

# FEASIBILITY AND IMPLEMENTATION OF VSM (VALUE STREAM MAPPING) AND 5S IN CASTING INDUSTRY

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## ABSTRACT

*Manufacturers Always face cost-reduction and efficiency challenges in their operations. Industries require improvement in Production Lead Times, costs and customer service levels to survive. Because of this, companies have become more customers focused. The result is that companies have been putting in significant effort to improve their efficiency.*

*In this paper Value Stream Mapping (VSM) tool and 5s is used in casting manufacturing industry by focusing both on processes and their cycle times for a product valve body. In order to use the value stream mapping, relevant data has been collected and analyzed. After collecting the data customer need was identified. Current state map was draw by defining the resources and activities needed to manufacture, deliver the product. The study of current state map shows the areas for improvement and identifying the different types of wastes. From the current state map, it was noticeable that finishing , closing, molding processing have higher cycle time and work in process.*

*The lean principles and techniques implemented or suggested and future state map was created and the total lead time was reduced from molding, closing, finishing cycle time and reduce rejected valve and non value activities.*

**Keyword :** - *Lean manufacturing, value stream mapping, 5s, Production lead time.*

## 1.INTRODUCTION

Industries upset more capital and resources to improve their productivity. It is necessary to optimize their capital, time and working environment. Industries needed improvements tools to optimize its processes to attain more capable results. Many improvement techniques and tools were developed and adapted to work in the different types of business.

Now day's industries focused on more production with higher efficiency in less lead time. The companies focused mainly on customer satisfaction. In an increasingly competitive environment many manufacturing firms are looking for a winning card over their competition. Manufacturers have to understand that the conventional production system has to connect with the lean tools and techniques. Lean manufacturing system was developed by Toyota, Japan.

### 1.1 Value stream mapping

Value Stream Mapping (VSM) tool shows all the activities, from supply to final product through the different processing steps.. In other words it is a sketch of a production line.

Value stream map is the techniques that bring the all processing steps at one place. It shows the big picture of shop floor rather than individual processes and improving the each area at the production line. It is used to draw attention to different wastes and eliminating them in future state map.

It is necessary that every process as closely as possible produces only what its customers need when they need it. The existing machinery processes have some types the waste in a production line which is the result of product design and machinery

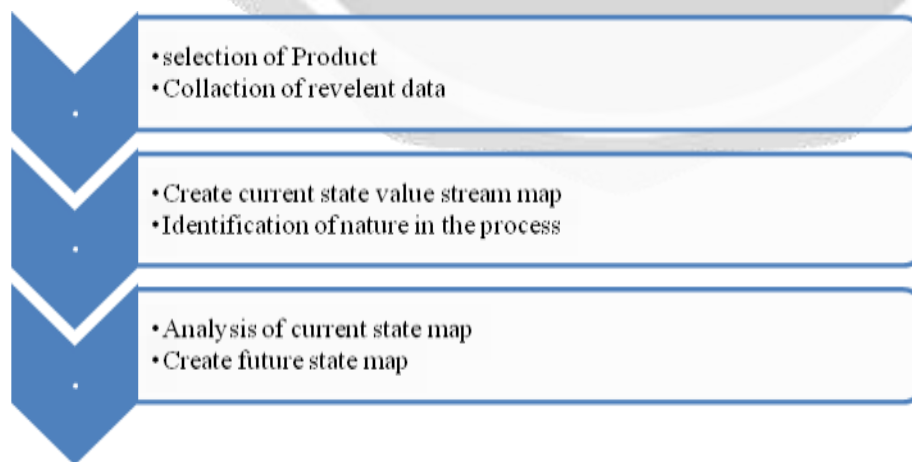
## 2. LITERATURE REVIEW

Value Stream Mapping (VSM) is used to define and analyze the current state for a product value stream and design a future state focused on reducing waste, improving lead-time, and improving workflow [2]. A value stream map provides a blueprint for implementing lean manufacturing concepts by illustrating how the flow of information and materials should operate [3]. VSM is divided into two components: big picture mapping and detailed mapping [4]. Rajenthirakumar and R.G. Shankar reported a noticeable reduction in cycle time and increase in cycle efficiency with an application of value stream mapping (VSM). The production flow was optimized thus minimizing several non-value added activities/times such as bottleneck time, waiting time, material handling time, etc. [5]. K. P. Paranitharan provide useful platform for research in implementation of lean tools in any manufacturing unit. Their results show a significant improvement in productivity, reduction of Production Lead Time and reduction in inventory. These can be achieved by creating flow by layout modification and balance to TAKT time [6]. R.M. Belokar reported a case study of application of VSM in an automobile industry where they achieved nearly 67% improvement in cycle time by improvement in value adding activities [7].

## 3. RESEARCH METHODOLOGY

The research objective is to reduce the production lead time and WIP in order to increase the production rate in mikpan alloys, ahmedabad so that customer order demand can be fulfill. Batch processing in full capacity and bottlenecks in the production process are key contributors to long

Production Lead Times. The results of the research would have direct impact on product Production Lead Time and WIP which would aid in reducing cost and meeting customer demand.



**Figure-1** Methodology Steps for Implementing Value Stream Mapping

The following strategies were applied for achieving the methodology steps:

- Detail of product, processes and other information obtained from company.
- Time studies for finding the time duration & data collected from shop floor observation.
- For drawing current and future state value map E draw software was used.

The current information was collected directly from the company by talks and discussions with managers, owner, and production supervisors. Example of such information is customer demand, general process flow, supply of raw material etc. Time studies were conducted to get exact information regarding cycle time, changeover time within each processing steps. The time studies gave the observed value of time for individual processes.

Information about cycle time, changeover time, and number of operators involved in each processing steps, amount of inventory and work-in progress between processes was determined. Current map was drawn which shows the material and information flow. Takt time was calculated and compared to average cycle time. The different areas were identified which needed improvement. Thereafter, future state map was developed followed by some suggestions. Lean tools and techniques were suggested for improving the material and information flow.

#### 4. PREPARATION OF CURRENT STATE VALUE STREAM MAP

Current state map is used to map work process, material flow and information flow. For this create current state map. The aim of this project demonstration of value stream mapping and 5s for visualization and rationalization of Process and its use in the context of a valve body.

**Table -1:** Value Stream map data

Customer Order	300 ( per month)
Working hour	Two shift with 12 hours per day
Break	40 minute / shift
Raw Material	Weekly

$$\text{Total available time} = 2 \times ( 12 \text{ hours} \times ( 60 \text{ min} / 1 \text{ hour} ) - 40 \text{ min} )$$

$$= 1360 \text{ minute}$$

$$\text{Demand per day} = 300 / 30$$

$$= 10 \text{ units}$$

$$\text{Takt time} = (\text{Available time per day}) / (\text{Customer demand per day})$$

$$= 1360 / 10$$

$$= 136 \text{ minute}$$

$$\text{Up time} = ( \text{Actual operating time} ) / ( \text{Available time} )$$

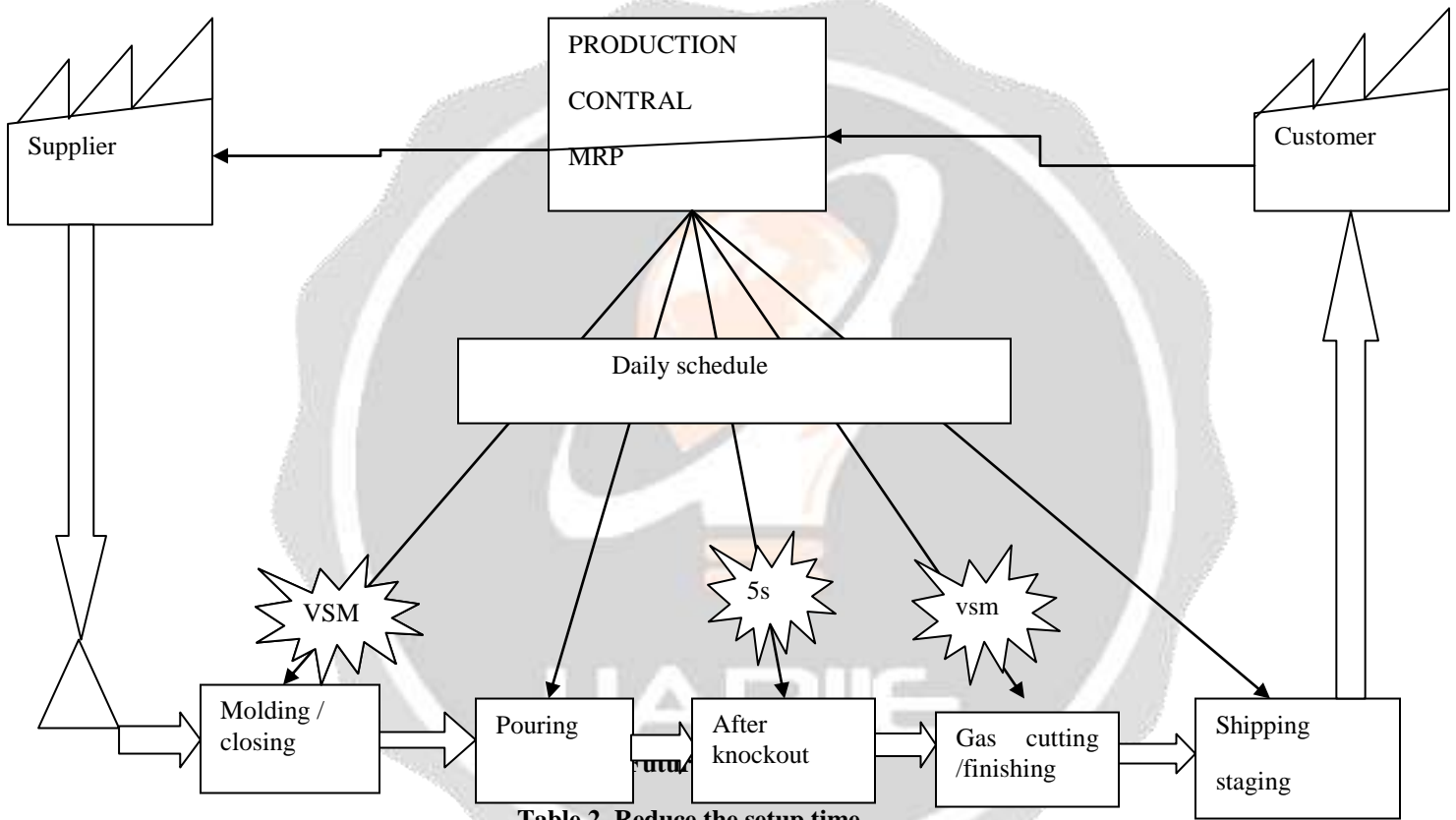
$$= ( \text{Available time} - \text{Change over time} ) / ( \text{Available time} ) \times 100$$

$$= ( 1360 - 50 ) / 1360 \times 100$$

= 96.32%

**5. FUTURE STATE MAP**

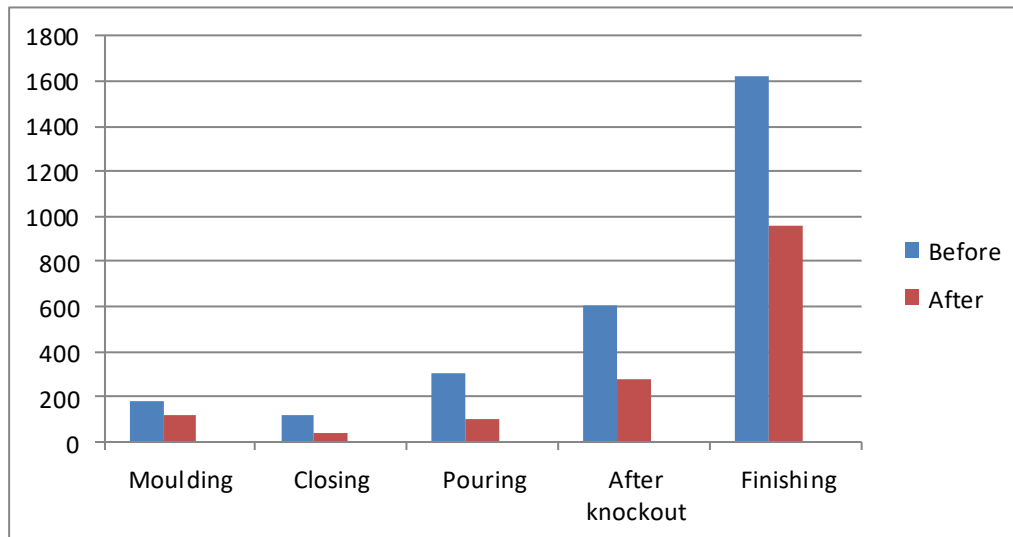
The future state map is draw to give propose suggestions and recommendations for improvement in the current position of the company. Cycle time should be considered a viable option when an organization is trying to improve efficiency , productivity , and cost base and customer responsiveness. Tools of lean manufacturing and line balancing are used to reduce the cycle time in an casting industries plant, which contains many non-value added activities and work. Molding and closing are various time consume. Lean manufacturing apply tool and reduce the time .Pouring in row material are not in near. 5s tool apply and time also reduce. After knockout then cast product remove various waste are also available. There will be clean in daily.



**Table 2. Reduce the setup time**

Process	Change over time (sec)		
	Before	After	Benefits
Moulding	180	120	60
Closing	120	40	80
Pouring	300	100	200

<b>After knockout</b>	<b>600</b>	<b>280</b>	<b>320</b>
<b>Finishing</b>	<b>1620</b>	<b>960</b>	<b>660</b>
<b>Total</b>	<b>2820</b>	<b>1500</b>	<b>1320</b>



**Chart 1. Chart of reduction setup time**

Moulding 60 second , Gas cutting 60 second, and finishing 240 second save time after implementation of lean manufacturing.

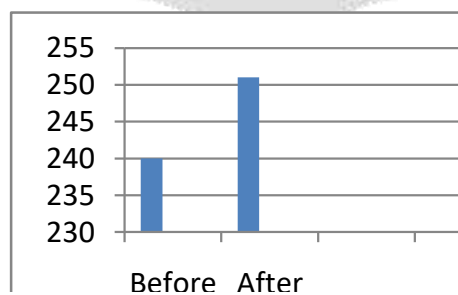
**6.RESULT AND DISCUSSION**

**PER PIECE REDUCTION OF PRODUCT CYCLE TIME**

200 mm valve body is consume 588 min/ piece before implementing value stream mapping and 5s and after reduces the cycle time of valve body per piece is 28 minute

**6.2 PRODUCTION BENEFITS PER MONTH**

It has been observed that before implementation of vsm and 5s company make 240 valve body per month and implementation of vsm and 5s company make 251.38 so that company has benefits of 11.38 valve body per month.



**Chart -2:** Chart of the production benefits per month

- 1) With the implementation super market company save sand mixer and moulding work station . So that company save 60 sec per valve body. So that company save 240 minute per month.
- 2) With the help of marking system company save 1 minute of cutting cycle time reduction per valve body. So that per month 240 minute save cycle of cutting operation.
- 3) After shot blasting valve body are finishing operation grinding are zigzag condition. Implementation of value stream mapping save 4 minute per valve body. So that company save 960 minute per month.
- 4) After reduce setup time company save total 1320 sec or 22 minute. So that company 5,280 minute per month.

So that company save total ( 240+480+960+5,280=6,960) minute per month.

Total cycle time of 200 mm valve body 588 minute. With addition of this result company make ( 6,960/588 ) = 11.83 more valve body per month.

Before implementation of lean manufacturing customer demand per month 300 pcs and company make 240 pcs per month.

After implementation of lean manufacturing company make more 11.83 valve body per month, so that company make 251.83 pcs per month.

The cost of one 200 mm valve body 3,600/- Rs.

So company make earn more ( 3600 x 11.83= 42,588 ) Rs per month.

## 7. CONCLUSIONS

The research is set out to attain the benefits of Value Stream Mapping by applying it to the one of the product line of a MIK PAN ALLOYS. The highest customer demand product line is choose and its analysis is carried out by applying VSM and 5s methodology and calculations. Three valve body are selected. For this 100mm, 200mm, 250mm valve body. From the analysis of current state map the key areas are found where improvement is required. By applying various lean manufacturing tool in product line considerable benefits are achieved. By applying super market in two place of product line considerable benefits are achieved. The benefits are that we reduce the change over time by 1320 second per valve body. Moulding, Gas cutting, Finishing 240 second per valve body .With help of cost benefits analysis we derived that after implementation of lean manufacturing company make more 11.83 valve body per month , so that company make 251.83 pcs per month, that cost of one 200mm valve body 3600 Rs. So company earn more (3600x251.83=42,588 ) Rs per month. Hence, after applying 5's and Value Stream Mapping steps along with lean tool it is concluded that Value Stream Mapping is a powerful lean tool for identifying waste and performance of process and improve the production without any investment.

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