

IMPLEMENTATION OF VALUE STREAM MAPPING(VSM) IN A COIR PRODUCT MANUFACTURING INDUSTRY

Shubham Ghushé¹, Shubham Deshmukh², Vrushabhsingh Basgoti³, Yogesh Yawale⁴,
Pratik Gangasagar⁵, Prof. N. S. Duryodhan⁶

¹Bachelor Student, Mechanical Engineering, DES'SCOET Dhamangaon Railway, Maharashtra, India

²Bachelor Student, Mechanical Engineering, DES'SCOET Dhamangaon Railway, Maharashtra, India

³Bachelor Student, Mechanical Engineering, DES'SCOET Dhamangaon Railway, Maharashtra, India

⁴Bachelor Student, Mechanical Engineering, DES'SCOET Dhamangaon Railway, Maharashtra, India

⁵Bachelor Student, Mechanical Engineering, DES'SCOET Dhamangaon Railway, Maharashtra, India

⁶Professor, Mechanical Engineering, DES'SCOET Dhamangaon Railway, Maharashtra, India

Abstract - Value Stream Mapping helps to identify the current flow of material and information of processes conducted for products, and finding the opportunities for improvement that will highly impact on the overall production system. Value Stream Mapping (VSM) is lean Manufacturing tool that can be used to minimize waste in manufacturing as well as to identify the bottleneck processes in an industry.

In this paper Value Stream Mapping(VSM) is applying on a coir manufacturing industry by keeping the attention on both processes and their cycle times used for the mattress manufacturing. In order to apply VSM, relevant data is to be collected and to analyze. the VSM is to be drawn defining the resources and activities needed to manufacture the product. The study of current state map will show the areas for improvement and to identify the different types of wastes. From the current state map, it will be noticeable that which waste we need to vomit out during the processes. we can also identify the embedded wastes, which had been neglected before in the working process. The lead time and Process time can be reduced and the efficiency of this process can be increased with the help of value stream mapping. Waste activities such as waiting, redoing and

batching are generally not modeled by other tools, however in value stream mapping those wastes can be easily identified.

Key Words: Lean Manufacturing, Manufacturing improvement, Value Added, Value Stream Mapping, Waste Reduction.

1. INTRODUCTION

Value Stream Mapping was first introduced by T. Ohno from Toyota Production in 1988 as 'Material and Information Flow Mapping', later it is named as Value Stream Mapping by John Shook and Mike Rother who co-authored the book 'Learning to See', published by the Lean Enterprise Institute in 1989. Value stream mapping is a tool that let us put all of the information in one place in a way that is not possible with process mapping or any other tools. A value stream is a collection of all actions value added as well as non-value added that are required to bring a product that use the same resources through the main flows, from raw material to the customers . Value stream mapping is a improvement tool which is visualizing the entire production process, representing both material and information flow.

1.1 Literature review

Bhim Singh *etal*: They have Researched in their research paper that the original concepts and definitions about value stream mapping (VSM) demonstrated that it is necessary to map both inter-company and intra-company value-adding streams. Value stream refers to those specifics of the firm that add value to the product or service under consideration. VSM was initially developed in 1995 with an underlying rationale for the collection and use of the suite of tools as being “to help researchers or practitioners to identify waste in individual value streams and, hence, find an appropriate route to its removal”. The process itself is very simple and straightforward. It usually starts with customer delivery and work its way back through the entire process documenting the process graphically and collecting data along the way. Finally it results in a single page map called “Value stream”, these maps contains data such as cycle time, work-in-process (WIP) levels, quality levels, and equipment performance data.[1]

Joseph C. Chen *etal*: They have cleared in their research that Although Lean was initially introduced by the automobile industry, its principles have more recently spread into other industries. There are a variety of companies that have experienced the advantages of applying Lean in their manufacturing area. For instance, Lean was applied by Boeing to eliminate waste and make its products more cost-competitive. Lean is a systematic approach for identifying and eliminating waste through continuous improvement by ‘flowing’ the product at the pull of the customer in pursuit of perfection.[2]

M. Rother *etal*: John Shook and Mike Rother co-authored the book published by the Lean Enterprise Institute, Cambridge, England. They were pioneers in introducing material and information flow diagramming and how to develop lean thinking using that practice. They have given the name as Value stream mapping, and is a flexible tool that let us put all of the information in one place in a way that is not possible with process mapping or other tools.[3]

Madhubala Rauniyar *etal*: She had given a very significant points in her research that, Every organization is striving hard on getting more work done in less time and with greater ease. The fundamental aim of any organization has been to continuously minimize waste and maximize flow which would ultimately lead to customer satisfaction by providing right product at the right time in the right quantity and the right quality at a reasonable price. This can be achieved greatly by adopting lean manufacturing system which is more than a cost reduction program. It aims at eliminating wastes which could be in the form of excess production and inventory, redundant movement of material, waiting and delays, over processing, excess worker motion, rework and corrections. [4]

1.1 Objectives

- To quantify by rank the seven wastes of lean within the mattress making process.
- To develop the Current State Map for use in developing the Future State Map.
- To formulate practical means of reducing the identified major wastes.
- To convert the improved work flow into a lean system with savings.

1.2 Symbols Used For Various Processes of Industry In VSM

There are several symbols used to draw the Value Stream Mapping (VSM). Each symbol represents their unique significance in VSM, the symbols are listed in the figure 2.5 given below-

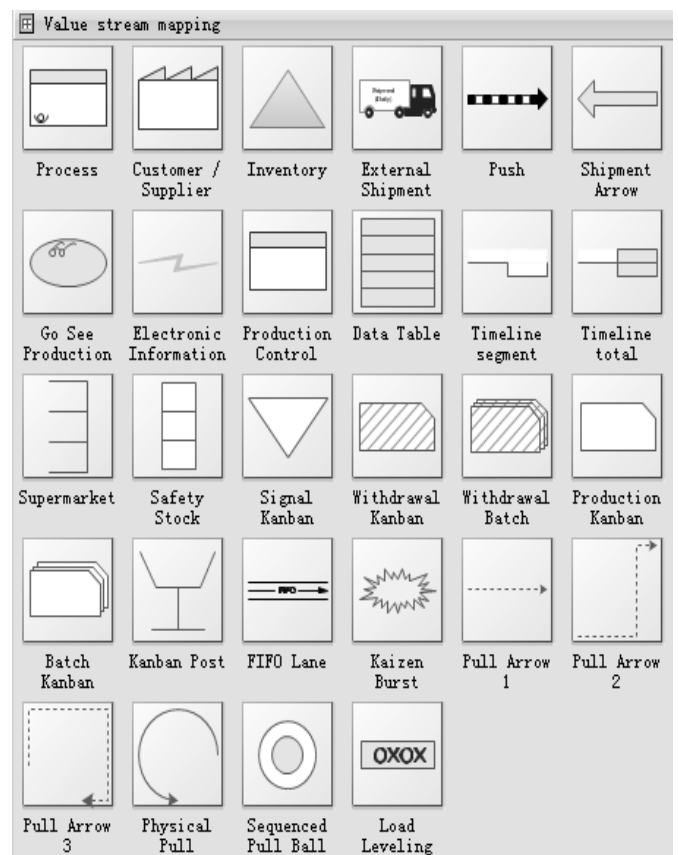


Fig -1: Detailed Symbols used For Drawing VSM

2. VALUE STREAM MAPPING METHODOLOGY:

The value stream mapping methodology are given below:

2.1 Collecting Data and Time Studies:

An important part in creating the VSM for the process is to obtain existing data. There are few ways in which we get information. The first, we get the data directly from the industry. And to contact with the operation managers of each section as well as the floor managers. Take production and work instruction data from the company, as well as observed the factories in motion, and conduct own time studies to get exact information on the cycle times within factory.

2.2 Creation of Current State Map:

Mapping the value stream always starts with the customer demand. To create Current Value stream map these following step are followed-

Step I- Calculate takt time:

$$\text{Takt Time} = \frac{\text{Effective Working Time per Shift}}{\text{Customer Requirement per Shift}}$$

Step II- Understand Customer Demand :

Customer demand is monthly or daily demand of customer as per need. Customer demand is 500 Units/ day.

Step III- Mapping the Process Flow:

This step involves various processes which are in sequence to complete product development and calculation of cycle time, changeover time and uptime for each. In this research ten processes are given to complete products which are discussed earlier.

Step IV- Map the Material Flow:

The flow of material from raw to finished good is given by supplier to customer.

Step V- Map Information Flow:

The information flow is also incorporated to provide demand information, which is an essential parameter for determining the process in the production system. Various

data regarding cycle time (c/t), changeover time (c/o), uptime, total lead time etc.

Step VI- Calculate Total Product Cycle Time:

After both material and information flows have been mapped, a time-line is displayed at the bottom of the map showing the processing time for each operation and the transfer delays between operations. The time-line is used to identify the value-adding steps, as well as wastes, in the current system.

Step VII- Detail Off-Line Activities:

Activities like placing of order, supply of material, daily schedule. Monthly forecast etc. is involved in this section which is well executed by transportation, supplier icons and information flow lines.

2.3 Analysis of Current State Map:

The current state map is a fancy way of saying „what happens now“ or the "as-is" process. The current state map should show all the process steps and sufficient detail on how each step is completed and what happens to the items being processed. This will enable us to spot the causes of problems and thus the means to improving the flow, efficiency, reliability and flexibility of the process. It can be as detailed or as simple as you need and can also exist in a number of different versions for consumption by different internal or external groups.

2.4 Creation of Future State Map:

To create future state map following steps are considered-

Step I- Create a Cycle Time / Takt Time Graph:

From the data collected and calculated during the creation of the current state VSM we are able to draw a cycle time / takt time graph. This graph simply compares the individual cycle times to the overall takt time of our process. This is an important step as it will help us make decisions as to how and what to improve in future steps.

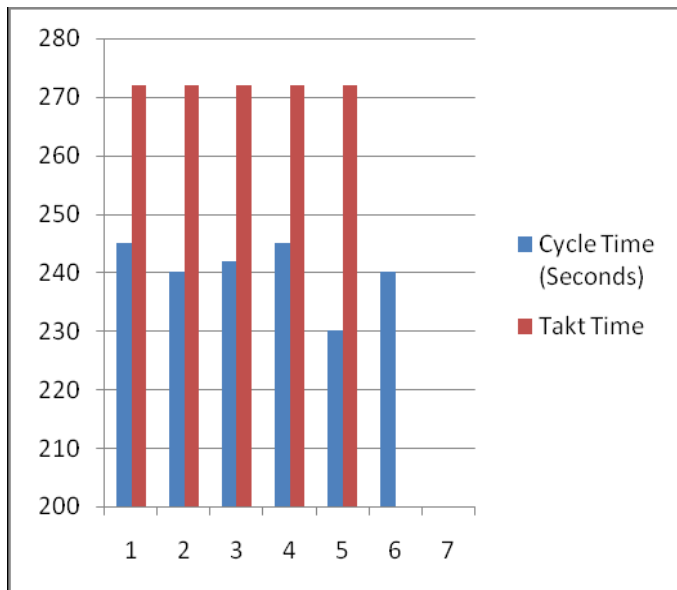


Chart -1: Example showing cycle time and takt time calculated during the process

Step II- Make to order model:

Next, we must decide what type of distribution model we will develop. Will we build to a finished goods supermarket or ship directly to the customer? In our example, we only produce one product and customer demand is relatively stable. Therefore, it would make the most sense to develop a make to order model. This means we would only produce what the customer wanted, when they wanted it. We have to reduce the wastage during changeover of one process to another this will cause PLT for process will get reduced.

Step III- Calculate Optimal Crew Size and Implement One Piece Flow:

Optimal crew size can be calculated as,

$$= \frac{\text{Total Cycle Time}}{\text{Takt Time}}$$

Step IV- Pull Process:

Anytime we build to supermarkets we must have a way of signaling when to produce and when not to produce. There are a variety of ways to accomplish this. The easiest way is to use Kanban.

2.5 Analysis of Future State Map:

In Future State Map for assembly process two processes are gathered to reduce non value added time during processes. Supermarkets are placed between processes to reduce inventory wastages during process and to turn process from build to stock to make to order. Make to order process lead to assembly of parts when order placed by customers. It results reduction in inventories. The information and communication flow between processing lines improved by scheduling pacemaker in the process as well process turned from push to pull by Kanban system.

3. VALUE STREAM MAPPING IMPLEMENTED ON THE INDUSTRY:

With the help of **current state VSM** following data is calculated-

- Total Lead Time = 30 days 1 hour 33 minutes.
- Value Added Time = 292 minutes.
- Total Distance travelled by the product = 268 mtrs.
- Inventory for LATEX = 30 days
- Inventory for COIR = 30 days
- Inventory for FOAM = 15 days
- Inventory for CHEMICALS = 60 days
- Inventory for CLOTHES = 30 days

3.1 Current state map of the industry:

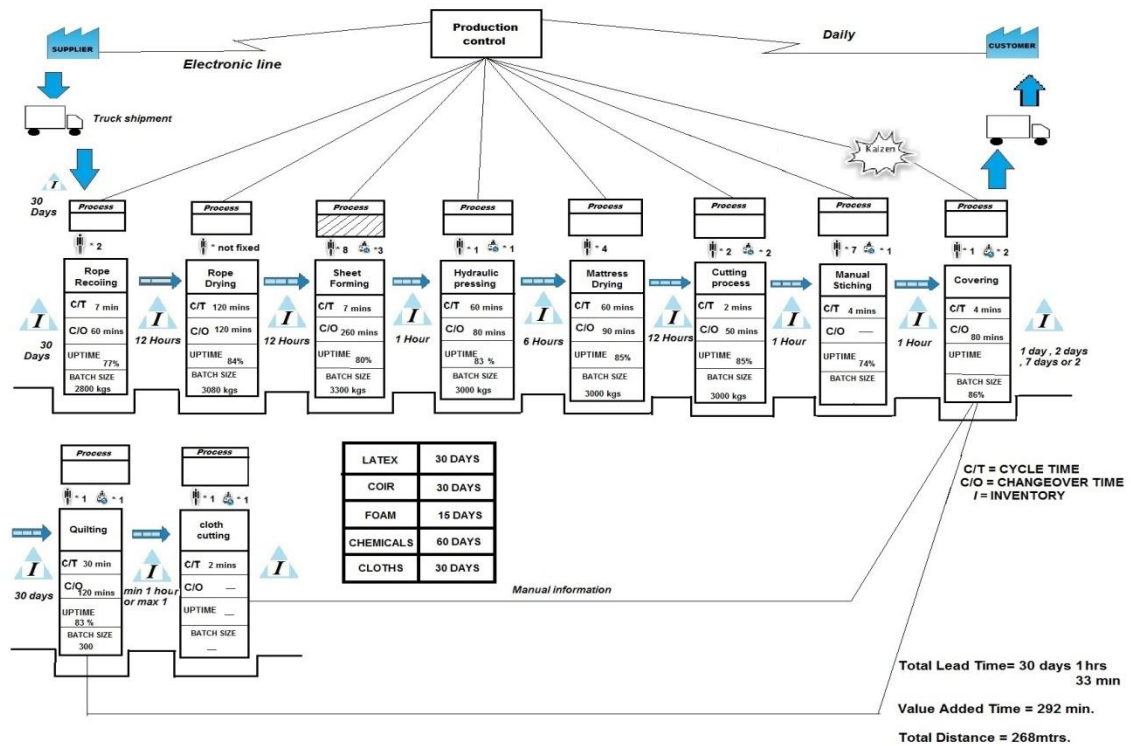


Fig-5: Current state value stream map.

3.1 Future state map for the industry:

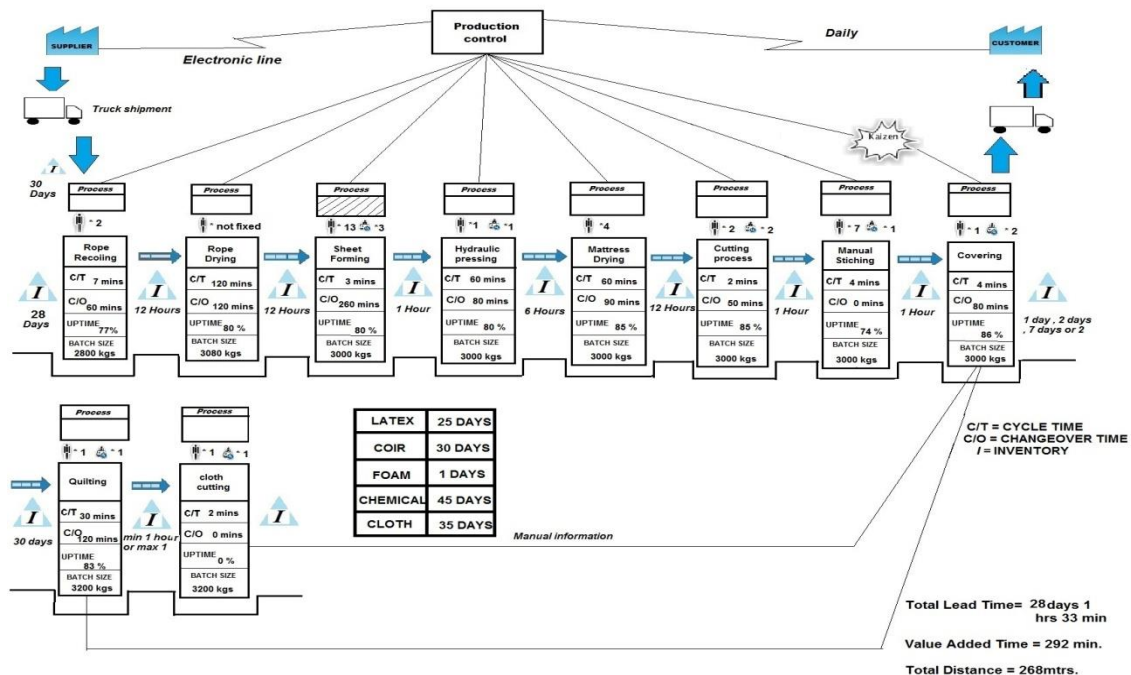


Fig-6: Future state value stream map

4. RESULTS AND DISCUSSIONS

With the help of **future state VSM** following data is observed-

- Total Lead Time = 28 days 1 hour 33 minutes.
- Value Added Time = 292 minutes.
- Total Distance travelled by the product = 268 mtrs.

From Future State Map it is observed that the inventory time is reduced from 30 days to 25 days and the total lead time is reduced from 30 days 1 hour 33 minutes to 28 days 1 hour 33 minutes.

5. CONCLUSIONS

With the help of Value Stream Mapping, we have identified the wastes, which had been neglected before in the working process. In the future state map of value stream, the lead time and Process time is reduced and the efficiency of this process is increased. Practically, also realized the advantages of value stream mapping over other tools.

ACKNOWLEDGEMENT

we take this opportunity to express our gratitude and indebtedness to our guide Prof. N. S. Duryodhan, Assistant Professor, Mechanical Engineering department, who has been constant source of guidance and inspiration in preparing this report.

REFERENCES

- [1] Bhim Singh and S.K. Sharma, "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, 2009.
- [2] Joseph C. Chen and Ronald A. Cox, "Value Stream Management for Production- A Case Study", *American Journal of Industrial and Business Management*, 2, 17-29, 2012.
- [3] M Rother, & J Shook, "Learning to see: Value stream mapping to add value and eliminate muda (The Book)" *Brookline: The Lean Enterprise Institute*, 1989.
- [4] Madhubala Rauniyar, "Value Stream Mapping at XYZ Company", *The Graduate School University of Wisconsin-Stout*, 2007.
- [5] Markus L. Stamm and Thomas Neitzert, "Value Stream Mapping (VSM) in Manufacture-to-order Small and Medium Enterprise", *School of Engineering AUT University Auckland, New Zealand*, 2007.
- [6] Praveen Saraswat, Deepak Kumar and Manoj Kumar Sain, "Reduction Of Work In Process Inventory And Production Lead Time In A Bearing Industry Using Value Stream Mapping Tool", *International Journal of Managing Value and Supply Chains (IJMVSC)* Vol. 6, No. 2, 2015.
- [7] Ritesh R. Bhat, "Improving the Productivity using Value Stream Mapping and Kanban Approach", *International Journal of Scientific & Engineering Research Volume 2, Issue 8, 1* ISSN 2229-5518, 2011.
- [8] Soniya Parihar, "Value Stream Mapping: A Case study of Assembly Process", *International Journal of Engineering Research & Technology (IJERT)* Vol. 1 Issue 8, ISSN: 2278-0181, 2012.
- [9] Xiaoqi Li, "Value Stream Mapping With A Case Study", *Graduate and Professional Studies of Texas A&M University*, 2014.