

Application of Value Stream Mapping and 5S for Redraw Machine in Pump Industry

Mr.A.Karthy¹, D.Navaneetha krishnan², R.S.Navin², E.Panneerselvam², A.Tamilvanan²

¹Assistant Professor,²UG Students

¹Assistant Professor , Nandha Engineering College,
Erode-52, Tamilnadu, India.,
Students of Mechanical Engineering,
Nandha Engineering College, Erode-52,
Tamilnadu, India.

Abstract—This paper deals the methods and techniques of lean concept used to reduce the time and make the production flow smooth. The lean tool and the 5S technique is applied in manufacturing plant. The problem in the manufacturing plant has lack of standardization during the machine setup, improper scheduling, irregular arrangements of components etc., To reduce these problems the Value Stream Mapping tool is applied to identified the waste in terms of non value added activities. Current state map is prepared to give detail about the existing position and identify various problem areas. Future state map is made to show the implementation action plan.

Key Words – Vsm, 5s, Productivity Increase, Time Reduce.

I. INTRODUCTION

The motors and pumps are like a device that vary from fluid machinery to supply the water to an suitable area to required working process. Their use consists in delivering pressurized air to pump at quantity of fluid to flow at controlled location. The different processes such as mechanical and industrial application (e.g.,machinery) casting, winding, impeller several materials are used to create the pieces of metals, cast iron, steel, titanium(welded), brass, copper(winding) in manufacturing plant.

The manufacturing plant will consists of some operation to create a product or component turning, drilling, boring, pressing, punching, threading and winding.

Every process has a specific sequence to flow at different machines for each operation. Our aim is to improve the flow of material in process line specifically the pressing and turning to finish the bracket to the next process will carry out the pressing to fix bush to speed the process and improve the delivery time of the orders and to increase the productivity of this process.

The main purpose of this project is to come up with feasible solution that will allow the employees to setup the redraw machine in less time as well as reduce the lead time of the final products. Mapping to analyze the time duration and production flow smooth.

A. Lean principles:

The lean principle is approach with manufacturing industries it can be equaled applicable to all service and administration processes.

It's not the new phenomenon Japanese auto manufacturers have been developing lean for 50 years. Lean principle is focus on 5s principle of lean.

B. Lean tools:

The basic purpose of lean manufacturing is to produce the product with minimum waste, time and continuous improvement of all process and activity operated in any form of work.

For the following are key elements which are used as lean tools are:

1. 5S
2. Value Stream Mapping
3. Just in time
4. Kaizen
5. Visual management
6. Andon
7. Gemba
8. Total productive maintenance
9. Takttime
10. Single Minute Exchange of Die (SMED)
11. Cellular Layout (flexible operation)
12. Supply Chain Management (SCM)

[1]5S

As pointed out, lean production is based on a constant search for losses and its elimination. Value is defined from the customer's point of view. Therefore, all the methods and techniques of lean production aimed at the removal of various types of losses. Some of the key lean tools are just in time, kanban, kaizen, but this paper will focus on the analysis of the 5S system.

5S - a set of rules for organizing the work of each worker. The goal is that every job is organized in such a way so as to be maximally effective and speed up the work of the employee. Since the "lean" originated from Japan, five words in the letter S coming from the Japanese language and they are: "Seiri" - sort, "Seiso" - set in order, "Seiton" - shine, "Seiketsu" - standardized, "Shitsuke" - sustain.

1. Sort - Sort and distribute tools. Sort by the tools that are frequently used are placed within easy reach, and those that are not used often.
2. Set in order - Set in order things that are important to them is easy access. The goal is to minimize the number of moves that a worker has to perform during operation.
3. Shine - To minimize problems with dirt, it is necessary to regularly cleaning machines and jobs. In some industrial processes, dust is one of the causes of bad products or contaminations were inflicted color. To help identify dust lean factory floors, often painted in bright colors and enhance the light sources within the plant.
4. Standardize - previous rules (sort, set in order and shine) should be standardized and printed procedures. There is a need after some period to choose the best ways to practice sort, set in order and cleaning and abide by them.
5. Sustain - Maintain 5S culture among employees. Maintain training and make the 5S becomes part of the corporate identity.

[2]Value Stream Mapping [VSM]

A value stream is the tool of activities running from raw material to finished component for a specific component. Value stream maps are powerful visual tool used to identify and understand the flow of raw material and information. Value stream maps show many actions are required to deliver a product.

All of the actions and tasks are both value added and non value added is required to bring an item an idea, information, product, or service from its delivery.

Value added activity that transforms or shapes raw material or information to meet costumer requirement.

Non value add those activities that TAKT time resources or space but do not add to the value of the product itself.

II. LITERATURE REVIEW

The applied lean manufacturing, 5S and Value Stream Mapping for the improvement of work organization at the motor and pump industry. The lean 5s method has been applied to production, quality control, purchasing, warehouse, human resources and quality assurance the result shows that these methods allowed improving the process and working conditions from a quality perspective, the staff satisfaction And the efficiency.

[1]. Y. Guan and H.Liao used Application of Lean and 5S for redraw machine in Bellow industry. Lack of machine setup, improper scheduling, irregular arrangement. The several problems prevent this as a part of the program to make it as a fast and leaner.

[2]. Rajan suri done QRM and POLCA as lean tool by applied in manufacturing enterprises in the 21st century. Strategies of flow, tact time and pull. In the journal this QRM is used to lead time reduction. The product delivery with short lead time.

[3]. Bong cheng siong , Chong kuan eng do an work at A framework for implementing quick response manufacturing system in the job shop environment. It will demand in better quality, low cost and fast delivery, and all resource constraints like small and medium companies to meet the

expectations. By this the QRM to maximize the potential improvement.

[4]. N. S. Jagtap, V. D. Ugale, M. M. Kadam Single minute exchange die (SMED). It is one of the most effective methods in the lean manufacturing to reduce the waste in the respected companies, were studying methods for a reduction on changeover techniques. Significant losses in equipment setup or a tooling change over, replacing the existing machine.

[5]. Yashwant R. Mali, Dr. K .H. Inamdar Changeover time reduction using SMED technique of lean manufacturing. The term refers that the theory and technique for an performance setup operation in less than ten minute. In long running process the high variety product manufacturing changeover time plays a very important thing and part of the maximizing the capacity of a components. We can able to face changing market demands and global competition.

[6]. S. Palanisamy, Salman Siddiqui prepared Changeover Time Reduction and Productivity Improvement by Integrating Conventional SMED Method with Implementation of MES for Better Production Planning and Control. The main work in content is to complete the high delivery time in the short lead time and high delivery reliability. To overcome this problem is to produce small lot size in most economic and efficient way.

[7]. Septika Rosiana Dewi, Budi Setiawan and Susatyo Nugroho W P, used 5S program to reduce change-over time on forming department (case study on cv piranti works temanggung) . From the analysis the team has found an major casue of the problem is the high length of the time required for changeover. They designed a work environment using 5s method to reduce and eliminate the non value added time.

[8]. Ferradás, Konstantinos Salonti is Improving changeover time: a tailored SMED approach for welding cells by Pablo Guzmán. Set up reduction, lot size. 33% reduction of the changeover time could increase more than 35% could be achieved in the process of welding cell the SMED technique is used to lead the time.

[9]. Arun Abraham, Ganapathi K. N, Kailash Motwani used the SMED method to work at the stamping production line. Setup Time Reduction through SMED Technique in a Stamping Production Line. The operation is to reduce the change over times, creating flow in manufacturing, production based on demand, reducing capital investment. The main objective is to reduce the set up time from 7 hours to 2 hours and improve the productivity.

[10]. Patel Chintan Kumar A perfect way for productivity improvement of computer numerical control (CNC) set up in manufacturing company. In the CNC the waste of time is ideal. Productivity improvement of Computer Numerical Control (CNC) set up. Similarly this type of Set up Reduction technique also applies to other machines of all manufacturing companies for achieving higher productivity.

[11]. Samson Mhlanga, Alphonse Marecha Use of the Value Stream Mapping tool for waste reduction in manufacturing. Case study for bread manufacturing in zimbabwe.. The case study shows how the VSM tool was

used to identify and reduce defects by 20%, unnecessary inventory by 18% and motion by 37%. The mapping will help to analyze the production values.

[12]. Palak P. Sheth, Vivek A. Deshpande, Hiren R. Kardani Value Stream Mapping: a case study of automotive industry.. 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. Value Stream Mapping aim is to identify 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.

[13]. Marko Milosevic, Petar Todorovic, Ivan Macuzic, Marko dapan. Implementation of the 5S system as a factor for improving the quality management. To increase the efficiency of all process in the company by using 5S system, Lean, Production.

III. PROBLEM IDENTIFICATION

There is no standardization in the setup process of machine sequence for the required operation done on the respected area.

In the manufacturing area the finished products are not arranged in a proper way. It is arranged in the floor like an waste material.

In the CNC machines the required level of coolant for the given operation is not produced so it will cause some damages in tool and components.

IV. OBJECTIVE

The setup process flow of a product is not standardization

For that operation should carry out the process to analyze in Value Stream Mapping to reduce the travelling time from one machine to another machine in the basic operation carried in an industry.

In the manufacturing field the completed components are not assembled as a line it's like a scrap so we implemented the 5S system to keep like a process clean and assemble like an step by step component arrangements. By this it will reduce some small damages in completed products.

In the CNC machine the required coolant is not correctly provided for the required operation by this components will causes some damage for this an scheduled maintenance is planned.

V. METHODOLOGY

The application of a lean and 5s technique to redraw machine set up for its required time and productivity.

The methodology will provide some steps to control the operation has going on the respected manufacturing area.

In a manufacturing field the problem must be identified and collect some journal related to the problem which we identified.

Then created a cad drawing and create the Value Stream Mapping for the current state VSM in the manufacturing field. Then create the future solution of the operation and get the values as positive.

The created an Value Stream Mapping to analyze the waste of time and time travel will reduce through the map

at an values provided like cycle time, value added time, non value added time and defects are applied to create the work operation.

In this methodology the 5s also implemented and rearranged to the respective places to neat arrangement. The VSM at future state mapping is also provided at the bellow of a paper presented.

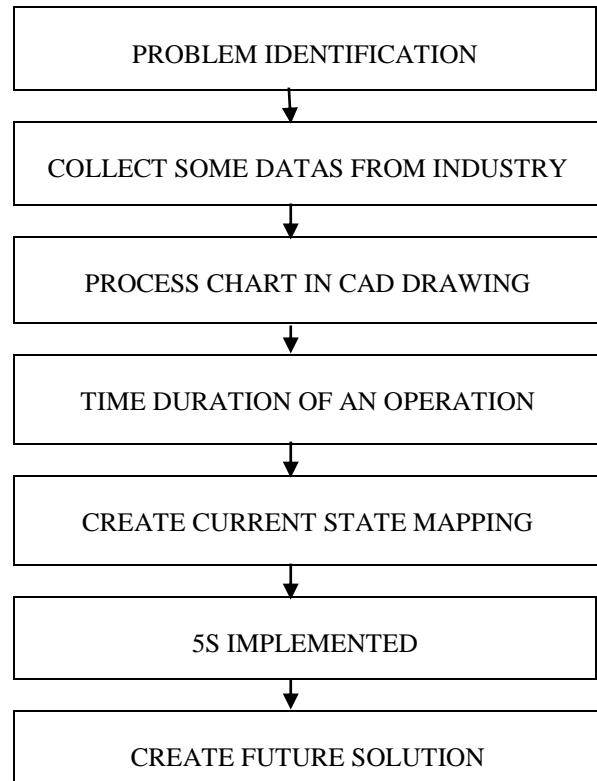


Fig.1.Methodology

VI. PROCESS CHART IN CAD DRAWING

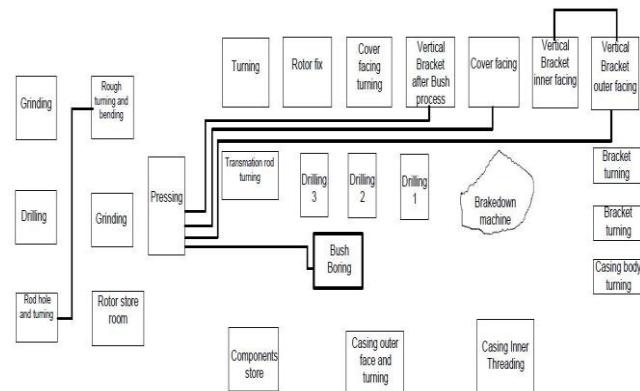


Fig.2.Current layout of CAD Drawing

A. Current process chart in company

The current process chart in CAD drawing at full flow process chart at the required industry.

The main operation like vertical bracket inner and outer facing operation is mentioned to modify as easy to the pressing operation will reduce the traveling time and lead time.

The cover facing is the one of the operation in a process chart to fix the nylon bush at center of a cover it will take some time is shown bellow. Then it will move through boring operation for the bush.

B. Time duration of current process

VERTICAL BRACKET (OUTER FACE):

Operation	-140 sec
Fixing	-20 sec
Travel time	-5 min

VERTICAL BRACKET (INNER FACE):

Operation 1st	-240 sec
Fixing	-20 sec
Travel time	-4 min

HYDRAULIC PRESSING:

Operation	- 2 min
Fix	- 6 min
Travel time	- 6 min

VERTICAL BRACKET AFTER BUSH (FINISHING):

Operation	- 120 sec
Fixing	-18 sec
Travel time	- 4 min

COVER (FACEING AND BUSH):

Operation	- 1 min
Fixing	-20 sec
Travel time	-3 min

HYDRAULIC PRESSING:

Operation	-2 min
Fix	-6 min
Travel time	- 4 min

BUSH BORING:

Operation	- 120 sec
Fix	-4 min
Travel time	- 3 min

C. Modified process chart

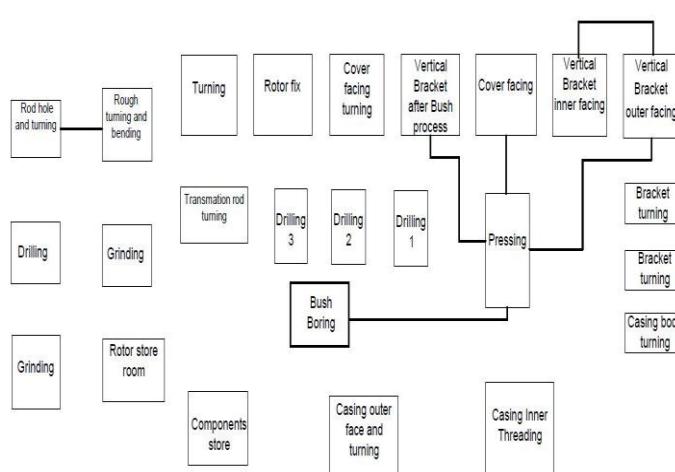


Fig.3.Modified layout of CAD Drawing

The modified process chart to reduce the distance from one machine to another machine which takes time to travel to the other process or operation.

For this problem we modified like the chart as gives lead time increases and productivity also increase through this pressing machine.

D. Time duration of current process

VERTICAL BRACKET (OUTER FACE):

Operation	-125 sec
Fixing	-20 sec
Travel time	-2 min

VERTICAL BRACKET (INNER FACE):

Operation 1st	-230 sec
Fixing	-20 sec
Travel time	-1 min

HYDRAULIC PRESSING:

Operation	- 2 min
Fix	- 6 min
Travel time	- 2 min

VERTICAL BRACKET AFTER BUSH (FINISHING):

Operation	- 108 sec
Fixing	-18 sec
Travel time	- 2 min

COVER (FACEING AND BUSH):

Operation	- 50 sec
Fixing	-20 sec
Travel time	- 2 min

HYDRAULIC PRESSING:

Operation	-2 min
Fix	-6 min
Travel time	- 2 min

BUSH BORING:

Operation	- 120 sec
Fix	-4 min
Travel time	- 3 min

VII. WORK FLOW PROCESS

A. VSM (Value Stream Mapping)

Value Stream Mapping came in an existence after the success of the TOYOTO Company in Japan since 1980. It was developed by Toyota Company between 1960 and 1970. It is an lean manufacturing technique used to document, analyze, and improve the flow of information or components required to produce a product or service for the required customer. At the beginning VSM is being used as a re-engineer business for identify some unwanted work and resource are used for the process of an operation to complete the cycle. It will contains the two Value Stream Mapping are current state map and future state map.

B. Current State Map

The current state map is shown of how the process is currently done by the respected industry. This is the current state mapping of the company which will take work as scheduled it is created from Value Stream Mapping (VSM) the principle of working is equal. It shows the current process methodology of an producing components are perform service for the customers.

This company contains many operation in this we taken only the pressing operation is applied in the required components are Vertical Bracket and Cover are the main product to do next operation in Hydraulic pressing machine to fix the Nylon bush.

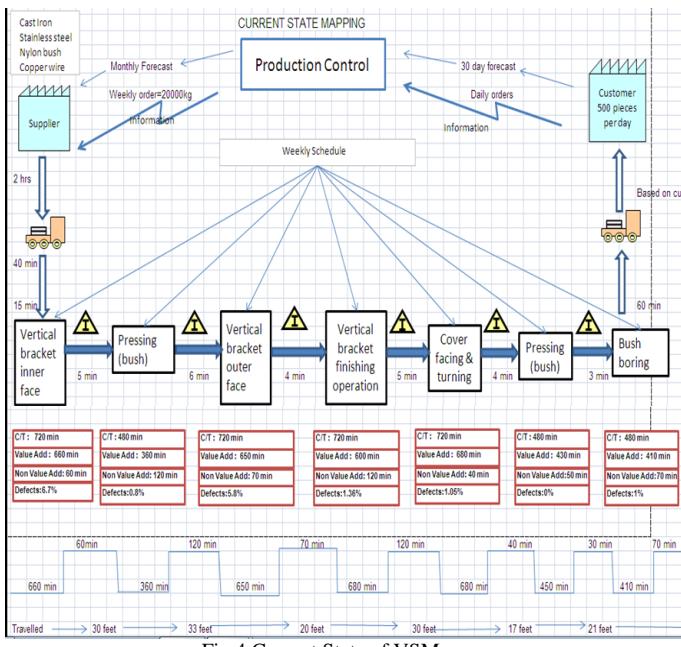


Fig.6. After 5S process

We can identify the process of industry in each section in cycle time, lead time, value added time, non value added time and travelled time and calculate distance in feet. We can analyze the all section by using current state mapping in VSM after that it will shows the overall value in map.

In this we implemented the 5S to reduce the defects in the components arrangement.

C. 5S Implemented

In the 5S process the company and product will developed in flow of manufacturing. The set in order is implemented to keep the completed products in neat arrangements. If the product are not arranged through set in order it will causes some damages in finished components. We shown the implemented photos.



Fig.5. Before 5S process

D. Future state map

Future state map in visual tools that shown below as Value Stream Mapping (VSM). The improvement has been implemented in VSM.

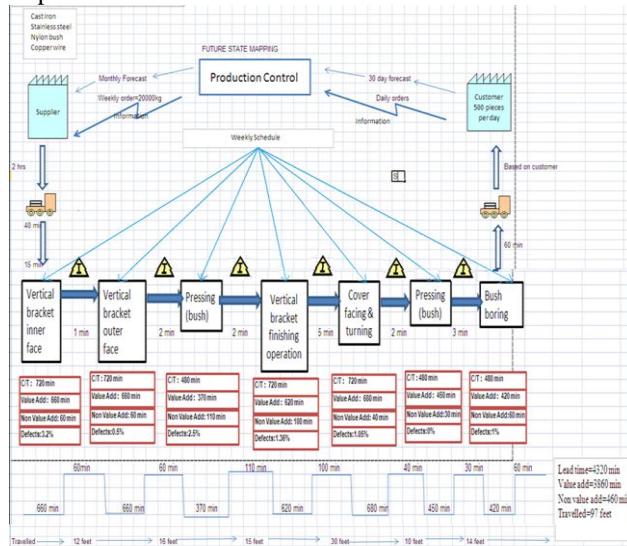


Fig.7. Future State of VSM

The current state map shows the existing process which can analyze the work flow process in current state production. After gathering this knowledge the future state map is developed and created.

During this stage of process, the nature of the customer demand namely quantity, quality, lead time, cycle time, transportation and defects are determined.

In future state map the pressing machine is replaced, so the travelling time is reduced and non-value added activity also decreased.

VIII. COMPARISON OF CURRENT STATE MAP AND FUTURE STATE MAP

Variable	Before	After	Improvement
Value added time(min)	3810	3860	50 (min)
Non-value added time(min)	510	460	50 (min)
Distance(feet)	125	97	28

Table.1.Comparision of Current and Future Value

IX. CONCLUSION

Thus the purpose of this study was to investigate and compare the impact of lean manufacturing concept in pump industry. The 5S is implemented in the company and proved the implementation. In Value Stream Mapping has created and proved to be the effective way to analyze the industries current production state map and controlled to reduce the distance. The visual nature of VSM is done by combining information and material flow on the map. In this we reduced non-value added activity by the travelling time for each operation is controlled through VSM mapping. By using Value Stream Mapping we analyzed that non-value added time is reduced by 10% and value added time is increased by 10%, Also the distance of machine set up is reduced for 17%. This proves the utility of VSM.

REFERENCES

- [1] Y. Guan and H. Liao, eds Application of lean and 5s for redraw machine in bellow industries: a case study 2014 Industrial and Systems Engineering Research Conference.
- [2] Marko Milosevic, Petar Todorovic, Ivan Macuzic, Marko dapan Implementation of the 5s system as a factor for improving the quality management 7th International Quality Conference May 24th 2013.
- [3] Rajan Suri QRM and POLCA: A Winning Combination for Manufacturing Enterprises in the 21st Century Director Center for Quick Response Manufacturing.
- [4] Bong Cheng Siong, Chong Kuan Eng A framework for implementing quick response manufacturing system in the job shop environment jan2014
- [5] N.S.Jagtap V.D.Ugale Setup time reduction of machine using SMED technique and lean manufacturing, International jorunals of the advance production issue 2-2015.
- [6] Dr.K.H.Inamdar Yashwant R.Mali Changeover time reduction using SMED technique of lean manufaturing, International journal of engineering research and applications issue 3, may-june 2012.
- [7] Patel chitan kumar A perfect way for productivity improvement CNC setup in manufacturing company. Journal of mechanical engineering research August 2012.
- [8] Pablo gugman ferradas, Konstantiro, salonitis Improving change over time a toilerd SMED approach for welding cells, CRIP conference on manufacturing system 2013.
- [9] Arun abraham, Ganapathi K.N Setup time reduction through SMED technique in stamping production line, SASTECH journal Sep 2012.
- [10] S.Palanisamy, salman siddiqui Change over time reduction and productivity improvement by integrating conventional SMED method with implementation of MES for production planning, International journal of innovative research in science engineering and technology, Dec 2013.
- [11] Septika rosiana dewi, Budi setiawan, 5S program to reduce change over time on forming department case study on CV piranti work temanggung, IOP conference series in material science and engineering 2013.
- [12] William M.Goriwond, Samsom Mhlanga, Alphone marecha is created use of the value stream mapping tool for waste reduction in manufacturing case study for bread manufacturing. Proceeding 2011 International Conference on industrial engineering and operation management Jan 2011.
- [13] Palek P.Sheth, Vivek A.Deshpande, Hiren R.Kardani take value stream mapping: A case study of automotive industry submitted International Journal of research in engineering and technology Jan 2014.