

# Improvement in Productivity of Leaf Spring Manufacturing Through Value Stream Mapping: A Case Study

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**Abstract:** Value stream mapping is a tool that includes all the phases of production line which is used to transform the raw material or unfinished goods into the desired finished product. A value stream observed all the activities through which the material gets transformed into the product. Value stream mapping use to provide the visual representation of every process that is related to existing material and information flow. A current state map of value stream helps us to identify the areas of waste and pinned them to improve, all the activity those are non value adding are also scrutinize by value stream. By making the modification in current material and information flow of existing plant a Future state map to be drawn. This map represents the improvement in selected family of product that is scrutinized in current state. In today's competitive era it is essential to every company that follow a path which derived the organization to forward than others. This will only make by the reducing the lead time, product cost, reducing non value added activities in plant these factor affect the overall production most significantly. The value stream mapping is tools that pay the attention to above cited factors. In this paper we opt the value stream mapping technique to eliminate the wastages, subjected to different process in leaf spring manufacturing plant. A CSM (current state map) represents the existing methods of doing and opportunities of improvement. Future state map represent the modification in process and overall reduction in production cost. Cost of leaf production decrease from 96.5lac to 96.1lac.

**Keywords:** VSM (Value stream mapping), lead time, non value adding activities, FSM (future state map), CSM (current state map).

## 1. Introduction

A value stream mapping is a lean manufacturing technique that originated from the Toyota a Production System. It is used to analyze and design the flow of material and information required to bring a product or service to a customer.

The tool VSM includes all the facets of activities required to convert the raw material into finished good. VSM is a set of method to visually display the flow of material and information through the production process.

The fundamental aim of any organization is to minimize the waste and increase the production and quality of product continuously. This will lead organization to customer satisfaction.

This can be achieved by adopting lean manufacturing system which is more effective than a cost reduction program. Its object is to eliminating waste, which could be in the form of excess production of goods and unnecessary inventories, movement of material waiting and worker motion rework and correction. In the VSM tool by gathering all the data related to the concerning process, draw a current state map of existing process. By the evaluation of current state map mark the prone area of wastage and non value added activities, which is further, helps us to eliminate the causes or substitutes the beneficial measure for non value added activities. With the beneficial implement we can draw the future state map of process this lead us to maximize the profit and reduce waste.

## 2. Methodology

Value stream mapping is an tool that help the user to figure out the material and information flow in concerning plant .The steps involved in value stream mapping in a given below-

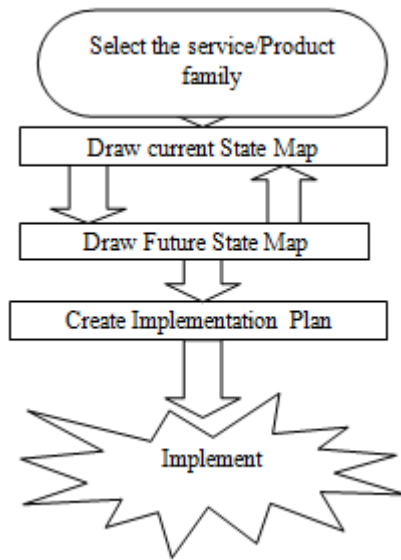
- 1) Determine the value stream to be improved. Select the part families.
- 2) Draw a current state map
- 3) How are we doing the things currently? This foundation for the future state.
- 4) Identifies opportunities for the elimination
- 5) Of waste and areas of improvement.
- 6) Developing a detailed plan of implementation
- 7) To support objectives.
- 8) Draw a future state map. Design a lean flow
- 9) Using lean techniques.

### Steps in complete VSM

Develop action plan and implement it.

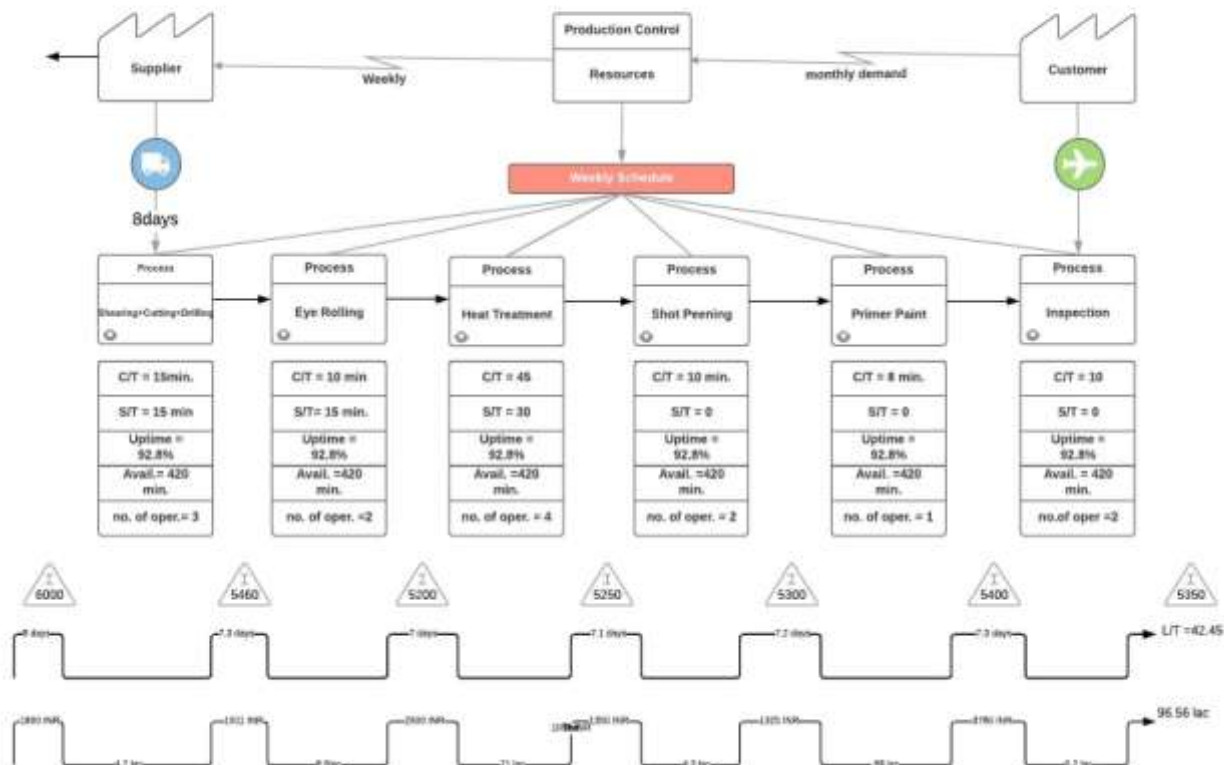
### 3. Current State Map

A leaf spring manufacturing company is selected as a case study in this paper. This company is one of leading suspension manufacturer of automobile. Basically manufacturing of no. assembly depend on the requirement of customer. Total assembly of suspension required 20000 per month approx in the company it required to produce the suspension leaf 5000 per week in firm. Total no. of working days available in month is 27. Available time for working in a shift is 7 hours i.e. 420minutes in a shift excluding 60minutes of lunch break. Required cycle time or associated cost to the different stages or process in manufacturing is shown in current state map. In addition there is in some process rework is required and to maintain the inventory, maintenance cost of inventory and transportation cost associated to different stages. Raw material travelled from store to finished goods inventory through the no. of process like shearing, cutting, drilling, eye rolling, heat treatment, shot penning, load testing and inspection. All the details of each process like inventory, cycle time, and total associated cost shown in current state map.



#### CURRENT STATE MAP

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### 4. Future State Map

A future state map created by identifying the prone areas of the waste and rejection in current state map, some changes in layout of the production line also proposed to save the cost of associated failure. It is suggested that in eye forming process of leaf there is some cracks generates on the curve surfaces this could be eliminate by proper heating or

continuous inspection of eye rolled leaf. Otherwise these cracks will be the reason of failure at testing.

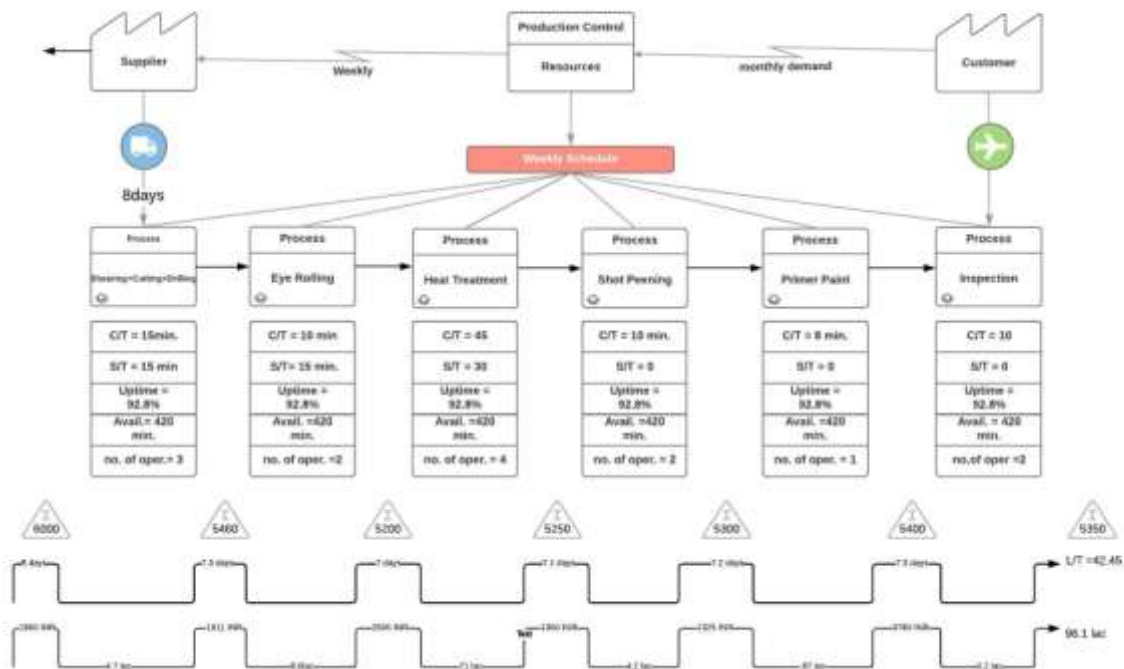
Some times what happened during the heat treatment process, quenching cracks will form this will increase the production cost ultimately. To eliminate the cost in further process we use the SEM (Scanning Electron Microscope) technique for detecting the cracks and discard these leaves.

By changing the sequence it could be possible to save the cost associated with the primer painting. If we use the painting section after load testing of leaf than it will

profitable to organization. Difference in cost seen in current and future state map.

**FUTURE STATE MAP**

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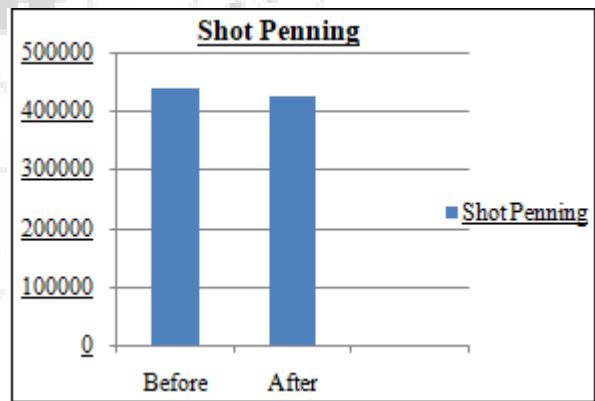


**5. Result and Discussion**

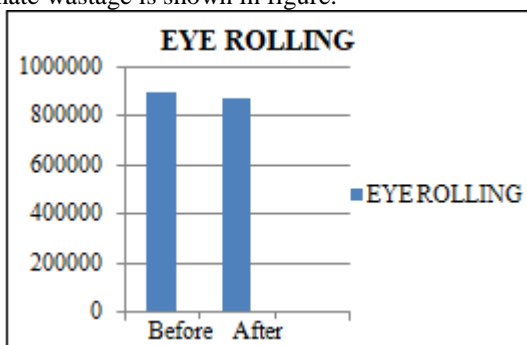
The main goal of the paper is to create a value stream map of actual production facility by observing the production line. The results in terms of cost saving are represented in the form of changes in bar graphs before and after corrective measure. Implementation is continuous inspection, deployment of SEM (Scanning electron microscopy) for cracks and by significant changes in layout of production line. It is observed that after applying the corrective method there is elimination of cost related to wastages. The production costs decrease from 96.51lac to 96.11lac after make a sizeable improvement.

We Use the Scanning Electron Microscopy able to detect the inner cracks and flaws in leaf this measure helps to remove them further the total productive cost. Change in cost before and after of implement shown in figure.

In the future state map it is suggested that to make eye rolling process defect free, eye rolling leaf should be inspect carefully. A continuous inspection able to reduce the cost of wastage associated to cracked leaf. Difference in cost after eliminate wastage is shown in figure.

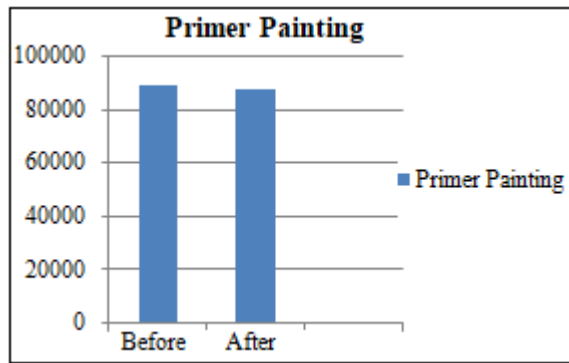


**Figure 2**



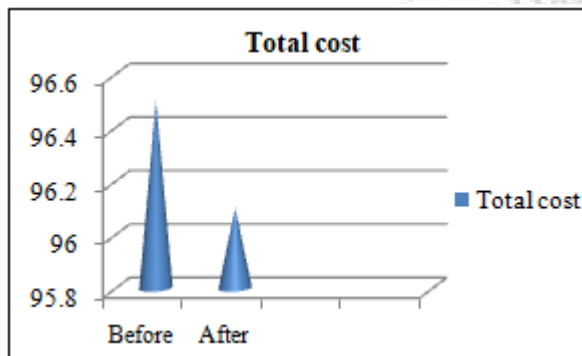
**Figure 1**

If the change in the existing process layout is considerable to save the total cost than it should be acceptable. By making the change in process layout it makes the possible cost saving during production process.



**Figure 3**

Productivity can be defined as to produce the desired product by the minimum resources. Reducing waste, decrease lead time, sufficient use of resources etc. are the lead factors that increase the productivity of an organization. We consider the total cost of wastage which affects the total production costs. The difference and saving in overall production cost is shown in figure.



**Figure 4**

## 6. Conclusion

The aim of this paper is to develop a value stream map for a leaf spring manufacturing company by observation and inspection. This will be allowing us to determine and eliminate the cost of wastages that increase the final cost. This final cost and wastage make a considerable effect on the productivity of Production facility. By implementing the technique like continuous inspection, scanning electron microscopy and change in process layout help in decrease the production cost from 96.5lac to 96.1lac. Thus a cost reduced affect the overall productivity of organization.

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