

Application of Value Stream Mapping For Manufacturing Cycle Time Reduction at Ampere Vehicles Pvt Ltd, Coimbatore

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Abstract

The objective of the study was to identify the non-value added activities present in the organization and to increase the productivity. The processes involved were studied in detail and a current state Value Stream Mapping map was obtained. Current state map is prepared, analysed and suggested to improve the operational process. Accordingly the future state map is drawn. The study reveals that there will be an improvement in the productivity by implementing the proposed changes in the future state map.

Keywords: *Current State Map, Future State Map, Value Stream Mapping, productivity*

INTRODUCTION

The study is about the implementation of lean manufacturing tool – Value Stream Mapping that helps in the reduction of cycle time at Ampere Vehicles Pvt. Ltd. The company aims to increase its productivity to a great extent within Q3 of 2018. The process of manufacturing a particular model of two wheeler involves about 60 operations, only including the

main assembly. There is a lack of standardization of assembly line in the organization. The study aims at reducing the number of operations and also identifying the wastes currently present within the organization. The value stream is the entire creation process for a product. The value stream starts at concept and ends at delivery to the customer. Every stage the product goes through should add

value to the product, but often this is not the case. Mapping of the value stream aids the identification of value adding and non-value adding (i.e. waste) activities. Value Stream Mapping is used for identifying the wastes through the current state VSM. Then the wastes are eliminated by which the overall cycle time can be reduced. If the cycle time is reduced, the company can increase its productivity and thus leading to improved profit.

LITERATURE REVIEW

Parihar, S., Jain, S., & Dr. Bajpai, L. (2012) conducted a study of value stream in assembly process. A value stream includes all activities required to transform a product from raw material into the finished goods. Value Stream Mapping scrutinizes business processes from beginning to end and a visual representation map is drawn of every process involved in the material and information flows. Then a future state map is drawn to show how things should work for best competitive advantage. Value Stream Mapping helps to identify the current flow of material and information in processes for a family of products, highlighting the opportunities for improvement that will most significantly impact the overall production system. This research paper addresses method of value

stream analysis, which is a tool for helping manufacturing companies to go lean and to achieve larger control of their value stream. It is a qualitative tool that is supposed to give an understanding of the value stream/value chain as a basis for reducing the pipeline of inventory and time compress the throughput time.

Venkataraman, K., Ramnath, V.B., Kumar, M.V., and Elanchezhian, C. (2014) studied that lean manufacturing initiative is being followed by various organizations in the recent years which mainly focus on improving the efficiency of operations by eliminating and reducing wastes. This paper aimed to explain the implementation of lean manufacturing techniques in the crankshaft manufacturing system at an automotive manufacturing plant located in south India. A multi criteria decision making model, analytical hierarchy process is applied to analyze the decision making process in the manufacturing system. Lean manufacturing system was selected to meet the company's quality, cost and delivery targets.

Apel, W., & Walton, V. (2007) studied that with manufacturing becoming a more and more competitive market, companies globally strive to increase their efficiency.

Increasing labour costs in many industrialized countries, as well as reducing and controlling operating costs, are just a few reasons companies choose to move or outsource their operations. Typically a majority of companies outsource to countries where wages are low and production costs are lower. To reduce cost and remain competitive with manufacturers abroad, companies use a variety of different methods. One of the main methods is called “lean manufacturing.” The main principle of lean manufacturing is to reduce waste in an operation, such as long lead times, defects and material waste. In order to visually display where waste occurs in the process, a value stream map (VSM) is drawn. Central Industrial Supply (CIS) in Wuxi, China is a manufacturing company that produces a variety of electromechanical components. The lead time for the 9G product is 6 to 7 days from when it leaves the first factory until it is ready to be shipped. This project focuses on creating current and future state value stream maps which, when implemented, will decrease the current lead time by 50%, as well as provide recommendations to improve current operations within the company.

Seyed, M., & Hariprasad, S. (2013) studied that Value Stream Mapping (VSM) has successfully been used as a lean tool in manufacturing processes. Applying this tool in other areas is an interesting issue for organizations and might involve particular considerations and adaptation. The purpose of this study is to identify the considerations for adapting Value Stream Mapping in a product development environment and provide a “best practice” approach for VSM. The findings from a literature review and interviews were tested during a case study at Renault truck. According to this study, identifying key specific objectives, choosing the suitable scope and project, and noticing the information and output uncertainties are the main subjects that should be considered during the application of VSM in the product development area. Based on the findings a step by step procedure is provided that helps organizations to apply VSM in Product development environment.

Irani, S.A., & Zhou, J. (2000) studied about the concept of Lean Thinking which is based on the Toyota Production System, extends continuous improvement efforts to reduce the costs of serving customer/s beyond the physical boundaries of a manufacturing facility, by including the

suppliers, distributors and production system that support the manufacturing function. These improvements and cost reductions are achieved by eliminating the muda (wastes) associated with all activities performed to deliver an order to a customer. Wastes are defined as “all activities that consume resources (add costs to the product) but contribute zero value to the customer.” According to Womack and Jones, there are five steps for implementing Lean Thinking in an enterprise:

- 1) Define Value from the perspective of the Customer,
- 2) Identify the Value Streams,
- 3) Achieve Flow,
- 4) Schedule production using Pull, and
- 5) Seek Perfection through Continuous Improvement.

Womack and Jones define a Value Stream as “the set of all the specific actions required to bring a specific product through the three critical management tasks of any business: Problem solving, information management, physical transformation.

OBJECTIVE OF RESEARCH

A. Problem Statement

For industries to remain competitive in market, continuous improvement of

manufacturing system has to be adopted. In Ampere Vehicles, the assembly line is imbalanced where the workstations are not proportionately divided so there is a lot of idle time in between the workstations. The company aims to increase its productivity for which reduction in cycle time is required by eliminating the non-value added activities and modifying the workstations so that the productivity can be increased. To improve productivity by identifying waste and then removing that by implementing lean principle in this industry we focus our attention on VSM tool. Value Stream Mapping enables a company to identify and eliminate waste, thereby streamlining work processes, cutting lead times, reducing costs and increasing quality and hence productivity. The goal of VSM is to identify, demonstrate and decrease waste in the process, highlighting the opportunities for improvement that will most significantly impact the overall production system. In this study lean concepts are introduced using VSM in working environment.

B. Objective of the Study

Primary Objective

- To apply lean tool - Value Stream Mapping for analysing various stages of manufacturing activities

with an aim to eliminate wastes and to improve productivity.

Secondary Objective

- To develop a Current State value stream mapping for the existing processes.
- To identify and determine the non-value added activities from the Current State VSM.
- To propose a Future State VSM with reduced Non Value Added activities by modifying the workstations.

DMAIC METHODOLOGY

DMAIC is a data-driven quality strategy used to improve processes. It is an integral part of a Six Sigma initiative, but in general can be implemented as a standalone quality improvement procedure or as part of other process improvement initiatives.

A Define - Study of Various Process Flow in the Organization

First, the study of various processes inside the organization was done by visiting the organization regularly. From the flow of raw materials to inventory, sub-assembly and main-assembly, quality control and

finished goods were studied. Apart from these processes, work flows of other departments were also studied.

B Measure - Collection of Data

From the organization, information like lead time for all the raw materials, quantity ordered, standard cycle time for each process, time required for producing one batch, number of workers working in each stage, available time for production were collected. With this data, the current state mapping can be drawn.

C Analyze - Create a Current State VSM

Value Stream Mapping (VSM) is one of the key lean tools used to identify the opportunities for various lean techniques. As VSM involves in all of the process steps, both value added and non-value added, are analysed and VSM can be used as a visual tool to help see the hidden waste and sources of waste. A Current State Map is drawn to document how things actually operated on the production floor. Therefore, from the data collected, its value is entered in respective fields and current state VSM is created using EDraw Max.

D. Improve - Identification of Wastes and Create Future State VSM

Lean is all about eliminating waste, so, major wastes like transportation, inventory, motion, etc., is identified in individual section. From that, lean tools are used to quantify the waste. The flow process in the industry is not in sequential order. Hence, it should be modified in order to make the process easy, to improve the production process efficient.

Finally, the Current State VSM is modified and Future State VSM is drawn. From this VSM the result can be arrived and result is suggested to the company in order to improve the production. After identifying the wastes in each process, suggestions have been given to reduce the non-value added activities thus the lead time can be reduced. From the Future State VSM it is clear that the total lead time and non-value added activities are reduced to greater extent.

E. Control - Implementing Future State VSM

After creating the Future State VSM, it is implemented in the organization so that the existing Non Value Added activities and the total lead time can be reduced. Thereby it helps in achieving the expected productivity by the organization.

According to the Future State VSM if the suggested changes are implemented,

- For a day of 8 hours shift, 120 vehicles can be produced. For a month of 26 working days (approximately) 3120 vehicles can be produced.
- If a standard procedure is followed for every processes other than the main assembly without any deviations, then the productivity can be achieved even higher than the estimated numbers.

The below table shows the comparison between the current state VSM and future state VSM. It is inferred that after the suggestions provided the value added time has been reduced by 1773.3 minutes (i.e) 29.5 hours. The non-value added time has been reduced by 13660.1 minutes (i.e) 227.7 hours. If the organization follows according to the provided suggestions there will be a huge reduction in the manufacturing lead time and non-value added time.

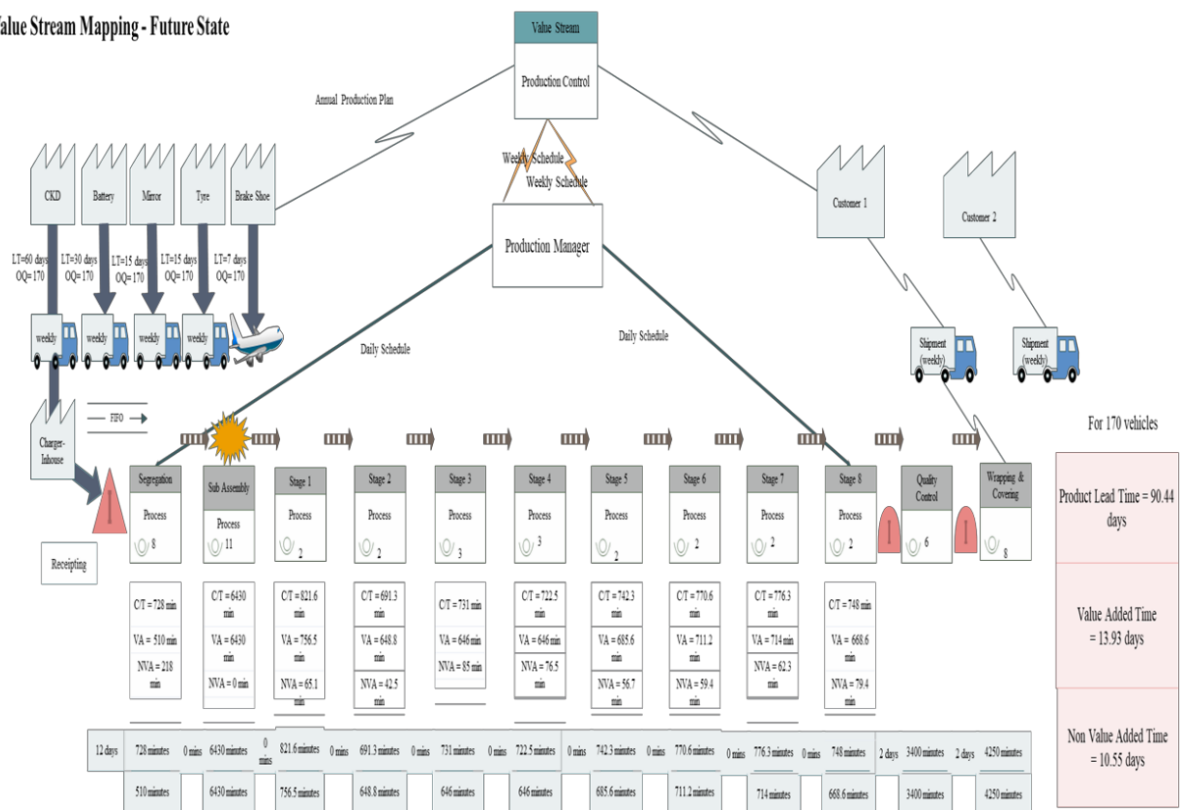
Table 1 Comparison of Current & Future State VSM

Process	Current State VSM		Future State VSM		Reduction in time	
	VA (in mins)	NVA (in mins)	VA (in mins)	NVA (in mins)	VA (in mins)	NVA (in mins)
Segregation	510	218	510	218	0	0
Sub Assembly	6430	340	6430	0	0	340
Stage 1	660	190	756.5	65.1	-96.5	124.9
Stage 2	637.5	42.5	648.8	42.5	-11.3	0
Stage 3	907	249	646	85	261	164
Stage 4	1065	40	646	76.5	419	-36.5
Stage 5	1371	91	685.6	56.7	685.4	34.3
Stage 6	935	85	711.2	59.4	223.8	25.6
Stage 7	824.5	195.5	714	62.3	110.5	133.2
Stage 8	850	204	668.6	79.4	181.4	124.6
QC	3400	9350	3400	0	0	9350
FG	4250	3400	4250	0	0	3400
Total	21840	14404	20067	744.9	1773.3	13660.1

RESULT

- If the organization follows up the provided suggestions without any deviations the expected productivity can be achieved.
- If the suggestions given as per the Future State VSM is followed, 3120 vehicles can be produced for a month.
- Utilisation of available space and adherence to procedures will help in increasing the productivity.

Value Stream Mapping - Future State



ANNEXURE

Sub Assembly (Current State) – Time Study

Process	Avg. Time taken (in secs)
On Motor	55.4
On Charger	29.7
On Controller	27.625
Front wheel assembly	119.3
Rear wheel assembly	144.2
Fitment of side stand, centre stand & swing arm with frame	22
Handle bar fitment	Mins (for 6 frames)
Front wheel with axle fitting	133.875
Front tool box cover fitting	91.6
Front indicator panel fitment	

Instrument Cluster box connections	73.2
Front headlight panel fitting	67.4
Speedometer fitment with instrument cluster box	42.4
Rear tail light & indicator panel fitment	125.5
MCB fitment in rear cabin	41.4
Fitment of rear cabin with seat	228.8
Handle & connections in battery box upper lid	75.2
Box cover for 1st set	93.8
Box cover for 2nd set	196.2
Engraving On Motor	205.6
Engraving On Charger	
Engraving On Controller	191.8
	59.4
	29.7
	27.6

CONCLUSION

The study aimed about reducing the manufacturing cycle time by identifying the non-value added activities and eliminating the same. The non-value activities were identified by analysing the current state VSM after which the suggestions were given to reduce the NVA

and increase the productivity. The organisation's expected productivity number can be achieved if it follows the suggestions given.

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