

Use of Value Stream Mapping in Transformation of an Organisation into a Lean Organisation

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ABSTRACT

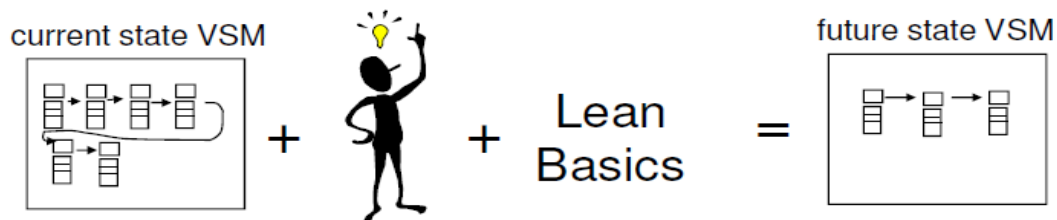
This paper addresses the application of Value Stream mapping as one of the Lean tools to eliminate waste, and improved operational procedures and productivity. Current state map is prepared and analyzed and suggested to improve the operational process. Accordingly the future state map is drawn. The study reveals that there is an improvement in the lead time by implementing the proposed changes if incorporated in the future state map. Value stream mapping helps us understand where we are (Current State), where we want to go (Future State) and map a route to get there (Implementation Plan), which can create a high-level look at total efficiency, not the independent efficiencies of individual works or departments.

Keywords: lean manufacturing tools, techniques and structures, VSM tools.

1. INTRODUCTION

A value stream map is an end-to-end collection of processes/activities that creates value for the customer. A value stream usually includes people, tools and technologies, physical facilities, communication channels and policies and procedures. A value stream is all the actions (both value added and non-value added) currently required to bring a product through the main flows essential to every product: (a) the production flow from raw material into the hands of the customer, and (b) the design flow from concept to launch. Standard terminology, symbols, and improvement methods allows VSM to be used as a communication tool for both internal communication and sharing techniques and results with the larger lean community.

It helps to understand 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. Waste being any activity that does not add value to the final product, often used to demonstrate and decrease the amount of 'waste' in a manufacturing system. VSM can thus serve as a starting point to help management, engineers, production associates, schedulers, suppliers, and customers recognize waste and identify its causes. The beauty of value-stream mapping is found in its usefulness and simplicity. VSM helps answer the question: How do we continuously improve in a capable, sustainable manner? VSM is a map that outlines the current and future state of a production system, allowing users to understand where they are and what wasteful acts need to be eliminated. The user then applies lean manufacturing principals to transition into the future state.



Why do VSM first?

Value stream mapping helps us understand where we are (Current State), where we want to go (Future State) and map a route to get there (Implementation Plan), which can create a high-level look at total efficiency, not the independent efficiencies of individual works or departments, visually show three flows - material flow, product flow and information flow to identify improvement opportunities, and help identify applicable lean improvement tools and plan for deployment. The practices of enterprises have successfully implemented lean production prove that VSM can

eliminate 50% waste process/steps, shorten cycle time by 30%, reduce variation from 30% to 5% and improve product quality greatly. So we should implement lean production first from VSM.

VSM is the process of visually mapping the flow of information and material as they are preparing a future state map with better methods and performance. It helps to visualize the station cycle times, inventory at each stage, manpower and information flow across the supply chain. VSM enables a company to 'see' the entire process in both its current and desired future state, which develop the road map that prioritizes the projects or tasks to bridge the gap between the current state and the future state. The value stream mapping is used to analyze & map in order to reduce the waste in processes, enable flow, and to make the process for better efficiency. The purpose of value stream mapping is to highlight sources of waste and eliminate them by implementing the future-state value stream that can become a reality. The goal is to build a chain of production where the individual processes are linked to their customer(s) either by continuous flow or pull, and each process gets as close as possible to producing only what its customer(s) need when they need it.

Objectives of value stream mapping

Various objectives of using VSM are follows;

1. It helps to visualize more than just the single- process level, i.e. assembly, welding, etc., in production. One can see the flow.
2. It helps to see more than the waste. Mapping helps to see the sources of waste in your value stream.
3. It provides a common language for talking about manufacturing process.
4. It makes decisions about the flow apparent, so one can discuss them. Otherwise, many details and decisions on the shop floor just happen by default.
5. It ties together lean concepts and techniques, which helps to avoid "cherry picking".
6. It shows the linkage between the information flow and the material flow. No other tool does this.
7. Provides a company with a "blueprint" for strategic planning to deploy the principles of Lean Thinking for their transformation into a Lean Enterprise.

Value Stream Mapping Methodology

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. The Value Stream Mapping method (VSM) is a visualization tool oriented to the Toyota version of Lean Manufacturing (Toyota Production System). It helps to understand 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. Waste being any activity that does not add value to the final product, often used to demonstrate and decrease the amount of 'waste' in a manufacturing system. VSM can thus serve as a blueprint for Lean Manufacturing. This section presents a methodology to develop a value stream mapping to identify material and information of current state.

Generally VSM has four major steps as follows:

1. Product
2. Drawing current state
3. Drawing future state
4. Develop work plan for implementation of future state

2. CASE STUDY

Methodology

Caparo Ltd. Bawal manufactures more than 150 various parts for two and four wheelers in north region of India. Press shop and welding shop are main shops of this unit including inspection shop. Press shop consists of presses whose capacity varies from 25 T to 1000 T. Raw material first goes through different processes in press shop to be transformed into final shape. Thereafter it goes into welding shop and then inspection shop to go through various quality checkups to assure the best possible quality demanded by customer.

Out of these 150 products main tunnel floor was picked up to carry out the case study due to its higher production as well as it is the most critical part in automobiles which is directly concerned with the safety of driver and other passengers. The problem related to this product were mainly the high inventory cost and great difference in the production rate in welding shop and press shops. The production rate in press shop was greater than welding shop. The

reason was large waiting time mainly due to difference in processing time at various stages. This lead to increase in lead time and wastages of various resources like labour time and slower production rate. This arrangement increase material handling cost and decreases labor productivity. These results in delay of orders which further disturb the overall schedule at floor shop and affect the production of machine parts. Although the plant have the ability to produce more than they are producing, it is having following limitations.

- Less labor productivity
- More Waiting times
- Large WIP
- Longer material movement

To overcome these limitations there is a need to identify the key areas which are producing trouble and wastes (seven wastes) and to identify bottleneck operations at shop floor. VSM tool is purposed to introduce in welding shop to locate the source of waste in value stream by the lean concepts and techniques to improve the productivity, quality of existing traditional manufacturing system and hence increase the profit also. These steps explain work done in welding shop for main tunnel floor, drawing and using VSM to visualize waste.

Most of Indian industries running on traditional manufacturing system suffer from low efficiency, under utilization of resources, wastefulness, poor quality, and face the problem of over production or under production. There is a need to adopt latest tools like lean, which will result in low investments, high productivity, better quality and higher efficiency and profits. In India automobile manufacturer have started thinking about Lean initiatives because of the obvious advantages offered by lean applications. The first visit to the tunnel floor weld shop of the company revealed that only a few techniques have been used so far in the plant to optimize the production activities. More over the literature review suggests that for the product like tunnel floor no study has been conducted to streamline the manufacturing process in the machine shop. The welding of tunnel floor in the plant is quite disorganized as far as lean considerations are concerned. The long waiting time and high inventories are some of the common problems in the weld shop of the company under study. The purpose of this study is to first develop a value stream map for tunnel floor and then identify wastes and to make recommendations for improvement. It is hoped that the company may use the value stream map for the future implementation of lean manufacturing in order to increase productivity and improve the quality of goods produced by the company, while at the same time reducing costs, total lead time, human effort, and inventory levels.

Steps to Implement Our Objectives

The methodology for the present work will include the following main steps:

1. To work within the production facility, to have knowledge of the production flow and to be familiar with the activities being performed in the shop floor.
2. Select which value stream to target for the practical mapping.
3. Observe and collect information related to product/process flow from raw material to finished goods for the value stream selected.
4. Determine the current state of the process activities by mapping the material and the information flow.
5. Calculate lean metrics from the value stream map.
6. Look at the current state map for opportunities to eliminate wastes and improve the process flow.
7. Draw future state map by incorporating the necessary changes according to the different lean tools and techniques.
8. Evaluate the benefits obtainable from the lean production techniques.

Drawing current state of VSM

To see material flow between different processes, process sequence flow was drawn and then value added (VA) and non value added (NVA) processes are marked to get clear picture of material flow of tunnel floor through value added activities which helps to draw current state VSM.

Table 1: Data Collection for Tunnel floor (Current State Map)

SR. NO	OPERATION	C/T (Sec)	No. of Operators	Available Time of M/C Per shift day (Hrs)	Production Lead Time
1	DRAWING	2.5	2	22	2
2	RESTRIKE	2.4	2	22	7
3	TRIMMING AND PIERCING	2.1	2	22	6
4	UP-BENDING & CAM PIERCING	2.0	2	22	6
5	QUALITY CHECKUP	40	2	22	62
6	WELDING	43	2	22	78
7	QUALITY CHECKUP	21	1	22	7

Proposed Changes For Current State Map

After identification of the gap areas by the value stream mapping of the existing state, some changes were proposed as indicated in the figure. SAP software is introduced. SAP was founded in 1972 in Walldorf, Germany. It stands for Systems, Applications and Products in Data Processing. Over the years, it has grown and evolved to become the world premier provider of client/server business solutions for which it is so well known today. The SAP has established new standards for providing business information management solutions. The main advantage of using SAP as your company ERP system is that SAP has a very high level of integration among its individual applications which guarantee consistency of data throughout the system and the company itself. The main purpose of using standard business application software like SAP is to provide a better information flow between various departments starting from administration department to shop floor and dispatching department. It is the one of the fastest way for information flow.

Drawing Future State of VSM

While we look at the current state VSM of tunnel floor and problems of large amount of inventory, the unconnected processes (each producing to its own schedule) pushing their output forward, and the long lead time in comparison to the short processing time, long travel distance are seen. To build future state first of all takt time is calculated for tunnel floor. Takt time includes no time for equipment downtime.

Table 2: Data Collection for Tunnel floor (Future State Map)

SR. NO	OPERATION	C/T (Secs)	No. of operators	Available Time of M/C Per day (Hrs)	Production lead time
1	DRAWING	2.5	2	22	2
2	RESTRIKE	2.4	2	22	7
3	TRIMMING AND PIERCING	2.1	2	22	6
4	UP-BENDING & CAM PIERCING	2.0	2	22	6
5	QUALITY CHECKUP	40	2	22	62
6	WELDING	22	2	22	8
7	QUALITY CHECKUP	21	1	22	7

By comparing Takt time with cycle time for tunnel floor it is observed that Takt time is less than Cycle time, available time is also shown. Total available time is divided into two parts, one is total cycle time and other is total loss time. Total loss time includes setup times, maintenance times, power failure, worker absenteeism, tool not available and no load.

A new weld machine introduced will reduce waiting time to make continuous flow between all stages of weld shop. Initially batch of semi finished product has to pass through different weld stages one after another. A close look and some basic analysis suggests that these weld stages are not interdependent. So batch of semi finished products can be divided into equal number of sub-batches according to weld stages. This provides the advantage of simultaneous welding at all the stages thus reducing the waiting time which restricts the smooth production.

Implementation of Proposed Solution (Work Plan)

The implementation phase of this lean initiative requires to:

- Build awareness of the future state
- Empower individuals
- Squeeze more from existing resources
- Fix problems quickly
- Implement milk run
- Implement SAP System
- Sustain the gains
- Implement visual tools

3. RESULT AND DISCUSSION

Table 3: cycle time and Lead time Comparison

SR. NO	OPERATION	C/T (Secs)		No. of operators	Available Time of M/C Per day (Hrs)	Production lead time	
		Before VSM VS	After VSM			Before VSM	After VSM
1	DRAWING	2.5	2.5	2	22	2	2
2	RESTRIKE	2.4	2.4	2	22	7	7
3	TRIMMING AND PIERCING	2.1	2.1	2	22	6	6
4	UP-BENDING & CAM PIERCING	2.0	2.0	2	22	6	6
5	QUALITY CHECKUP	40	40	2	22	62	62
6	WELDING	43	22	2	22	78	8
7	QUALITY CHECKUP	21	21	1	22	7	7

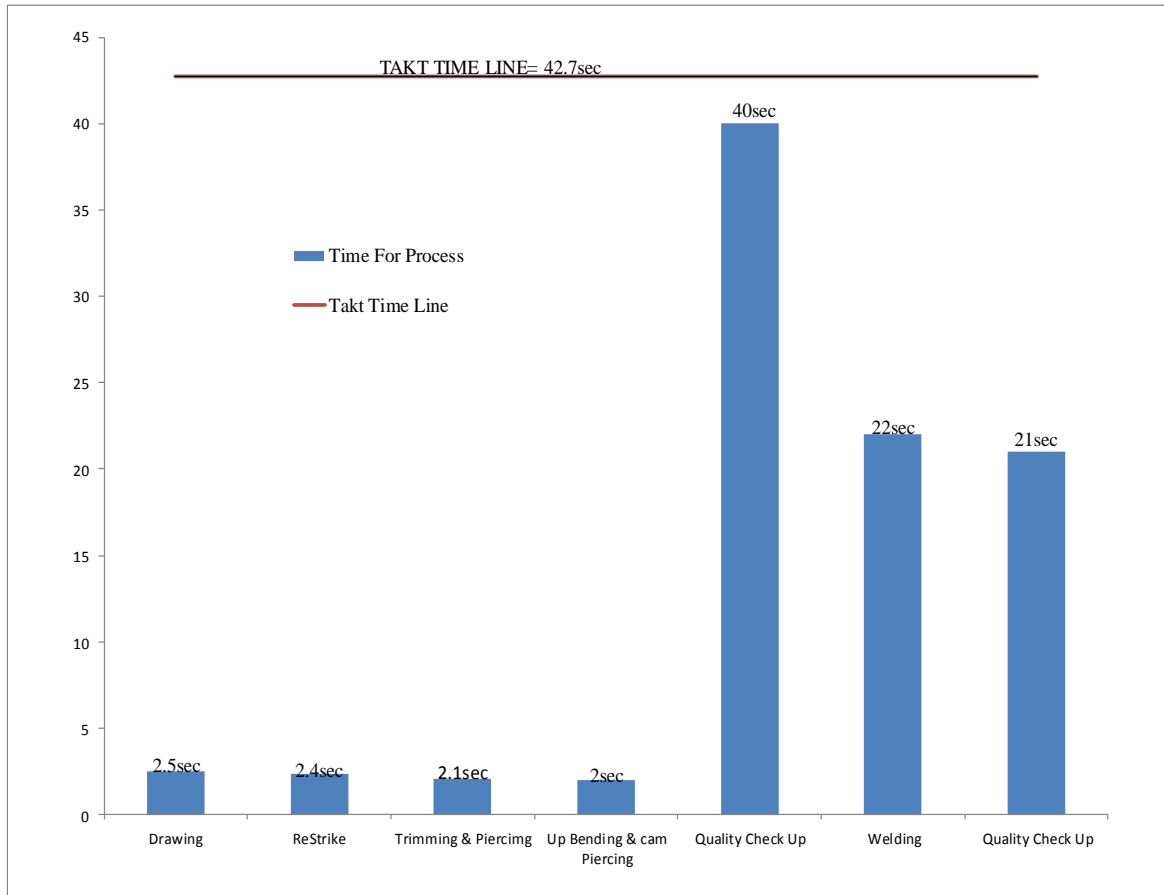


Figure 1: cycle time after implementation of VSM

	Lead time		Total lead time
	Inventory lead	Production lead time	
Before	15+3=18 Days	18 hrs 2 min 48 sec	18 days 18 hrs 2 min 48 sec
After	10+1=11 Days	18 hrs 1 min 38 sec	11 days 18 hrs 1 min 38 sec

From above tables, we can see that

- Large amount of waste can be removed after using Pull System in Caparo Ltd.
- Cycle time has reduced
- Production lead time has been reduced from 18 days 18 hrs 2 min 48 sec to days 18 hrs 1 min 38 sec. Tunnel floor total lead time is reduced by 37.3 %.

It resulted in better and optimum utilization of labour and human resources.

4. CONCLUSIONS & SUGGESTIONS FOR FUTURE WORK

Conclusion

In this study the methodology is implemented to manufacture the tunnel floor at Caparo Ltd, Bawal. A pull system is introduced to control the production and raw material delivery using SAP and milk run. The current manufacturing system is compared with the proposed pull system. Comparison showed the superiority of the proposed lean manufacturing system over the existing traditional manufacturing system. The lean system showed reduction in total lead time by 37.3 %. VSM (value stream mapping) proves to be a powerful technique which provides a company with a "blueprint" for strategic planning to deploy the principles of Lean Thinking for their transformation into a Lean Enterprise.

Suggestions For Further Research

The Concept and technique of VSM can be extended beyond the suppliers and customers for a given facility where opportunities for cost savings may be more. Lean manufacturing concept can be extended at the enterprise level. Value stream mapping tool can be further used along with simulation to predict the result of lean tools well in advance of its implementation. Robotic arm can be used into the welding shop to reduce the lead time and new inspection methods can be adopted to defect free product. Software can be developed to make the VSM more effective.

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