



IMPLEMENTATION OF LEAN MANUFACTURING METHOD IN A MANUFACTURING INDUSTRY USING VSM

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ABSTRACT

Presented study is based on the lean manufacturing including the improvement methodology that suggested the implementation of lean manufacturing along with its concept in which lean manufacturing is based on and the principles of lean production. Lean manufacturing is the way that efficiently eradicates the waste from the every aspect that contain by the organizational operations. Organization supplies the product which was demanded by the customers according to their need and demand of the customers. Mainly the companies establish the lean plant because of three main reasons: to get high production by using fewer resources plus costs as well as to increase the quality of products and to improve the responsiveness of customers. The methodology of lean production recommends the differences of current state VSM as well as the future state VSM including raw materials, cycle time and change over time. This paper concluded the advantages and disadvantages of lean manufacturing, also comprises the tool and tactics of lean to eradicate the waste, over-production, over-processing, transportation, inventory, waiting, motions and defects.

Keywords: Lean manufacturing, VSM, customer, cycle time, change over time, inventory

1.0 INTRODUCTION

There is an intensely change had been seen in the international market since from the past few years. As a result of which the clients are not accepting the products those have low quality along with the long lead time as well as the restricted changes that had been done in the products. The demand of Customers upsurges day by day and the older way of production is

unable to fulfill the present demand that made by the customers. Therefore, to obtain the products those have high quality and produce in short period of time along with cost effective products are made by applying the new method of production. These new methods are able to survive globally in the competitive market. The approaches regarding the Lean Production is being utilized through the various companies and enterprises all over the world in the direction of achieving the economical reward. Moreover, lean production is founded by their individualities; this procedure was developed through the large institutions (companies). The Small scale enterprises along with the Medium scale Enterprises i.e. SMEs also hold the large number of shares in the comprehensive economy.

1.1 EMERGING OF LEAN PRODUCTION

When no innovative ideas are arises except the whole conventional ideas as well as elucidations which are not applicable. These lines are said through the Womack et al. in 1990. "Lean Production" is introduced by the Womack and his colleagues. It is the western version of TPS (Toyota Production System) concerning about the recognition of TPS. Toyota Production System of its own ascended despite the fact that there was the requirement of manufacturing enlargement in the Japan. Even though, the précised economic circumstances especially, during the down time of Japan at that particular time period the traditional way (conventional methods) become the useless. Thus, at the time of 1950 the first man i.e. CEO of Toyota, Eiji Toyota toured to the USA planned for the second visit of Toyoda family in Cast Rouge, during that time Cast Rough was well known factory for its efficiency in the world. Accordingly, during the tour Taiichi and Eiji

discussed about the intellectual engineering production of Toyota. Eiji stated that they was not exactly replicate the production system of Ford as the bulk production however there are some aspects/fields where possibility of modification can be occur as well as setup the adapted system of production. Due to this TPS ran that afterward introduced western version as the Lean production.

1.2 LEAN MANUFACTURING

The approaches that make the Lean Production in the systematic manner that identified as well as eradicate the waste by means of nonstop progress. Getting less with more amount of work is known as Lean such as inventory as well as space along with the people also money. The objective of Lean Production is to reduce the work pressure of humans including fewer inventories along with the less time to develop products as well as less space to be more reactive or responsive toward the customer demand but it is possible to produce the products of top quality along with the great efficiency plus economically affordable.

1.3 VALUE STREAM MAPPING

It is the part of lean-management system which is used to analyze the existing design as well as planning for the future, which contains the chain of procedures that takes up the products or else its services from their initial stage to the customer, the reduction of lean made is compared with the current map. Value stream emphases on the region of firm that added values, to the products or else services, however a value chain can be referred towards the entire activities that takes place in the company.

In Lean manufacturing the VSM (Value stream mapping) is an instrument (tool) that contain the major importance with the intention of accomplishing the nonstop development of the way in which work takes place. The benefits of VSM (value stream mapping) are:

- It agrees to visualize as well as assured the procedure.
- It helps to enhance the deliver value to the customers.
- It helps to identify the steps that contains by the process having a great importance.

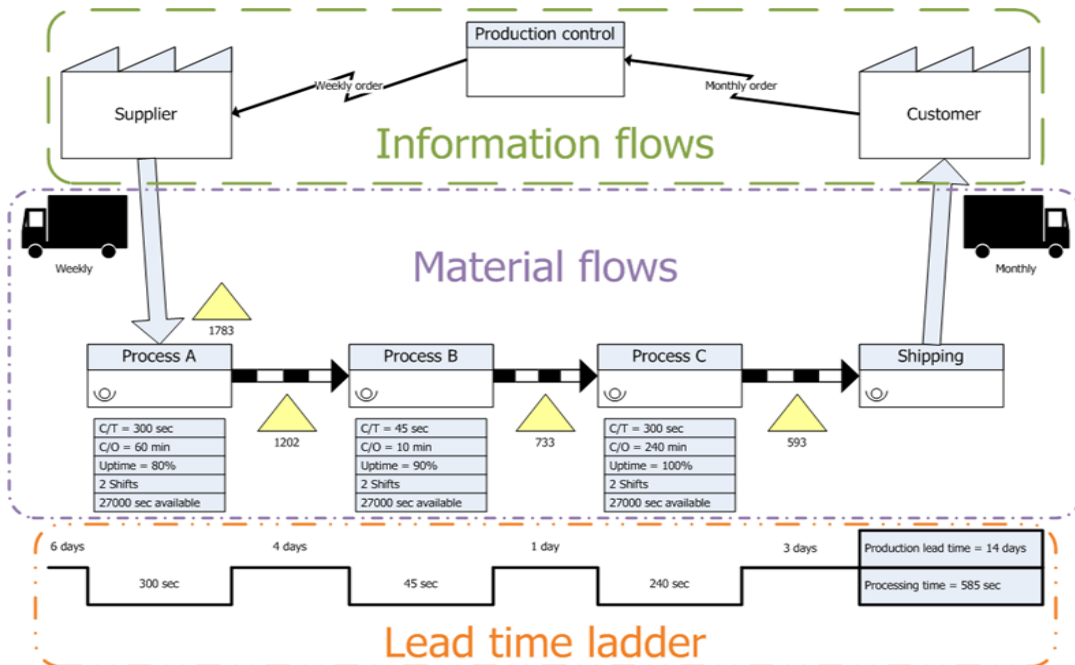


Fig.1. Value Stream mapping procedure

1.4 Advantages of Lean Manufacturing

• **Waste Minimization** - Debatably the most important advantage of this system, LM can

proficiently diminish the waste contained by a production unit.

• **Enhanced Customer Relationships** - This is the way that how you are capable to build

strong as well as trustworthy relationships with the reliable customers.

- **Lean Infrastructure** - lean infrastructure can be define as the dealing of several components including tools along with the building as well as equipment together with the labor, plus supplies to accomplish the demand of near-term inventory.

1.5 Disadvantages of Lean Manufacturing

- **Equipment Failure** - Lean contains the very less possibilities of errors. Equipment failure or labor failure may direct the major consequences that comprises inconsistencies and irregularities inside the procedures of lean as well as causes the failure of entire operations and procedures that taking place in the lean manufacturing.

- **Delivery Inconsistencies** - In the association of equipment failures that restrict the production can lead the inconsistencies in delivery due to this disadvantage of lean can hamper the customer relationships with the company as well as pushes the consumers in the opposition or competitors that makes financial blunder or can even cause the bankruptcy of the company.

2.0 LITERATURE SURVEY

(Verma and Sharma, 2017) stated about the case in which work can be completed by means of recognizing the waste associated areas where lean production takes place. The reason behind the activities which are non-value added type is because of improper way of managing material along with the extended distance together with the faults (flaws) as well as inadequate inventory.

(Yadav *et al.*, 2018) exposes the “lack of management commitment and leadership” including “lack of communication” as well as “lack of resources” are some serious issues so, these issues are considered as the basic if lean enactment project in Small Medium sized Enterprises.

(Thanki and Thakkar, 2018) outcomes of this paper clearly recommended the support of Government along with the assurance of top organizations together with the provision of funds are more significant for the positive placement of lean-green enterprises.

(Meena *et al.*, 2018) resolve the rejection related problem because of the core distance along with

the coordinated (concentric) length which is displayed in the table number 9 plus 10 that enhanced by means of DMPEAIC establishment.

(Phanden, Jain and Verma, 2013) the author recognized lean as a unified manufacturing. In this current paper the procedure of IPPS can rapidly incorporate the functions along with the implementation without disassembling together with rearranging or rescheduled the current procedures that formalized by the schedule department, PPSM along with the SM including PPMM plus SAM are the four major modules.

(Ruben, Vinodh and Asokan, 2018) predict the sustainability or maintainability benefits of LSS i.e. Lean Six Sigma framework through the perception of environment is valuable to acquire the assimilated tasks along with the reimbursements of environment. The framework of LSS can be more enhanced through the integrating of design that was an eco-design as well as the properties of environmental sustainability.

(Sahoo and Yadav, 2018) recommends the instigation of lean in manufacturing firms of SMEs through an easy task in the place of profound laden through the indoor and outdoor obstacles of several business houses. Along with the recognition of key barriers to implements the lean manufacturing of SMEs in India.

(Ramadas, 2017) defines the apprehension of acute obstacles to employing the lean manufacturing by means of small together with the medium scales start-ups. Current paper concluded the participation of two conceptual broad. The first one is the obstacles identification. And the second one is: it offers the identification keys of obstacles that can be useful for the future studies of lean manufacturing.

3.0 METHODOLOGY

3.1 Flow process of methodology

1. Selecting the suitable industry for implementing the lean manufacturing procedure.
2. Study the different procedures of machining and manufacturing adopted in the industry.

3. Calculate the machining time and other time based operations which can contribute in the improvement of production process of current study.
4. Apply value stream mapping on the current scenario to calculate the complete procedure time and to suggest future state changes.
5. Finally Comparing both the states that is present and future state with incorporated benefits

3.2 Introduction

On the basis of theoretical principles along with the concepts the lean manufacturing or design is an improved practice for the establishment of lean manufacturing with the help of proposed methodology. The aim of presented methodology is to consider the other prospective of lean procedures, which is not similar to the classical one, activate the process of detection as well as examine the other characteristics which generally veiled. Presented

methodology summarized the methodological views of following industry.

- Industry: For the present Study, **Digvijay Plastic Allied Pvt. Ltd** is considered for performing the study based procedure.

3.3 VSM Data for Current State

The current state VSM of lean manufacturing uses the raw materials for performing the various processes to form the products. The process take certain time to perform the processes which are under progress and the time taken by these procedures are considered as the cycle time as well as the extra time that utilized by the process due to some defects or mechanical errors that takes place in the machinery is considered as the change over time which is represent in seconds are displayed in table 4.1, the table also contains the various processes like Shearing together with the Size Cutting as well as Blanking plus Piercing including Bending along with the Assembly, also Paint and dispatching of product too takes place in the manufacturing unit.

Table 1: VSM Data for Current State

S.No.	Operation	WIP	Cycle time (sec)	Changeover time (sec)
1	Shearing	0	10	15
2	Size Cutting	0	7	12
3	Blanking	950	65	20
4	Piercing	0	12	10
5	Bending	840	35	25
6	Assembly	1200	105	25
7	Paint	2000	35	7
8	Dispatch	880	45	0

Current state VSM Map

The process of making products contains the several stages, starting from the inventory and processes various process like Shearing, Size Cutting, Blanking, Piercing, Bending,

Assembly, Paint and Dispatch, there process are also under goes with some stages of production to finalized the product for sales. The production contains the raw materials and resources to form the products; these are the

part of inventory or the initial stage of production. Then, there are 8 process for finalize the product then the product is ready for sale. To understand these complex procedures,

here we use the diagram to get the better understanding of these processes which occurred from the inventory to client and clients to inventory. This is the repeated procedure.

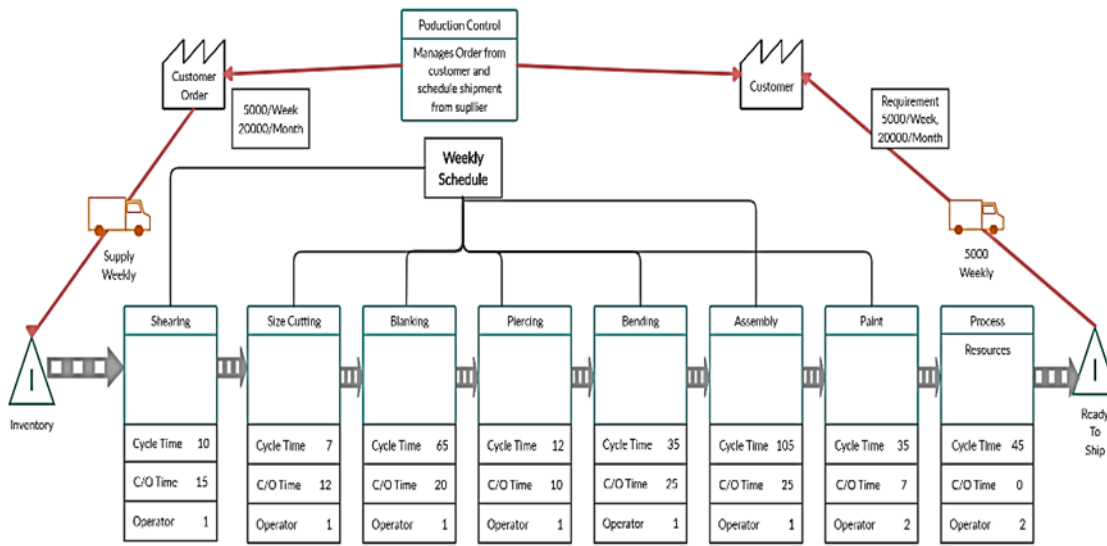


Fig.2 Current States VSM Map

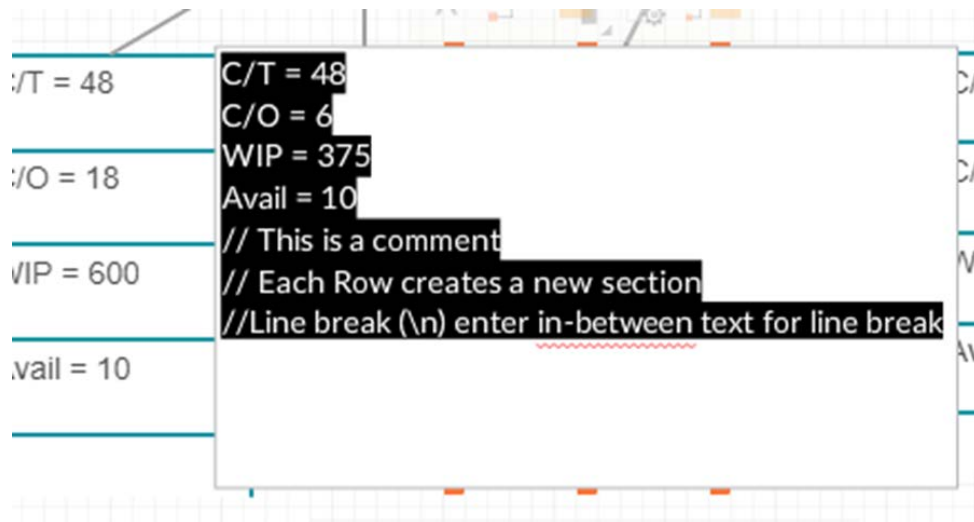


Fig.3 Giving input values for cycle time and change over time in E-Draw tool

Calculations

- Customer Order - 5000 (one week)
- Working Hours - One shift with 12 hours per day
- Break - One hour
- Raw Material - Weekly
- Working Day/ Month - 26 days

Take Time Calculation

- Available working day in a week = 6 days
- Demand per day = 5000/6 = 833
- Hence, Take Time = (Netavailabletimeperday)/(CustomerDemandperday) = 79200/833 = 95 sec

Where,
 Net available time is calculated as = number of working hours - downtime
 Therefore, Net available time = 22 x 60 x 60 = 79200 sec

(LCT) Line cycle time = sum of all cycle time
 Hence, LCT = 10+7+65+12+35+105+35+45
 = 314 sec

Mean line cycle time = 314/8
 = 39.25 sec

(LCOT) Line Change Over time = sum of all change over time

Hence, LCOT = 15+12+20+10+25+25+7
 = 114

Mean Line Change Over time = 114/8
 = 14.25 sec

The above calculations are helpful to estimate the future value of VSM

4.0 RESULT

4.1 Future State VSM 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. On this research we have made some sizeable improvements

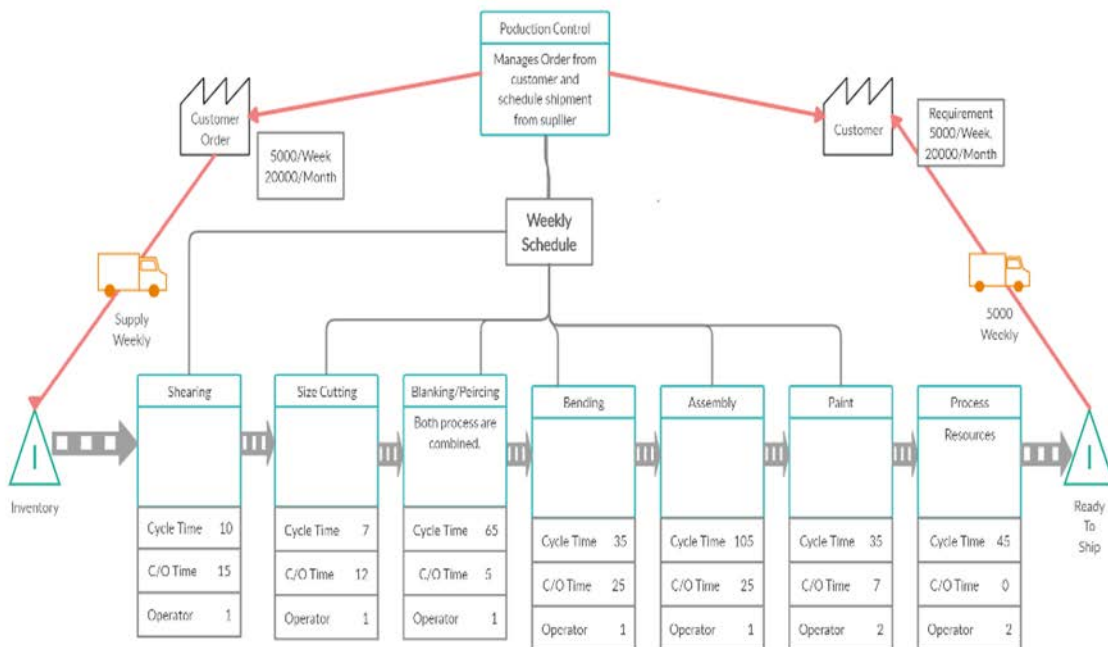


Fig.4 Future State VSM Map

4.2 Comparison of Future and Current State Maps

When comparing the VSM values and maps of current state as well as future state, it is observed that the eight process that taking place in existing (current) state have their recommended cycle time along with the change over time.

Additionally, after applying the VSM the processes in the future state are reduced from 8 to 7 as blanking plus piercing became the one procedure as well as assembly & packaging has also considered as a single procedure.

The VSM map displays the no deviation in the work force which was required. The man power of both the state remains constant.

Comparison of Production in Process

	$\Sigma(\text{WIP})$	$\Sigma(\text{CT})$ sec	$\Sigma(\text{CO})$ sec
Current state	5870	314	114
Future state	5420	302	106

So, it is observed that the procedure of blanking together with the piercing became one in the future state. The whole value of WIP including cycle time plus Change over time get compact in the future state map.

5.1 CONCLUSION

- The proposed method of implementation of lean manufacturing and the pathway of waste eradication along with improvement of production system were studied here.
- The comparison of current state of VSM and future state VSM clearly displayed the cycle time and change over time of processes taking place in lean manufacturing during the formation of products and conclude the methods to increase the productivity of the company by establishing lean plant.
- Combining of two processes also reduce the manufacturing time including cost and raw material and provide better productivity
- There is a reduction in the number of operators that required for the functioning of each operation in future state mapping as compared to the current VSM mapping, also reduces the labor cost.
- The comparison of current state VSM and future state VSM contains the changes in the value of raw material, in current state the value of raw materials (WIP) are 5870 while in future contains the value of raw materials is 5420, clearly shows the difference of 450. The cycle time of current state VSM and future state VSM is 314 sec and 302 sec, the observe difference of cycle time of current state VSM and future state VSM

is 12 sec. the observational difference of change over time in current state VSM and future state VSM is 8 sec as the change over time of current state VSM and future state VSM is 114 sec and 106 sec.

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