from the raw material to the client. The final aim of the Value Stream Map is to identify all types of wastes in the value flow and to eliminate all these wastes.

II. Methodology of VSM Applied by the Researcher

Manufacturing process is done with a pencil and paper using various process symbols of VSM to visualize the flow of material and information as a product takes its way in manufacturing line. Mapping is done keeping in view of the lean manufacturing principles which are the backbone of VSM. These principles are:
• Define value from your customer's perspective.
• Identify the value stream.
• Eliminate the seven deadly wastes.

• Make the work flow.
• Pursue to perfection level.

The proposed methodology is given as a flow chart (Fig. 1), which starts from current state map and its analysis. Finally it is concluded with the future state, analysis and implementation.
To start improving productivity by identifying waste and then removing it by implementing lean principle in the Industry there is no other tool better than VSM. Value-stream mapping can be a communication tool, a business planning tool, and a tool to manage company change process. Creating a value stream map will allow the company to document current production lead time, inventory levels, and cycle times in order to determine the ratio of value-added to total lead time of the product family being analyzed, creating a vision of an ideal value flow.

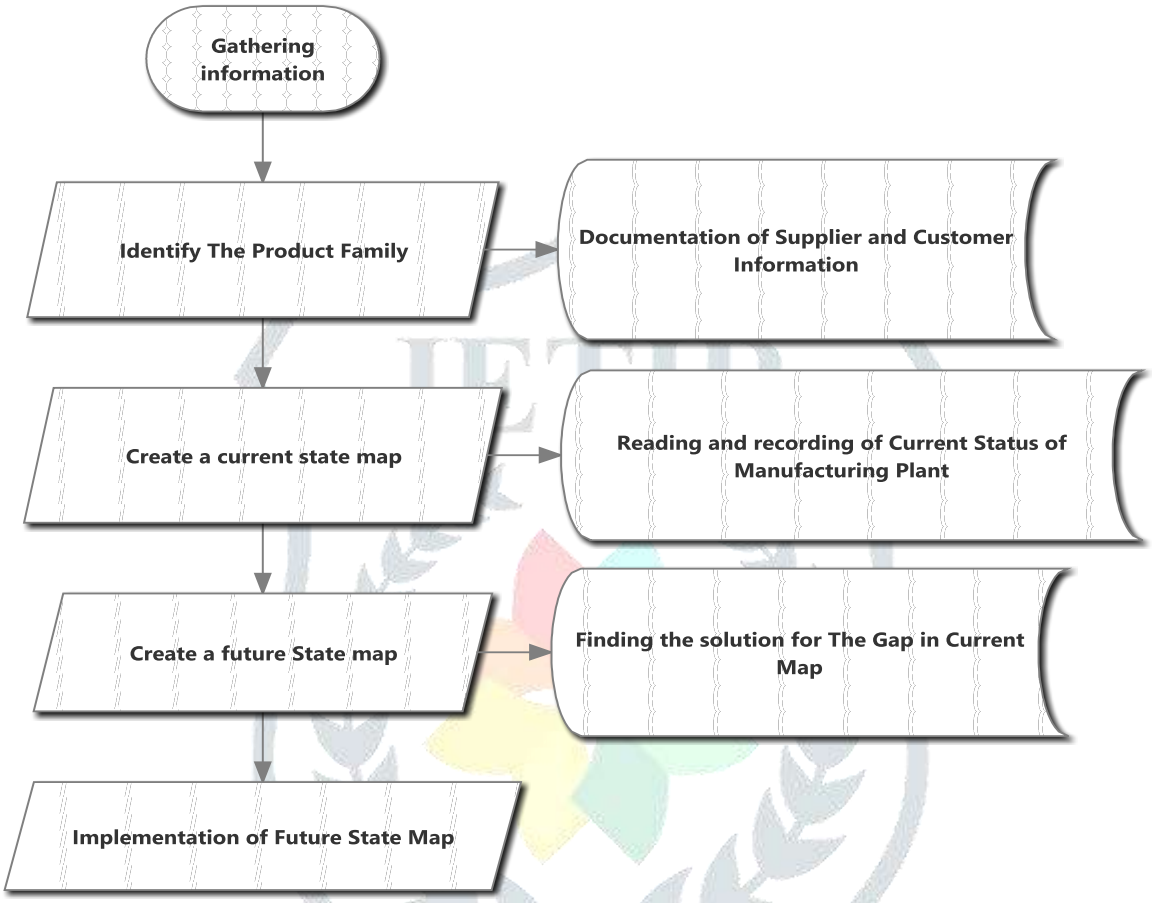

Figure 1 VSM Methodology

J. Dinesh, A. Prabhukarthi [5] Introduced The Value Stream Mapping method (VSM) is a visualization and streamline work processes using the tools and techniques of Lean Manufacturing. The goal of VSM is to identify, demonstrate and decrease waste in the process. A manufacturing system operates with timing of step-by step activities. There are several important steps to getting started with your value stream mapping process That are shown in the (Fig. 1).
The process analysis is carried out by collecting the data from various enquiries with expertise in shop floor, workers and directly participating in measuring the time of various processes

III. LITERATURE REVIEW

The following are the brief review of literatures on lean manufacturing concepts.

1. Mimnun Sutana and Mazarul Islam [7] suggested that to remain competitive in the global market the most important task for garnment industry is to reduce the lead time which is also important for long term stable development.

2. Florin Buruiana, Mihaela Banu [3] introduced Value Stream Map is used as an improving method to progress in implementing 'lean thinking' and as a leading formula in the improvement activities. As an improvement tool, VSM simplifies the measurement of times without added-value, so the calculation of lean coefficients is much easier and it is possible to improve the operative actions with strategic results.

3. Nitin Pandhia and Sanjeev Vermaa [9] introduced Value Stream Mapping (VSM) is an important tool for implementing lean philosophy. VSM is a method to describe the flow of material and information through the production system. The ratio of value added to total lead time is determined by documenting the current lead time, inventory levels, and cycle times. Value added activities make the product more closely to the customer requirement. Non Value added activities do not create customers value, and anything that does not constitutes to value is defined as Waste.

4. J Dinesh *et. al* [5] introduced VSM is a useful tool for process analysis and improvement by identifying and eliminating time spent on non-value-added activities. By using Value Stream Mapping the process time and value added and non-value added activities are identified. Lead time is reduced by improvement made in the pump industry. VSM have been proven to be a greatly useful tool to eliminate some waste in a cycle and find there are more waste for you to eliminate in next cycle, during which lean becomes a habit or culture

5. Muhammad Abdus Samad *et. al* [8] introduced Value Stream Mapping (VSM) is a Special type of flow chart that uses symbols known as "the language of Lean" to depict and improve the flow of inventory and information. Value Stream Mapping Purpose is to provide optimum value to the customer through a complete value creation process with minimum lead time. For this purpose they have tried to show how the lead time can be reduced by using lean tools properly.

6. Emil and mihai [2] present a strategy used to create an image about the informational and material flows of products and services. Value Stream Mapping is not a project that covers a specific period of time; instead it is a working methodology to differentiate activities that add value compared with the non-value added, and is addressing to all employees, to the management, suppliers and customers. Value Stream Mapping methodology cannot be used by itself, that is why for obtaining this improvements are necessary other methods like Kaizen, 5 S, Total Productive Maintenance, Setup reduction and others

7. Rahani Ar, Muhammad al-Ashraf [10] described a case where Lean Production (LP) principles were adapted for the process sector of an automotive part manufacturing plant. Value Stream Mapping (VSM) is one of the key lean tools used to identify the opportunities for various lean techniques. The contrast of the before and after the LP initiatives in determine managers potential benefits such as reduced production lead-time and lower work-in-process inventory. As VSM involves in all of the process steps, both value added and non-value added, are analyzed and using VSM as a visual tool to help see the hidden waste and sources of waste

8. Ashish Chopra *et. al*[1] Describes Lean is a working philosophy designed to produce better products by using less resources to obtain more profit and has been applied to vast variety of manufacturing sectors; however, very less work have been done in the electronics industry in India, hence study mainly focuses on this area. This paper presents a case study on Value Steam Mapping (VSM) approach using lean principles (reduction of wastes, popularly terms as muda in the Japanese context) in the electronics field. Reduction in the WIP was attempted by converting the push system to pull system and also through improvement of the process by incorporating kanban, kaizen and supermarket concepts. Implementing lean manufacturing system can increase the competitiveness of a company in the global arena.

9. G Saranya, Mr. S.B. Nithyananth [4] have implemented value stream mapping (VSM) is helpful in lean implementation and to develop the road map to tackle improvement areas to bridge the gap between the existing state and the proposed state of a manufacturing firm. In This paper they compares the current state and future state of a manufacturing firm and witnessed 20 % reduction in TAKT time, 22.5 % reduction in processing time, 4.8 % reduction in lead time, 20 % improvement in production, 9 % improvement in machine utilization, 7 % improvement in man power utilization, objective improvement in workers skill level, and no change in the product and semi finished product inventory level..

10. Rumbidzayi Muvunzi *et. al* [11] Inroduced Using the VSM, Productivity increased from 20,220 tiles per month to 28,350 tiles per month, In the tile manufacturing industry. There was reduction of defects from 245 defective tiles per day to 10 defects thus saving the company up to $4419.9 per month. Raw materials were saved which contributed to 168 tiles per day which translates to $2993.76 per month. Lead time reduction from 8467 seconds to 5657 seconds, that is by 46.8 minutes, which contribute up to 12% of production time.

Authors and Year	Tool Used	Work Done	Results
G.Saranya et al 2012	-VSM , -Kanban	✓ Understand the current state of the crankshaft supply chain. ✓ Identify key areas of waste, problems and opportunities across the supply chain. Develop a future state vision of each of the supply chains. ✓ Develop an action plan to achieve the future state.	✓ Reducing tied up capital, ✓ Smoothing production flow, ✓ Lowering space rental costs, ✓ Shortening throughput time.
Rahani AR et al 2012	-VSM -SOP -Kaizen	✓ Current VSM ✓ Data collection for percentage rejection ✓ Takt time calculation and find out the bottleneck ✓ Improvement by minimizing handling, WIP and change plant layout	✓ Standardization of processes ✓ Overall lead time reduction ✓ Future State VSM not shown ✓ Worker did not follow strictly assembly standards
Ashish Chopra et al 2014	-VSM -Kanban -Kaizen	✓ Current State map of VSM ✓ Takt time calculation ✓ Identify bottlenecks by comparison of cycle time and Takt time ✓ Future State VSM	✓ Lead time reduction by 37.56%, ✓ Overall process time reduced by 16.22%, ✓ Inventory reduction by 30%
J. Dinesh 2013	-Current state map, - cycle time, -future state map, -lead time, -takt time, -VSM.	✓ Understand the `current state of the pump manufacturing. ✓ Identify the key area of waste, problem and opportunities across the process. ✓ Develop of future state vision of each process. ✓ Develop an action plan to achieve the higher production and lead time reduction.	✓ production lead time has been reduced from 1896 mins to 1838 mins, ✓ production capacity increased from 121 to 182 respectively. ✓ The production is increased by 50%.
K. Venkatramanam et al 2014	-VSM -Kaizen -layout Design -AHP	✓ Current plant layout ✓ Current State of VSM ✓ Kaizen implementation ✓ Improve layout ✓ Future State VSM	✓ Reduction in cycle time, inventory and no of workers. ✓ 100% deliver fill rate ✓ Improve productivity from 20 Unit/hour to 25 Units/hour ✓ Limited to crankshaft manufacturing cell.

IV. CONCLUSION

A VSM technique is introduced to control the production and raw material delivery using some processes,Value Stream Mapping (VSM) proves to be a distinguished technique which provides a company with a blueprint for strategic planning to organize the principles of Lean Thinking for their transformation into a Lean Organization.

Stocks have been reduced through VSM which identified the improvement points and kanban cards which eliminated administrative inefficiencies. By implementing the kanban cards wastes of unnecessary inventory were reduced, excessive transportation and idle times applicable to every production and layout design. VSM objective was to find the non-value added time and cut those as much as possible. By using the VSM it can reduce the WIP by convert the push system to pull system. VSM supports the lean supply chain and identifies potential opportunities for continuous improvement to eliminate waste. Culture change is a long term philosophy is highlighted as the foundational for Toyota and other companies to sustain success.

The efficiency of Value Stream Mapping is revealed when the team goes to the production process, talks to workers and observes how the product is actually made from the beginning to the end. Value Stream Mapping must be drown in such a way that can be understood by anyone: all the operators, the management, suppliers and the customer. Only on this condition the team can discover the real problems from the current process flow and create a vision of how the process should look like by making improvements.

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