International Journal of Engineering Research and Technology. ISSN 0974-3154 Volume 10, Number 1 (2017)

Application of Value Stream Mapping for Reduction of Bottleneck Operations& Continuous Improvement In Rose Engineered Products Sinnar, Nasik.

Author 1
Surendra U. Suryawanshi
PG student, Department of Industrial & Production Engineering, Vishwakarma Institute of Technology, Bibwewadi, Pune.

Author 2
Vijay K. Itnal
Assistant Professor, Department of Industrial & Production Engineering, Vishwakarma Institute of Technology, Bibwewadi, Pune.

Author 3
Suvarna. V. Patil
Assistant Professor, Department of Industrial & Production Engineering, Vishwakarma Institute of Technology, Bibwewadi, Pune.

Abstract
Nowadays in a competitive market, companies require small lead times, low costs and high customer service levels. As such, companies pay more effort to reduce lead time. Value Stream Mapping (VSM) techniques are used in some big companies like Toyota. Value Stream Mapping (VSM) is the one of the lean manufacturing tool. This paper addresses the implementation of value stream mapping in automotive industry. Value Stream mapping aim is identified waste in terms of non-value added activities. Current State Map is prepared to give details about the existing position and identify various problem areas. Future State Map is made to show the implementation action plan. A case study carried out in ROSE Engineered Product in Sinnar, Nasik.

Keywords:
Value Stream Mapping,Lead time, Lean manufacturing tool.

Introduction
Companies are continually striving to increase productivity and output of their operations [2]. Lean has been originally created and defined as the process of eliminating waste Toyota along with the support a system to reduce or eliminate waste and non-value added activities from the various processes.[4] Value Stream is all the steps, both value added and non-value added required taking a product or service from raw material to the customer. Some examples of value added and non-value added activities are listed below: Value Added activities-molding, welding etc. Non-value added activities - walking, waiting, inspecting, reworking etc.

Value Stream Mapping is visualization and streamlines work processes using the tools and techniques of Lean Manufacturing. VSM help to identify demonstrate and decrease waste in the processes. Waste being any activity that does not add value to the final product. VSM can serve as a blue print for Lean Manufacturing.

Lean Manufacturing is the elimination of **Waste**. It is using resource, without adding value, Waste is all around us, but it can be very hard to see &**V**alue **S**tream **M**aps help us to see/find waste.

A Value stream is all the actions (both value added and non-value added) currently required to bring a product through the main flows essential to every product: the production flows from raw material into the arms of the customer, and the design flows from concept to launch.

It is a visualization tool oriented to the Toyota version of Lean Manufacturing (Toyota Production System). It helps to understand and streamline work processes using the tools and techniques of Lean Manufacturing. It is a means of understanding where you are adding value and how to do so more effectively.

A Process of eliminating the waste. Whenever there is a product or service for customer, there is value stream. Value stream mapping is a pencil and paper tool that helps you to see and understand the flow of material and information as a product makes its way through the value stream. What mean by value stream mapping is simple: follow a product's

production path from customer to supplier, and carefully draw a visual representation of every process in the material and information flow. Then ask a set of questions and draw a "future state map" of how value should flow.

Within the production flow, the movement of material through the factory is the flow that usually comes to mind. But there is another flow – of information – that tells each process what to make or do next. Material and information flow are two sides of the same coin. We have to must map both of them. Value stream mapping helps to visualize more than just single- process level, i.e. assembly, welding, etc. in production. We can see the flow. Value stream mapping helps to see more than waste. Mapping helps to see the sources of waste in value stream. It provides common language for talking about manufacturing processes. It forms the basis of an implementation plan. Design how the whole door - to – door flow should operate- a missing piece in so many lean efforts- value stream maps become a blueprint for lean implementation. it shows the linkage between the information flow and material flow. No other tool does this.

It is much more useful than quantitative tools and layout diagrams that produce a tally of non- value added steps, lead time, distance traveled, the amount of inventory, and so on. Value stream mapping is a qualitative tool by which we can describe in detail how our facility should operate in order to create flow. Numbers are good for creating a sense of urgency or as before/after measures.

Literature review:

The following are the brief review of literatures on lean manufacturing concepts.

1. Manjunath M., Dr. Shiva Prasad H. C. [5] [2014] suggested that Value Stream Mapping is a most important tool for lean manufacturing and allows firms to understand and continuously improve towards lean thinking. It bridges process, tools, people, and even reporting necessities to achieve lean goals. It gives clear and brief communication between shop floor teams and management about lean outlooks, along with actual information and material flow.
2. Praveen Tandon, Dr. Ajay Tiwari, Sunanda Das and Shashikant Tamrakar, [6] [2015] observed that By using value stream mapping we observed that non-value added time is reduce by 25.6%.Also,the WIP is reduced and thereby lead time is reduced by 66.7%.This proves the utility of value stream mapping technique.
3. Deepak Sharma, Alok Khatri and Dr. Y B Mathur, [7] [2016] study result of the case study shows that the waiting time can be reduced from 2 min. to 1.33 min. Thus overall non value added time may be reduced from 14.70 min. to 12.84 min. during Bhujia manufacturing process.

Value Stream Mapping Purpose

Provide optimum value to the customer through a complete value creation process with minimum waste in:

– Design (concept to customer)

– Build (order to delivery)

– Sustain (in-use through life cycle to service)

Value Stream Mapping Steps

- **Current State Map**

1. Document: customer information
2. Map the basic production processes
3. Document: supplier information
4. Document: customer & supplier delivery schedules
5. Map information flow
6. Map material flow
7. Calculate status of current state

Value Stream Mapping is a pictorial tool that incorporates material flow and information flow into a crucial path chart to understand the importance of Value added and Non-value added activities. For drawing current state map the particular product process has to be observed, real time data is to be captured and it should be represented in pictures.

Customer is the most important in any production process. He will be the one who is going to buy the products and based on his demand the company plans for production of the product.

The product must be delivered on time without comprising with quality. For this reason companies use daily demand to calculate the rate at which the product must be produced and it Is known as Takt time:

Takt time =Net available time/Customer demand

- **Future State Map**

1. Produce to your TAKT Time
2. Develop continuous flow
3. Use Supermarkets to control production
4. Try to send the customer schedule to only one production process
5. Level the production volume
6. Level the production mix
7. Develop the ability to make every part every day.

After drawing the current state map, it is the time for team members to evaluate and list all the improvement actions required to draw the Future state. The Future State Map can be designed to monitor the positive changes that are required for the future which shown in below figure.[5]

Major symbols used in Future state map are Kaizen burst and Pull icon. Kaizen burst is used to highlight where the improvement can be done in the processes. Pull system is used to produce what was consumed. After designing the Future State Map it has to be presented to everybody who is involved in the process flow so that it helps in adding some more changes required for improvements in the map.

CASE STUDY:

VSM METHODOLOGY:[1]

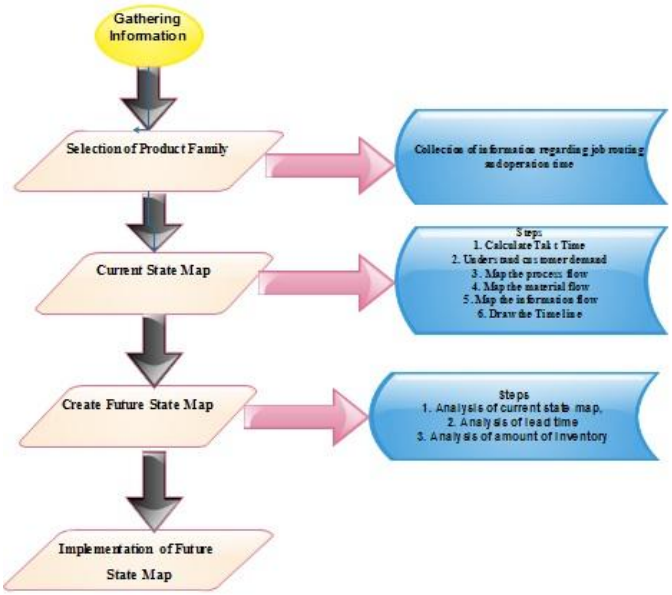


Fig1. VSM Methodology

VSM has four major steps as given by Rather and Shook shown in fig1.

1. Select a product family
2. Draw Current state map
3. Draw future state map
4. Develop work plan for implementation future state.

A case study conducted at sheet metal manufacturing industry and some of the observations may be useful to engineers in implementing VSM in industries.

Gathering Information:

Selection of Product Family

The first step is selection of critical part family. After study of all part families, one part family was selected over all the product families. The HYUNDAI part is selected for improvement & its highly consumable product of the company. Flow process of Hyundai part in company shows in fig2.

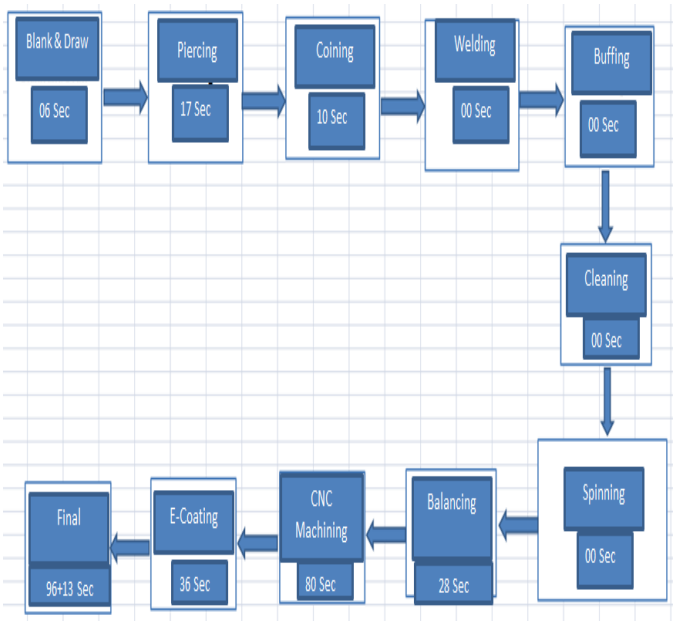


Fig.2 Flow process

Current State Map

Before draw a current state map collect a require data to draw current state map.

Data collecting method: Method that will be used in collecting data needed is observation to the activities that performed in the shop floor. Data is collected by using a stopwatch in Table 1.

Table1: Time matrix for each process

Process Name	Cycle Time (Value Aided)	Operator
1.Blank and Draw	06sec	02
2.Piercing	17 sec	01
3.Coining	10 sec	01
4.Machining	80 sec	02
5. Balancing	28 sec	01
6.E-coating	36 sec	05
7.BSR	96 sec	04
8.Packing	13 sec	01

Mapping the value stream always start with the customer demand.Value stream Map uses special symbols to represent where there is waste in manufacturing process and to find ways to eliminate that waste. VSM symbols are shown as below fig3.:

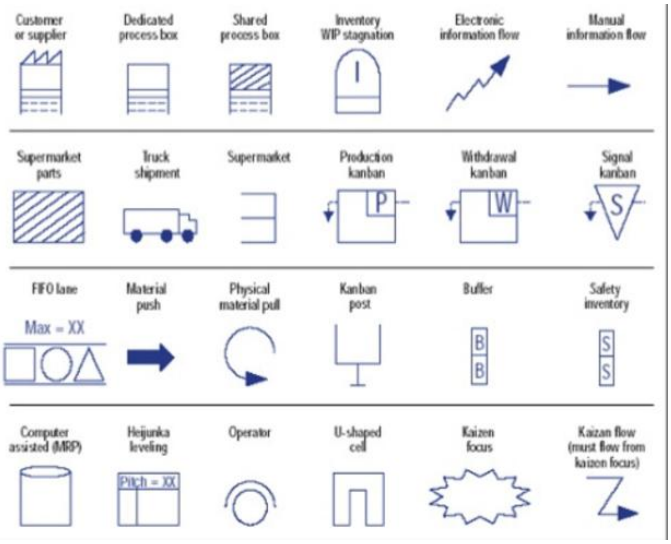


Fig3. VSM symbols

To create a current state map following steps are followed.

Step-1 Calculate Takt Time

Takt time is defined as net available time divided by customer demand.

The net available time is the total operation time during a specific period, meaning the total amount of time, which adds value on value stream. Customer Demand can be determined on customer forecast or based on the currently customer order. [3]

Step-2 Understand customer demand

Customer demand based on monthly or weekly. Customer demand is 35000 units/ month.

Step-3 Map the process flow

This step involves various processes to complete the product. In addition, measure relevant data to put in a value stream mapping box. Moreover, see the WIP between two processes.

Step-4 Map the material flow

The flow of material from raw material to finished goods is given by supplier to customer.

Step-5 Map the information flow

The information flow provided demand information. Information are given by electronic or manually.

Step-6 Draw the Time line

Calculate production lead times for inventory triangles by dividing quantity of inventory by the customer daily requirement.[1]

Current State Map shown in **Fig 4.**

Future State Map

Analyzing the current state map, the lead time and amount of inventory are more between processes.

Future State Map shown in Fig 5.

SOFTWARE USED TO DRAW VSM

E-Draw Max, Version 7 was used to draw all the maps. E-Draw Max is vector-based diagramming software with rich examples. E-Draw Max software is easy to create flow charts, network-diagrams, chart and graphics, value stream mapping, SWOT diagram etc. E-Draw Max includes all the libraries and examples of E-draw product line.

Current State Map:

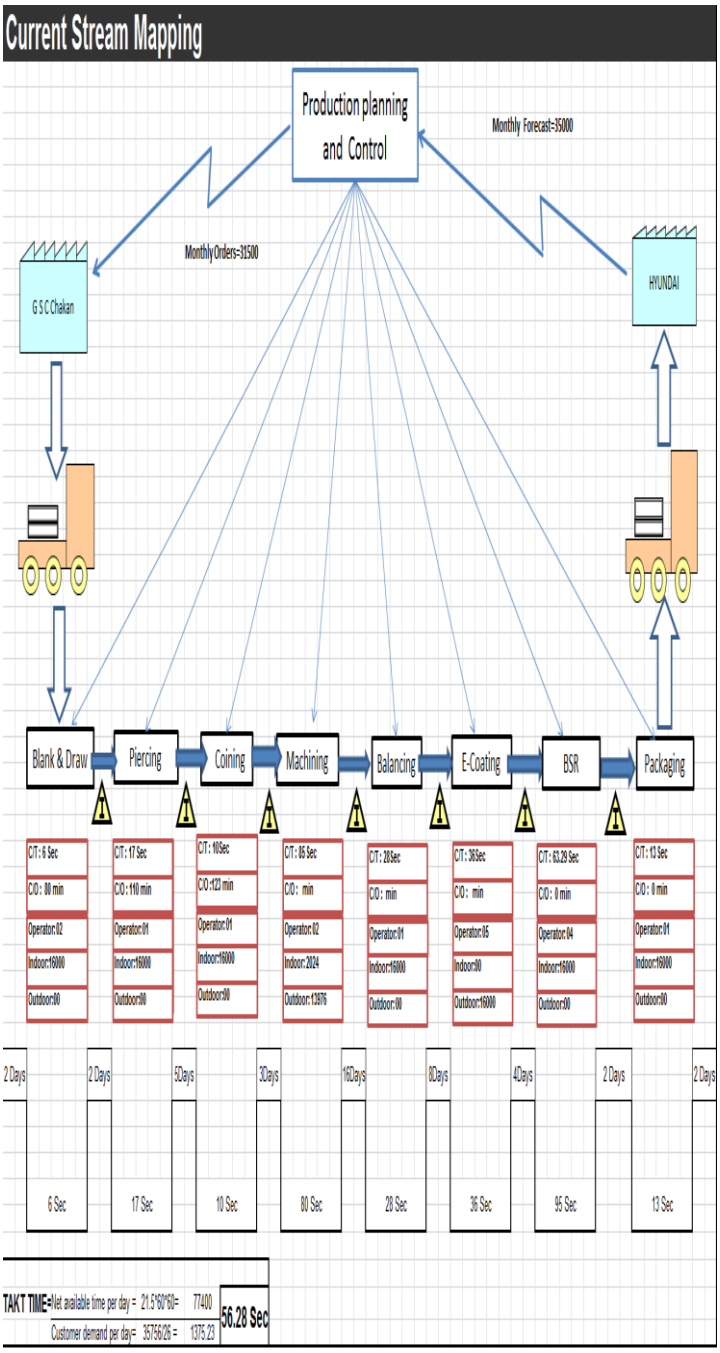


Fig4: Current State Map

Future State Map:

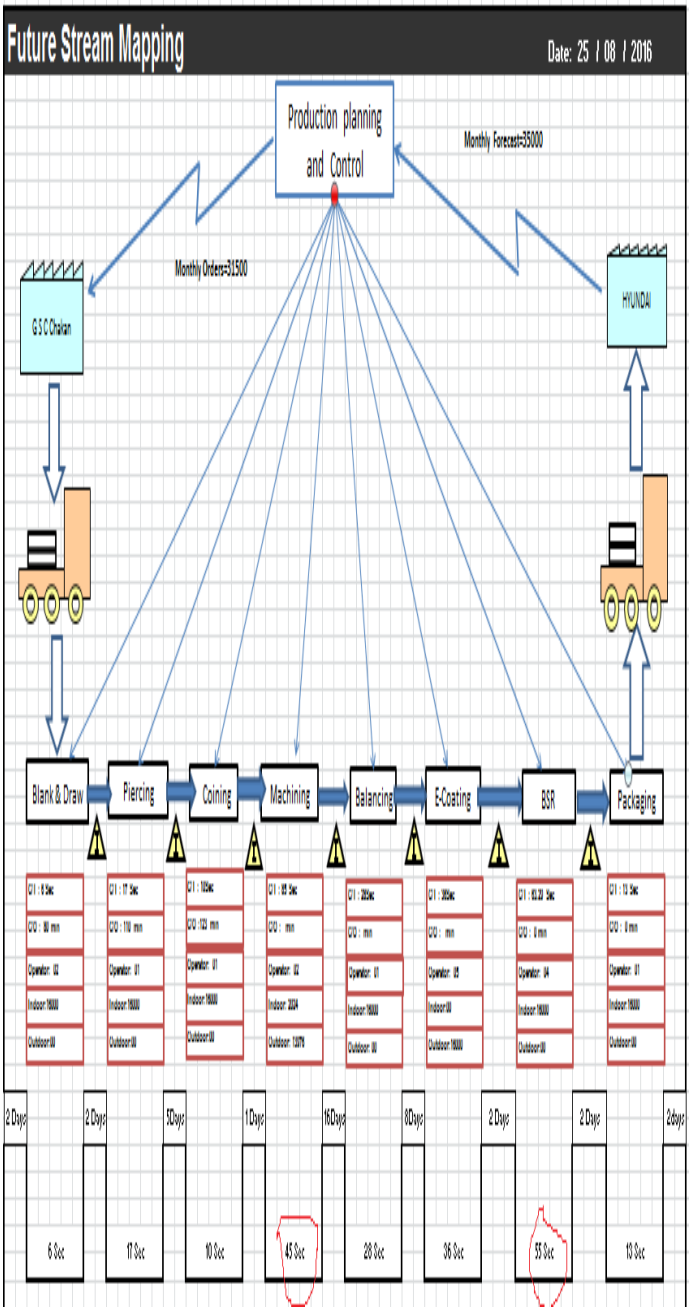
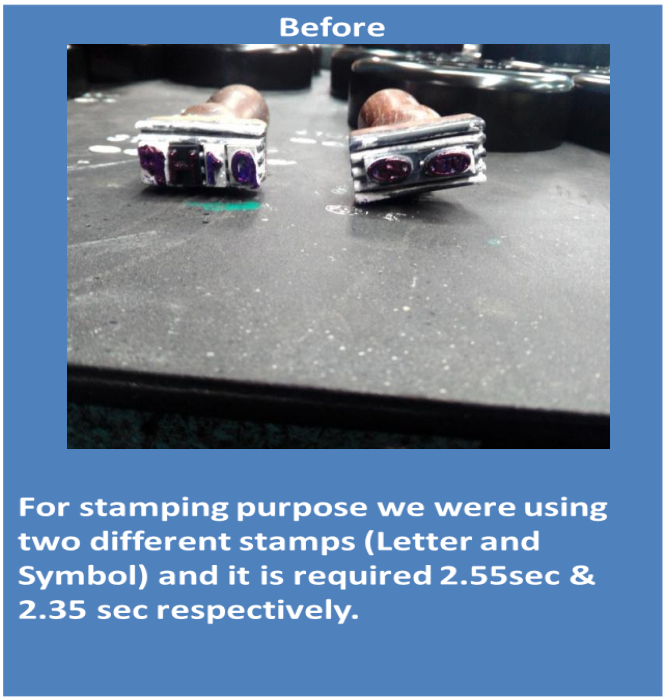


Fig 5:- Future State Map

Improvement in VSM

1. **Stamp Improvement:**



2. **Stamping Pad Improvement:**

Before

We have use this stamping pad for stamping & operator use only one place of this pad and remaining part will be dry after some time.

After

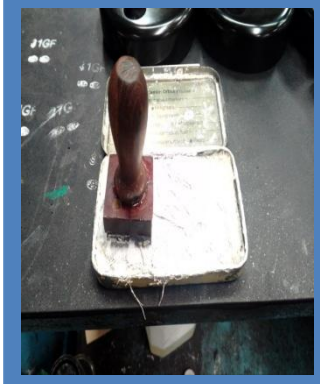


Fig 1

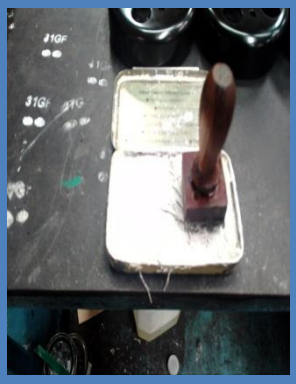


Fig 2

Now we have use this single stamp & its use in two different part of pad as shown in fig 1 & 2.

3. **Stamping Ink Improvement:**

Before

- We used these paint for stamping purpose but its takes longer time for dry.
- This ink required thinner oil for mixing purpose.
- Cost of the Ink is Rs220/year & cost of the thinner oil is Rs2000/year (Total Rs2220/year).

After

- Now Instant dry ink used for stamping purpose and it takes shorter time for dry.
- This instant dry ink not required any type of oil for mixing purpose.
- Cost of this instant dry ink is (Rs525/Litter) Rs1575/year.

4. Printing Ink Improvement:

5. Layout Improvement:

6. Machining Improvement:

The most time consuming process in machining is adjusting part on jaw or job fix on CNC m/c jaw, sometime its takes longer time and sometime its take shorter time for fixing part on jaw.

So we introduce this Poka-Yoke [avoid (yokeru) mistakes (poka)] system to avoid this non value added activities (Bottleneck operation), this improvement shows in bellow figures Fig6 & Fig 7:

Jaw with Locator Pin

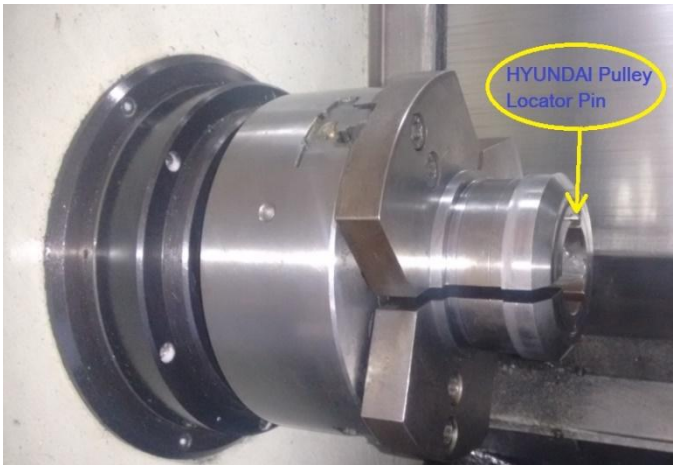


Fig 6. Jaw with Locator Pin

Pulley during clamping

Fig7.Pulley during clamping

RESULT:

Comparison of Current State Map and Future State Map:

Table2: Before after comparison of VSM.

Variable	Before	After	Improvement (%)
Lead Time	1.3Days 2.4Days	1.1Days 2.2Days	1.66.67 2.50.00
Cycle Time(NVA) Sec	1.80 2.96	1.45 2.55	1.43.75 2.47.67

CONCLUSION:

By using value stream mapping we observed that non-value added time is reduce by 1.43.75%& 2.47.67%.Also, the WIP is reduced and thereby lead time is reduced by 66.67% & 50.00%.This proves the utility of value stream mapping technique.

References:

[1]. Rother M., J.Shook, "Learning to see", Lean Enterprise Institute, 1999

[2].Juan C Tinoco [2004] "Implementation of Lean Manufacturing"

[3]. Emil suciu, Mihal, Arvinte value stream mapping-A lean p1roduction methodology, 2011

[4]. G.Saranya, Mr.S.B.Nithyananth, "Improvement of crankshaft assembly supply chain using lean techniques", IJMER, Apr-2012, pp-403-406

[5]. Manjunath M., Dr. Shiva Prasad H. C., 'Value Stream Mapping: A Lean Tool',(ISSN 2321 – 8916) April 2014.

[6]. Praveen Tandon, Dr. Ajay Tiwari, Sunanda Das and Shashikant Tamrakar, 'Complimentary the Lean Manufacturing in Foundries by Including the Value Stream Mapping to Improve The Production of Cast Steel.', November 2015.

[7]. Deepak Sharma, Alok Khatri and Dr. Y B Mathur, "Application of Value Stream Mapping in Bhujia Manufacturing", November–December 2016, pp.443–448, Article ID: IJMET_07_06_043.