

Value Stream Mapping – Demonstration of Lean Tool to Save Cost in a Small Scale Industry

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Abstract - Value Stream Mapping is a lean tool which is easy for visualizing the production process in the organisation, it helps in identifying and reducing of nonvalue-added time. it shows the both material and information flow across the manufacturing line. The case study was carried out at Relic Industries, Bangalore, the manufacturers of watch cases for Titan-3039 model. In this case study objective was to explore VSM for its usage in a small-scale industry to demonstrate the cost saving by using lean tools. The tools used to collect data were Gemba and interview of the process owners. The data revealed that, there was a need for elimination of large amount of NVA time. The proposed VSM reduced the cycle time from 33.65 to 6.6 days. The production efficiency was increased from 0.86% to 7.983%.

Keywords: Lean tools, VSM, Gemba, Process

1. INTRODUCTION

Whether a small scale or a large-scale manufacturing industry, lean manufacturing is an imperative concept for the continuous improvement of the organizational performance and also to increase the cost effectiveness to achieve business competitiveness. Many tools of lean manufacturing has been adopted by most of the large-scale Indian manufacturing industries, but very few Indian small scale manufacturing industries have adopted lean manufacturing, though most of them have ISO 9001 certification. In this study a small scale industry Relic Industry located at electronic city Bangalore was picked for implementing the lean tool as an social outreach program from academicians. This case study aims at implementing a VSM for Relic Industry located at electronic city Bangalore. Relic industries are watch case manufacturing industry, supplying to Fastrack, Titan, Timex, Sonata and Fossil.

A case study on “Application of VSM in automotive industry” explained about the four major steps for general VSM that was given by Rother and Shook. The case study was conducted in CAPARO LIMITED situated at Bawal, India where they have focused on improving the production rate [1]. VSM is a qualitative tool that is supposed to give an understanding of the value chain as a basis for reducing pipeline of inventory and time compress the through line [2]. Anand Sasikumar et. al, (2013) in their work have briefed about the steps involved in VSM process, case study for analysing current state VSM and future state VSM, also calculated the takt time, process time, product efficiency etc. [3]. The economic impact of time improvements using process cycle time evaluation. Also, they have improved the

VSM using up initiatives as it eliminates the non-value-added time and increases the productivity of D45T [4]. VSM was used effectively to reduce the patient waiting time and the also to increase the patient throughput [5]. The case study of a steel pipe manufactures concluded that VSM is a popular easy tool for visualizing production processes in enterprise [6]. There are many faced by an organization due to increased changes in the business environment. The importance of value-added time to attain the perfection through implementing lean technology cannot be overlooked. [7]. The effect of the three main contextual factors i.e, plant size, plant age and unionized status for the implementation of lean management for 22 manufacturing practices and implementation of inter related practices like just in time, total quality management, total preventive maintenance and human resource management have been studied [8]. The application of lean tools and VSM in a sterilisation unit of hospital so as to decrease lead time, inventory levels and also eliminate the waste to improve the skills of management of public services [9]. The increase in high quality and low cost to meet the customer satisfaction by implementing feasible kaizen in an auto-ancillary industry [10]. The application of VSM in health care sector have focused on sustainability indicators [11]. The application of lean management to a small scale industry i.e. a plastic bag manufacturing unit, could demonstrate the good results through VSM which might be very useful for different small scale industry [12]. The authors have conducted the present case study to investigate the application of a VSM for a small scale industry in Bangalore.

1.1 Process at Relic industries:

The processes involved in the manufacturing of watch case are press shop, turning, drilling, milling, polishing, plating and assembly. And inspection department is classified into Stage QC and Final QC. Stage QC inspect the workpiece at every department whereas Final QC inspect the final assembly. The study is carried out for manufacturing of titan 3039 model.

In the manufacturing of Brass watch case involves different department from procuring raw materials to final product ready for dispatch, as we have already mentioned the departments involved , we will directly enter into actual manufacturing process . Firstly, they get order from titan for a model Titan 3039 with monthly forecast, along with master drawing from the company for model. Raw material required for the production i.e Brass rods is delivered from the

Gujarat 30 days prior the actual production starts, once the Brass rods are delivered to the company. Inspection and testing team tests the Brass rods by testing the few billets. The work was carried out on the order of 1000 pieces and considered one time production flow. Brass rods are converted into billets of diameter of 33mm by using cutting machine.

Press shop includes the two processes:

Hot forging and Trimming: At the hot forging process the billet is heated and forged into the required shape by pre designed die mould, Removal of the excess material formed is removed by trimming process it takes about 10sec for hot forging and about 15 sec for trimming process and it takes 10 of lead time between the forging and trimming

Turning department:

This department involves bottom and top turning. Both top and bottom turning carried out with two different machines placed at the different location inside the manufacturing layout. First bottom turning process is carried out it takes about 20 second of value added time. After bottom turning work piece are moved to top turning it also have 20sec of value added time. In each process about 0.52% of the pieces are used in the machine setup. After turning pieces are sent to drilling department which is next to turning department

Drilling department:

This process involves the drilling of stem hole and spring holes to the model. Drilling of stem hole and spring hole requires 20 seconds for a model, rejection is 0.5%. After drilling work pieces are sent to polishing process it takes about 15min of lead time between drilling and polishing department.

Polishing department:

Polishing unit comprises of 3 steps - rough polishing, Diamond cutting and final polishing. first they carried out a rough polishing using different type of materials it takes about 85 sec of value added time. then workpiece is sent to diamond cutting which is placed at the different unit. It takes about 20 sec of value-added time for diamond cutting on the top of the watch case center. Last process is final polishing it involves sand bursting and final buffing takes about 15sec of value-added time. It takes about 15 min of lead time for workpiece movement between the process. After polishing 100% of workpieces are tested, about 20% of total work pieces are get rejected.

Plating department:

The plating process was carried out a different location, so the models have a travel time of 2.30 hours and the actual plating process with the required colours required 3.30 hours, total time required for the complete process is 6 hours. The rejection rate is around 5%.

Assembly department in the assembly case centre is assembled with the components such as mineral glass, MG Gasket, back cover, ORring, Case pipe, Crown and Moment holder. The assembled case is sent for Water resistant test, then the cases are packed and dispatched.

The tool Value Stream Mapping (VSM) was used to demonstrate the cycle time reduction and efficiency increase. Identified the various muda's and started eliminating them. VSM was drawn for current as well as for the proposed state. Monitoring the proposed state is done for continuous improvement of proposed state VSM.

Steps used in VSM for drawing current state and proposed state:

- Gathering of all the information.
- Study of lead time and cycle time for analysing purpose.
- Drawing Current state map.
- Identifying the problems by analysing the current state.
- Drawing the Proposed state map by referring current state mapping.
- Finally analysing the continual improvement.

2 VSM before implementation of lean principles:

Terms used: BS: Batch size, PW: People working, VAT: Value added time, NVAT: Non Value added time, TT: Total Time, ST: Machine setup time, Y%: yield percent, R%: Rejection percentage, Takt time, Total lead time.

Product cycle efficiency = Value Added Time / Production Lead Time

$$=22504.8/2613610$$

$$=0.86\%$$

this means in the total time less amount of time is utilized for conversion of raw material into the finished product.

Takt time =total time/daily customer demand

$$=21*60*60/ 2000$$

$$=37.8\text{sec.}$$

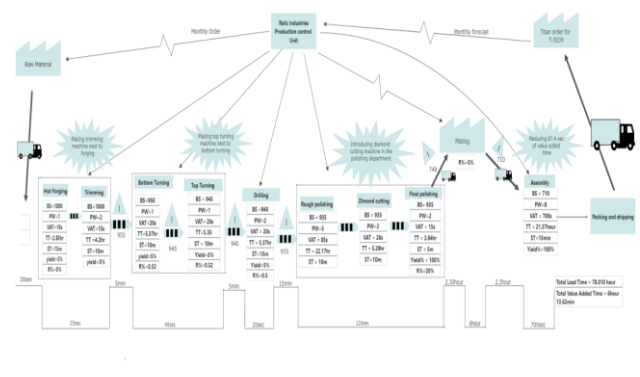
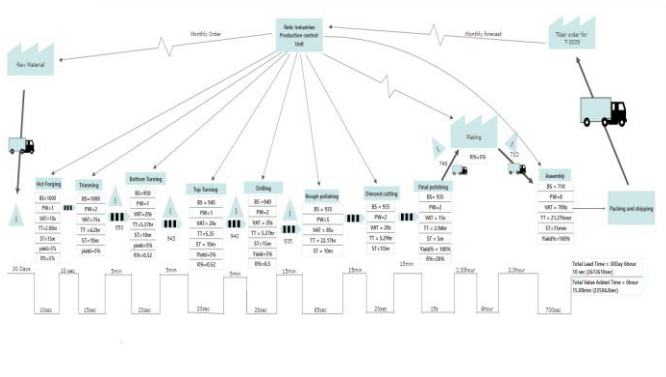
this means we need to complete the work within this time in each department then only we are able to meet the actual customers demand

Cycle time =Working period + Break period

$$=81.79+726.010$$

$$=807.8 \text{ hour}$$

$$=33.65\text{days}$$



2. VSM after implementation of lean principles:

To draw the proposed value stream mapping the following points were considered:

- To develop the new layout for the proper material flow
- To bring the raw material at the point of usage
- Line balancing in order to produce the product with in the takt time
- To eliminate the non-value-added activities to improve cycle time

Calculations of Proposed VSM:

1.Number of operators required = Total processing time/takt time

$$= 905 / 37.8$$

$$= 23.94 \text{ i.e., approximately } 24$$

workers required

2.Proposed cycle time = 90%of Takt time

$$= 0.9 * 37.8$$

$$= 34.065 \text{ sec}$$

3.Total work content with proposed cycle time with 24 workers = 24*34.06 = 817.56 sec

4.Difference between current and proposed cycle time = 905 - 817.56 = 87.44 sec

5. Product cycle efficiency = VAT/PLT

$$= 22417.36 / 280810$$

$$= 7.983\%$$

6. Cycle time = 81.79+78.010

$$= 159.8$$

$$= 6.6 \text{ Days}$$

RECOMMENDATIONS:

It was observed that value added time of current mapping was 22504.8s which was then reduced to 22417.36s by drawing proposed state VSM. Cycle time decreased from 33.65days to 6.6days. The production efficiency was increased from 0.86% to 7.983%.

FUTURE POSSIBILITIES:

The possible inclusions were suggested to the management, by introducing diamond cutting after the rough polishing we can reduce time by 30mins. By placing top turning after bottom turning machine we can save 5 mins. Also, by providing safety equipment at every department and introducing stage QC in each department we can save 25mins. We can also save upto ₹ 25704/year by implementing VSM in the organization. **Cost reduction in eliminating of non-value-added process**

- Time reduced by introducing diamond cutting after the rough polishing -30min
- Time reduced by placing top turning after bottom turning machine -5min
- Time reduced by providing safety equipment at the every department it self -10min
- Time reduced by introducing stage QC in each department -15min
- Total number of workers - 24
- Average salary of the each worker = ₹ 500 /day
- Average salary of the each worker per minute = ₹ 1.19/min

Cost saving per day = 60*1.19

$$= ₹71.4/\text{day}$$

• Cost saving per month = ₹ 2142/month

• Cost saving per Year = ₹ 25704/year

Take away for other small-scale industries:

Small scale industries are back bone of an Indian economy. Most of them have ISO 9001 certification. However, there is reluctance to adopt lean principles, may be because of their own causes. This case study demonstrates the use of lean tools to increase their revenue through cost reduction.

CONCLUSION

Value stream helps towards continuous process improvement, optimizing the flow and generate savings, identify the wastes and streamline production process, maximize of customer satisfaction, improved cross functional collaboration, improved end product quality [3,4,6]. The results obtained from the implementation of Value Stream Mapping (VSM) indicates that VSM is helpful and a useful tool for an industry to increase their productivity and profit. Product cycle efficiency before implementation of Value stream mapping was 0.86 % and after implementation it was found to be 7.983%. Cycle time before Implementation of VSM was 33.65 days. After implementation we observed 6.6 days reduction is 27.05 days is a huge reduction in the cycle time.

CONFLICT OF INTEREST

The authors confirm that there is no conflict of interest to declare for this publication.

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