International Journal of Latest Trends in Engineering and Technology
Vol.(8)Issue(1), pp.480-485
DOI: http://dx.doi.org/10.21172/1.81.061
e-ISSN:2278-621X

VALUE STREAM MAPPING IMPLEMENTATION TACTIC AS A LEAN TOOL

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Abstract-An efficient and qualitative product can be achieved by implementing LM. LM is referred as approaches initially developed by Toyota that focuses on elimination of waste in all forms. Value stream mapping is a visual representation of all the specific activities, including the flow of material and information, which occurs along the value stream selected for a product or family. This paper illustrates the VSM implementation tactic as a lean tool in manufacturing and assembly industries. The purpose of this paper is to highlight the effective tactic of the VSM implementation for process parameter improvements by different authors.
Keywords – Lean manufacturing, value stream mapping, WIP

I. INTRODUCTION

The main goal of manufacturing organization is to fulfill customer demand by providing an exact product with high quality, required quantity and at a minimum price in the shortest time possible. In order to meet the organizational goal and compete with global market, there is a need to improve productivity and quality of product. Lean manufacturing (LM) considered as waste reducing mechanism and after implementation of LM manufacturing organization became an outstanding organization. LM considered as one potential approach for improving organizational productivity [1]. LM based Companies are achieving the remarkable improvement in efficiency. Lean manufacturing believes the simple fact that customer will pay for the value of services they receive, but will not pay for mistakes [2].Value is addition that attracts end customer. The whole process of the value addition should be observed and optimized from the end customer's point of view[3].

II. VALUE STREAM MAPPING

2.1 VALUE STREAM MAPPING

Value stream mapping is a visual representation of all the specific activities, including the flow of material and information, which occurs along the value stream selected for a product or family [4].Value Stream Mapping is a manual method for mapping. It represents all activities of product from raw material to finished product in the hand of customer. Software used to draw the value stream map for current and future state VSM are listed below

a) SimCAD
b) Breeze Tree
c) Edraw
d) Smart Draw
e) Leanpilot
f) Eves
g) Lucid chart
h) Microsoft Visio

1.2 VALUE STREAM MAP ICONS

Various icons used to draw value stream map. Some of them are shown in Fig.2.1

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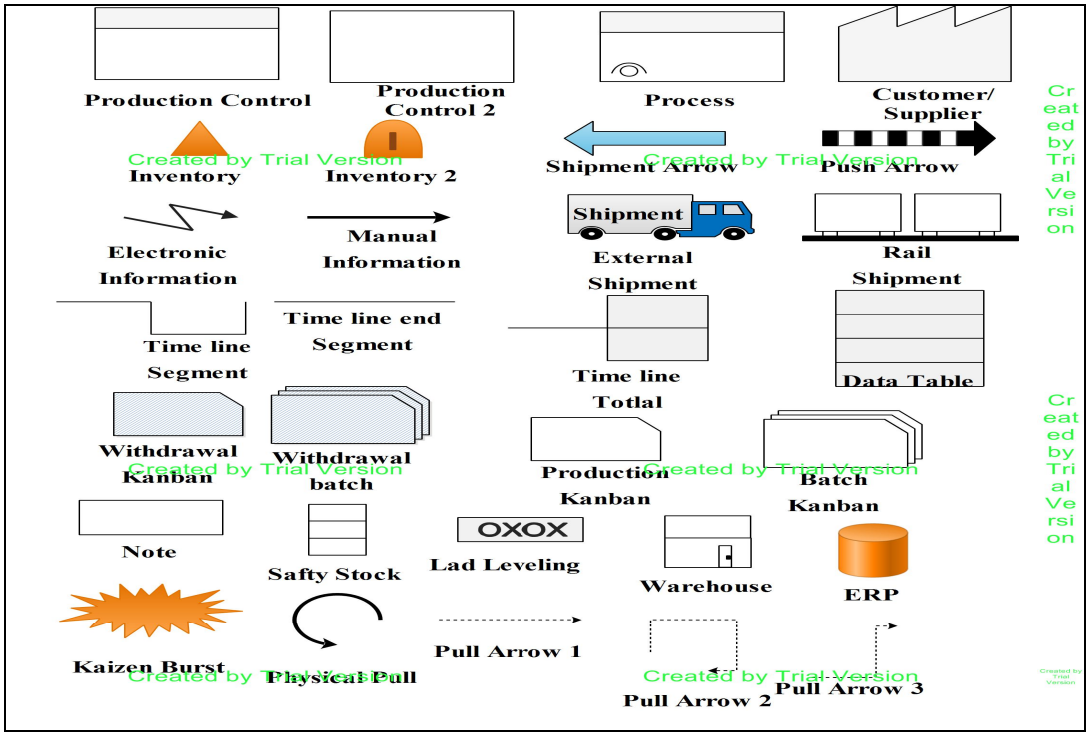

Fig.2.1Value Stream Mapping Icons [Created By Edraw Software]

1.3 DATA BOX ELEMENTS USED IN VSM

Metrics used to define data box element are

a. T/T = Travel time

b. P/T = Process time = $Q/T + C/T + C/O$

c. L/T = Lead time = P/T + T/T = VA time + NVA time

d. FPY = First path yield = Goodpieces produced / Totalpiece

e. Q / T = Queue time

f. $\text{Takt} = \dfrac{\text{Available work time per shif}}{\text{Customer demand quantity per shift}}$

g. C/T = Cycle time

h. C/O = Change over time

i. A/T = Available time

j. $\text{Cycle efficiency} = \dfrac{\text{Value added time}}{\text{Lead time}}$

k. VA time = Value added time = C/T

l. NVA time = $Q/T + T/T + C/O$

1.4 PARTS OF VALUE STREAM MAP

VSM has three main parts are shown in Fig.2.2

i. **Information Flows**
It is a communication method in the production system which refers to a flow of information from the customer to production control and from production control to a supplier is shown in Fig. 2.2

ii. **Material Flows**

It refers to a flow of material as per the production planning and control. It shows the flow of material from one process to next process as per scheduling is shown in Fig.2.2

iii. Lead Time Ladder

It consist time line segment and time line total icon which indicate lead time and process time of production line is shown in Fig.2.2.

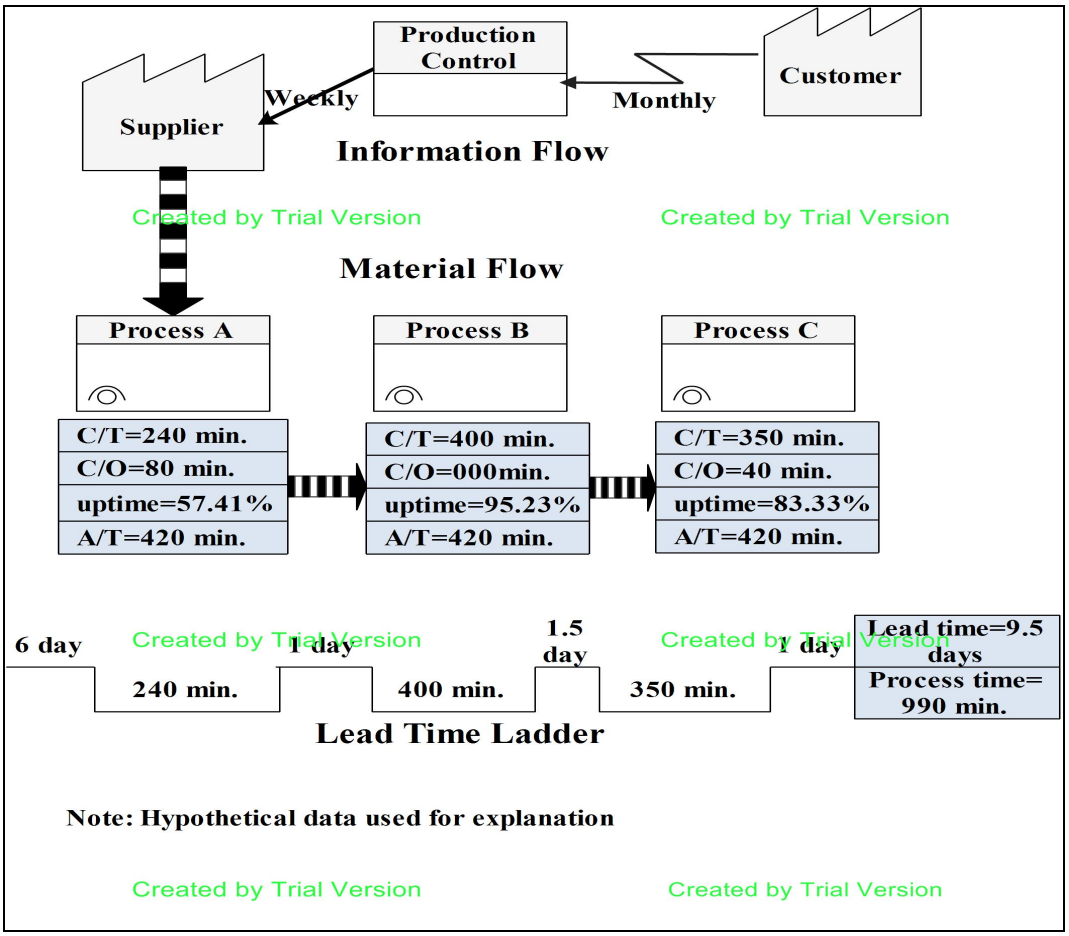

Fig.2.2 Parts of Value Stream Map [Created By Edraw Software]

II. LITERATURE REVIEW

Ciarniene and VienaZindiene [1] presented a model of Lean implementation process to show the main principles of Lean and disclosed the success factors in Lean implementation. Seth and Gupta [2] used the VSM as LM tool for improving productivity at supplier end by taking the case study of an auto industry. They discussed both current and future states of supplier shop floor scenarios by using value stream concepts and analyzed the VSM by takt time calculations. They achieved a gain in production output per person, reduction of work in process (WIP) inventory and finished goods inventory. Patel *et al.* [3] illustrated the review of VSM techniques and its benefits in machining industry. Abdulmalek *et al.* [5] implemented the VSM (value stream map) as Lean Manufacturing (LM) tool in the case study of a large steel mill. A Simulation model developed to contrast the ‘‘before’’ and ‘‘after’’ scenario in the case study company. Production lead-time and work-in-process (WIP) inventory reduced through VSM as LM tool in the case study company to increase productivity. Alvarez *et al.* [6] redesigned the assembly line of the case study

organization by using Kanban and Milk run technique with VSM as LM tools. Achieved improvement measured in terms of the lean rate (LR) and dock-to-dock time (DtD) parameters. Eswaramoorthi *et al.* [7] developed an effective strategy for configuration of the assembly system using Lean concept and proposed an integrated cost model for the assembly process. Giao and Cachadinha [8] made an attempt for the use Lean construction as Lean Manufacturing tool in the construction sector. They carried out a study and identified problem and waste present in road work by implementing VSM as Lean tool. Lead time of work reduced by elimination of waste. Khalil and Mohammed [9] investigated and analyzed the wastes elimination of the manufacturing firms in Gaza Strip and analyzed its important role for reducing the production cost. The main aim of the research was to promote lean thinking through studying the seven wastes which targeted by the lean manufacturing philosophy. Rawabdeh [10] explored the relationship between seven waste of lean manufacturing (overproducing; processing; inventory; transporting; producing defects; time waiting; and motion waste) by investigating a method of waste allocation. Ramesh *et al.* [11] used Value Stream map (VSM) as a lean implementation tool. They carried out a practical study in a manufacturing industry for the manufacture of Machining center. Singh *et al.* [12] covered review and classification of literature available on VSM and presented the case study of small manufacturing Indian industry in which LM implemented through VSM (Value Stream Map) as LM tool. Lead time, processing time, work in process (WIP) inventory and manpower requirement reduced.

III. VALUE STREAM MAPPING METHODOLOGY

Analysis of process carried out by acquiring related information pertaining to process. The various steps followed in VSM methodology are shown in Fig.4.1

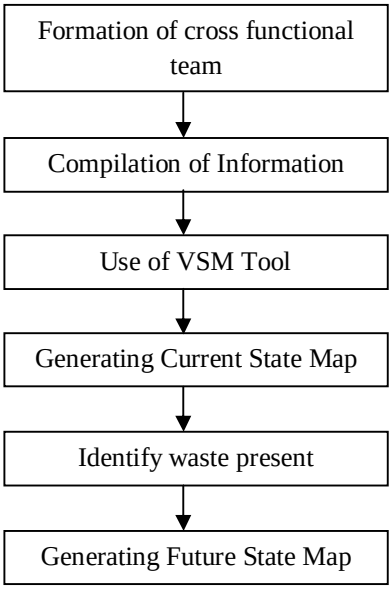

Fig.4.1 Steps in VSM Methodology

A. Formation of Cross Functional Team

A cross functional team is formed that included 4-5 persons. The function of this team is to create cultural change and collect data for study.

B. Compilation of Information –

1) Related to Demand-

Information pertaining to product family, variety of product, quantity required, Lot size, type of packing, number of delivery points are compiled.

2) Related to Information Flow-

Information pertaining to forecasted demand, departments, methods of supply, time taken during supply and processing, ordered quantity for supply are compiled.

3) Related to Material Flow-

Information pertaining to Process layout, cycle time, change over time, available time, travel time are compiled.

C. Use of VSM Tools

Complied information are arranged for generating map as per VSM tool which are shown in Table 4.1

Table 4.1 VSM tools

S/N	VSM tools	Parameters
1	Information flow mapping	Data related to supplier, customer and production control
2	Material flow mapping	Data related to process like C/T, C/O, T/T , A/T and inventory
3	Time ladder mapping	Data related to lead time, VA and NVA time
4	Demand mapping	Quantity of defects less produced product
5	Quality mapping	Data related to defected product and service
6	Variety of product mapping	Data related to variant manufacturing process path

D. Generating Current State Map –

Information compiled by team is used to draw current state map. Following steps have to follow to draw a current state map.

1) Draw process layout
2) Map information flow
3) Map material flow
4) Map lead time ladder

E. Identify Waste Present

After drawing of current state map find out the waste present and also find that which tool applied to improve the process.

F. Generating Future State Map

The improvement in the existing process applying various lean tools like 5S, Kanban, Kaizen, Line balancing, etc. comes to this phase. The lean tools ultimately helps in reducing lead time, change over time, NVA time, WIP inventory and improving productivity.

IV. CONCLUSION

It is concluded that VSM to be used as lean tool to improve process parameter. The methodology of value stream mapping implementation is expressed after referring number of papers. This paper will provide help to use VSM as lean tool to reduce waste and enhance process.

ACKNOWLEDGEMENT

I would like to acknowledge and extend my sincere gratitude to Prof. B S Pabla, NITTTR Chandigarh and Associate Prof. J P Bhamu, Gov.ECB Bikaner for their constant assistance and motivation to publish a paper.

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