CAN VALUE STREAM MAPPING BOOST MANUFACTURING INDUSTRY? : REVIEW OF EXTANT LITERATURE

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Abstract:

Lean manufacturing is perhaps the most preferred practice in the world to eliminate wastes in production service and other sectors. Literature cites a large number of successful implementation of lean tools in the industry. The main objective of lean methodology is to eliminate or reduce the non value added activities and hence the production rate can be achieved. Among many lean tools in Toyota production system value stream mapping is the frequently used tool for manufacturing industry. This will be treated as best potential tool and can be implemented for any kind of sectors which reduces and eliminates the maximum non value added activities which were affecting the productivity of the organization. This paper presents the discussion on various case studies on value stream mapping tool that highlights how best it can be beneficial to the production systems.

Keywords: wastes, lean practice, values stream mapping (VSM), value added activities.

1. Introduction

The lean practice is a widely accepted technique to improve the production process and to achieve better quality of product. It provides a cutting edge for a manufacturing plant to reduce cost of manufacturing and thereby, become competitive in the market. Taiichi ohno (1988) contributed significantly towards building lean manufacturing tools. The main concept behind this is to improve the productivity by adopting the lean tools to eliminate the non value added activities in manufacturing. The main objective of the lean is to maximize the efficiency of the industries with low cost and with minimum risk so that the company can reach a target. Many research papers have dealt with the efficacy of implementing lean tools to minimize wastes in large scale manufacturing industries. Based on the situation of the company, different lean tools such as 5S, VSM, SMED, kanban are implemented to stream line production. Out of these, VSM is one of the effective tools which can be implemented in workplace in order reduces the different kinds of wastes.

VSM helps in standardizing and improving working environment. VSM is a technology transforming tool, which reduces the waste and the consumer can receive the product with most efficient, effective and economical manner. In recent times, many government organizations have started using lean tools to improve the performance by implementing lean practices in both public and service sectors. There is a consensus in literature that for long time sustainability and to produce a better quality of product, lean practices are essential and thus the company can be achieves a better quality of output. All these are attained through proper training, which should be given at different managerial levels, so that continuous retention of lean practices is possible in large scale

manufacturing industries to a large extent. Toyota is the first company which adopted lean practice effectively and came up with good results of production cost which is reduced from 2.5 to 5%. They will be treated as the bench mark for other industries to implement the lean practice effectively to achieve the high volume of productivity.

2. Value stream mapping methodology

Value stream mapping was developed and being practiced by the Toyota Motor Company. Figure.1 shows in detail the step by step procedure of VSM. VSM creates a value to the customer through the different processes. It is visual tool which map the present method by drawing the current state map and reduces the non value added activities.
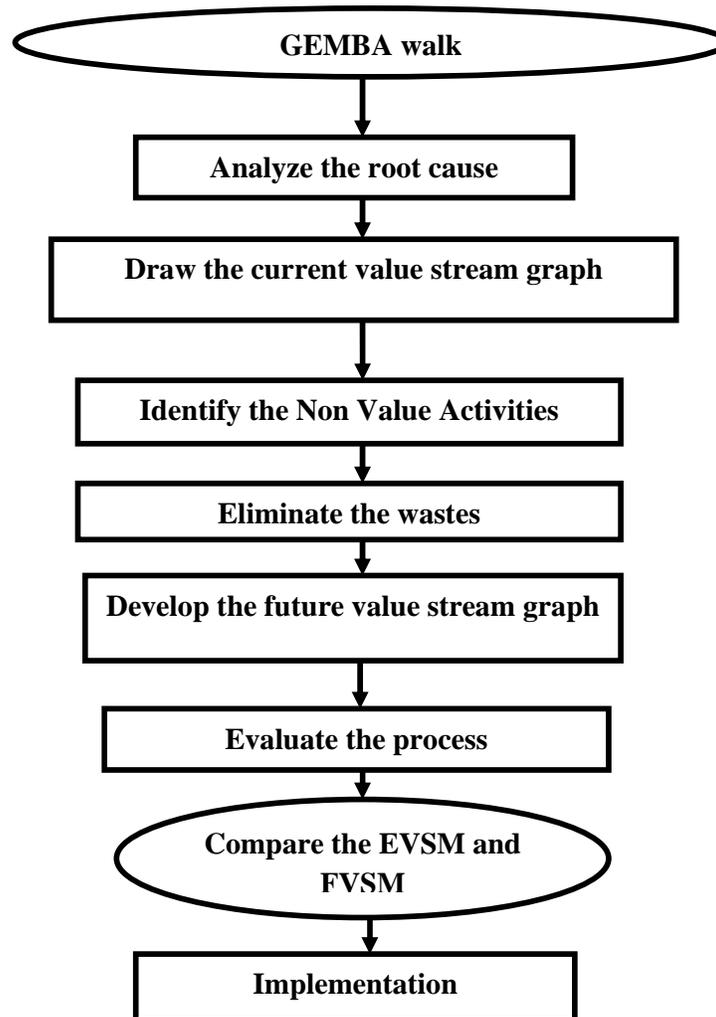
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            ┌─────────────────────────────┐
            │        GEMBA walk           │
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            │   Analyze the root cause    │
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            │ Draw the current value      │
            │      stream graph           │
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            │ Identify the Non Value      │
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            │   Eliminate the wastes      │
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            │ Develop the future value    │
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            │   Evaluate the process      │
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            │  Compare the EVSM and       │
            │          FVSM               │
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            │     Implementation          │
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Figure.1 VSM Methodology flow chart

The performance improvement can be shown by drawing the future value stream mapping. Value stream mapping shows the clear visualization of each step with the help of symbols, metrics and arrows, information to increase the productivity. This graph enables where exactly wastes occur in the flow line (cycle time, change over time. etc). Traditional value stream mapping which give the information of each step in detail in shop floor by GEMBA walk and where dynamic value stream mapping implemented

for complex manufacturing processes which uses the RFID signal to identify the wastes.

3. Review of Literature on VSM

Lean manufacturing, popularly referred to as just 'lean', has been one of the widely discussed production system in literature. The lean concept originated as Toyota Production System (TPS) in Japan, it is one of the widely accepted practices by companies all over the world. There is abundant literature in the form

of books, journals, articles, conference proceedings, internal working papers, so on and so forth. Lean manufacturing, pioneered by the Toyota Motor company, has become very popular among manufacturing organizations around the world, to reduce waste. Value stream mapping (VSM) is a lean-management method for analyzing the current state and designing a future state for the series of events that take a product or service from its beginning through to the customer. A number of research studies have been carried out to analyze the effect of VSM on productivity.VSM is frequently and efficiently used in many manufacturing or service sectors. This tool mainly reduces the different wastes and improves the production process. Based on literature survey, following industry sectors appear to be more popular for implementing VSM. However, for the purpose of our study, we have identified and reviewed literature, which are classified as follows

 E.andnes –lepezet et,al [1] made significant contributions in value stream mapping(VSM). They have demonstrated that VSM can be implemented for both manufacturing and service sectors. Value stream mapping is the fundamental tool of lean practice which has been proved efficiently in reducing the different mudas. Finally, authors propose that value stream mapping is one of the best tools of Toyota production system which can be implemented successfully for the organization to reduce or eliminate the wastes.

Zelio Gerroidodos et,al [2], also did case studies on value stream mapping. This tool helps in drawing the present and future map and also different wastes can be eliminated and flow line can be made smoother. Interestingly, authors have showed that VSM can help in the ergonomic design of work stations and make the production line streamlined. Hence, the productivity also can be improved. **Zelio Geroidodos** et,al [2], also worked on value stream mapping. They demonstrated the efficacy of the tool in identifying different wastes on shop floor. They also elicited feedback from employees and found that poor ergonomic design of shop floor resulted in increased fatigue of workers on the shop floor. From the survey author declared that redesigning the shop floor ergonomically, unnecessary movements, fatigue of the worker can be eliminated and productivity can be improved.

Mehul magantra et,al [3] have proposed effective implementation of value stream mapping. VSM can be implemented for both manufacturing and service sectors. The tool explores on different muda, which is a serious issue in the organization which affect the production level tremendously. By representing the future mapping graphically, improvements in lead time, overproductions etc can be done effectively. Therefore, the authors declared that value stream mapping is the best tool which eliminates the different wastes.

K.Venkataramanan et,al [4] also worked on value stream mapping. The tool reduces the wastes and increases the efficiency of the production line. They have done a survey of lean tools used in various industries and conclude that VSM is one of the most commonly used lean tools along with 5S, kaizen and kanban.

According to **A.Dief** [5] VSM helps in reducing different non value added activities like process variation, product defect, machine variability, etc. Value stream mapping represent the whole process of assembly line by graphical method whereas VSMII shows the process mapping for a product family i.e. group of product which have gone through similar process. And with the help of variability index, processing time can be calculated.

Prof. Dayi A. [6] examined implementation of VSM for enhancing the life of machine tools. This tool represents different problems in a flow line graphically. This helps in the identification of major problems with clarity so that they can be solved effectively.
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According to **Aupam Sihag** et,al [7] value stream mapping is frequently used potential tool which improves the operational efficiency by reducing different types of wastes. By drawing the future value stream mapping graph, different operational procedure of manufacturing line can be improved. Hence authors conclude that the value stream mapping is the best productivity tool which can be implemented to automobile industry in order to highlight the ineffiencies such as lead time,

operational procedure etc, of the production line and increase the productivity.

Benjamin Haefner et,al, [8], have designed a procedure model, which is relatively different from classical value stream mapping tool. This tool is implemented in electronic industry where it can not only identify the wastes as in traditional VSM tool, but also identify, analyze, and also inspect the product quality with the help of **ishikava** and **FEMA** concepts. Hence author declared that the procedure model best method to identify the quality related costs.

Author **Vaibhav s. kengal** etc, al [9] implemented VSM for both production and service sectors. From several surveys done by them, it has been proved that the value stream mapping is the best potential tool which can be applied to the both production and manufacturing sectors.
The research work done by **V.Ramesh, K .V. Srenivasa Prasad** [9] was able to depict the gap where exactly the improvement will be made and identify the non value added activities such as cycle time and set-up time, etc with the help of future value stream mapping tool.
Ulf.k.teichigraber and Maximilian De Bucourt [9]] also worked on value stream mapping tool for endovascular stent. They proposed that value stream mapping is the finest tool which can be applied effectively to procurement of endovascular stent from the supplier to point of use. Finally authors declared that VSM tool can be implemented to trigger the consignment of stocks.
Bhim Singh Garg .k. [9] implemented value stream mapping for the small scale industry to eliminate the non value added activities like processing time; work in process (WIP) etc. Authors conclude that the performance of manufacturing sectors can be improved by the implementing the value stream mapping tool and this is the best tool to reduce and eliminate the wastes and smoothen the production process.

Nitia kumar kasava et,al [10] proposed a new supporting model for value stream mapping to identify the overall cost accumulation for the production process. They showed that the non value added activities can be optimized with help of cost profile value stream mapping tool.

Umangi d. patghak et,al [11] used VSM to identify the wastes in production line and make the process stream lined and smoothen with the help of future value stream mapping(FVSM) and they highlighted the application value stream mapping for both manufacturing and service sectors.

According to **Peter hines and Nick rich** [11] most promising wastes such as waiting time, over production and transport cost can be eliminated in production line with the help of value stream mapping. According to **Ramesh R.Bhat, Prof.S. Shivakumar** [11] reported that a reduction in lead time can improve the efficiency of production. **Roberto jarbulu, iris** [11] proposed VSM tool to coordinate the modeling and analyzing supply chain to improve the efficiency of the production. Therefore author comes to the conclusion that VSM is the best potential tool which can be applied manufacturing and service sectors to improve the production.

J.A.Devaprince, K.S Sreenivaan [12] had selected value stream mapping tool to reduce the cycle time for auto auxiliary industry. From the survey done by many experts it has been found that VSM is the best business tool which identifies the waste in the production processes and improve the productivity. Hence authors suggest that value stream mapping is treated as best productivity tool to reduce the cost and cycle time.

Author **Praveen Saraswat** et,al [13] works on tool called value stream mapping. He implemented value stream mapping for bearing industry and identified that higher works in process (WIP) and cycle time are the major wastes tremendously affecting the production process. In order to come over this problem, author come up with the tool called value stream mapping which reduce total processing time from 409 to 344 seconds.

According to author **Sheriff Mustafa** etc, al [14] VSM tool can be implemented to manufacturing industry. This frame work is essential to analyze, document and removal of wastes. According to author traditional value stream mapping can give clear picture of shop floor by GEMBA walk. Whereas the dynamic value stream mapping uses RFID signals which

eliminates the wastes automatically with the help of radio frequency signals.

According to **Rohani A.R** [15] Lean tools have been implemented tremendously for a manufacturing industry to improve the productivity of the organization. Out of many lean tool value stream mapping is the best tool to document and the identify the root cause of production line such as lead time and work in process etc. Therefore author proposed powerful tool called value stream mapping to identifying and reducing wastes and hence improve the productivity.

According to **Sujatha Y**.et,al [16] value stream mapping can be implemented for silk reeling process industry and observed the major wastes in a production line. The major wastes found during process are cycle time and setup time for different processes such as stifling, sorting, storage; boiling process etc. Authors declared that VSM is the business tool to improve the process by eliminating wastes and hence achieves the better results.

According to the author **Rajenthirakumara** et,al [17] lean strategy is implemented to improve the production process for manufacturing sectors. The main objective of this paper is to reduce the cycle time and improve the cycle efficiency. Authors had chosen painting department in a shop floor and found bottle neck time, waiting time, material handling time are major wastes in the department. They concluded that values stream mapping is the best communication tool to identify and eliminate the wastes and hence improve the productivity.

According to **Fridrich morelock** et,al [18] value stream mapping is the professional tool which can be implemented for service industry. Author declared that VSM is the progressive tool to identify and measure the performance such as planning, controlling, and monitoring process and improvements can be shown by drawing the future value stream mapping graph.

According to author **Amir azizi** et,al [19] a value stream mapping tool implemented to PCB assembly line. Production lead time is the major issue identified in the assembly line. kaizen and SMED technique helps to draw a future value

stream mapping and non value added activities can be reduced .Therefore author declared that kaizen and SMED techniques supports to draw future value stream mapping to eliminates the wastes.

kuhlang S.hempen et,al [20] showed that continuous improvement of production line within the frame work of organization can be done with the support of systematic and continuous improvement of value stream to reach a customer demand. Therefore author declared that the cyclic improvement is implemented within frame work for continuous and systematic improvement in the value stream. According to author **Maheshwaran Gopalakrisnnan** et,al [21] planning of maintenance activities can be improved by drawing future value stream mapping .Author declared that the implementing VSM for the shop floor of industry can reduce the non value added activities and hence productivity can be improved.

4. Conclusion

The main objective of this paper is to emphasize the application of VSM for both the manufacturing and service sectors. Much evidence has been proved experimentally that VSM had a strong impact on manufacturing industry. It will be treated as world class manufacturing tool which identify, quantify and minimize the various types of wastes which come across the production line. Hence VSM is a best lean tool which can be effectively implemented to both manufacturing and service industry.

VSM has also proved to be a versatile tool, which also finds applications in product design activities, ergonomic design of work stations etc. Since poor ergonomic design of shop floor could result in increased fatigue of workers, VSM can chip in to improve work place design and mitigate the stress caused to the workers. Good work place design will also enhance productivity. Many researchers have implemented VSM for medical applications also. VSM can give clear picture of shop floor by GEMBA walk. There is also tremendous scope for utilizing embedded technology for mapping the shop floor. Researchers have successfully implemented dynamic value stream mapping by using RFID signals, which can map

the shop floor with the help of radio frequency signals. In medical field VSM has proved effective role in procurement of endovascular stent in hospital to trigger the stock shipment which eliminates major bottle necks. Also VSM tool has reduced various mudas in painting department of the shop floor and found bottle necks like waiting time, material handling time etc.

We conclude that application of VSM is limitless in manufacturing and service industry. Successful implementation can trigger a new revolution in enhancing the productivity of the Indian industry.

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