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IMPLEMENTATION OF LEAN MANUFACTURING IN SMALL SCALE INDUSTRY USING DMAIC SIX SIGMA

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ABSTRACT

The small scale industries have less concern about having an improvement program at their organization. Due to this reason they suffer from common problems like having low productivity, efficiency, increased production cost, waste, and non-value added time, etc. The plant resources are also not effectively utilized by them. This result in production of low quality product, defects in finished goods, increased inventory etc. Implementation of lean manufacturing overcomes these above stated problems thereby, increasing the productivity and eliminating the wastes. In this paper an effort has been made to overcome these problems and to successfully implement the lean manufacturing technique in a small scale industry. For implementing the same a HDPE polythene bottle manufacturing industry was approached to apply lean manufacturing.

INTRODUCTION

Lean manufacturing is about applying the comprehensive sets of technique which would help the organization to eliminate the wastes. For example, to attain a goal each and every member has to contribute their effort towards the achievement of the goal. That's how the lean manufacturing works for eliminating the wastes from the organization. Eliminating the waste is very important for any small scale industry because it not only stops the growth of the industry but also decrease the productivity. Basically there are seven types of waste found in manufacturing industry. This paper focus on eliminating these wastes like non-value added time, over production, increased inventory area etc. Implementation of lean manufacturing is very important because it not only eliminates the wastes but also improve the production processes of the industry. When an industry becomes lean it's profit and productivity increases along with reduction in costs, inventory and non-value added time. Earlier, the lean manufacturing was applied by the use of different Lean tools and techniques. In this paper DMAIC six sigma is used for successfully implementation of lean manufacturing in the selected industry.

It is much simple and easier to apply in any manufacturing industry. The DMAIC is used because it searches for the root cause of the problem and suggests solution to fix the appropriate problem. It is very useful because it provides the necessary steps for the implementation and gives the measure for which process the main focus is to be made. The method is already been used in many other industrial sectors like food processing and manufacturing industry for significant improvement and contributing towards increasing the profitability of the industry.

LITERATURE REVIEW

Since many researcher had given their views and also applied it to different field and areas. They have also used various lean techniques like 5S, KANBAN, KAIZEN, total productive maintenance, etc. Proper sequence of the lean manufacturing elements should be done in any business organization for successfully implementation of lean manufacturing [1]. Sanjeev Kadian (2015) discusses that to increase the production application of lean principles is very important. When the organization becomes lean all the non-value added processes and activity gets eliminated which contributes towards the overall increase in production rate of manufacturing organization [2]. Amine Bilhadi (2016) says that an effective developed framework is needed rather than existing one for implementing lean properly to the small & medium scale enterprises[3]. Mazen Arafeh (2015) aimed in his study to combining the six sigma DMAIC methodology with lean principles for improvement in manufacturing processes [4]. Anil kumar (2015) research focuses on implementing lean manufacturing reduces waste and also minimizing the defects to zero level. This would enable in maximizing the profit and improvement in quality of the product and processes [5]. But these all lean tools need continuous improvement in the system. DMAIC six sigma is the one of the best tool and methodology for implementing lean manufacturing in any small scale industry because, it not only identifies the root cause of an existing problem but also provides proper and fixable solution to it.



International Journal Of Engineering Sciences & Management Research

OBJECTIVE

The main objective of this paper is to successfully implement lean manufacturing in a small scale industry using DMAIC six sigma. So that to increase the productivity of the industry by reducing wastes and creating more value for customers with fewer resources. This would increase the profit of the industry without compromising with quality of the product.

METHODOLOGY

For implementation, HDPE polythene bottle manufacturing small scale industry was approached, which produces plastic bottles form HDPE graduals. DMAIC six sigma provides the guidelines for implementing lean manufacturing. It is a strategy which uses data and information of the industry to improve the processes. Basically it has five steps which are as follows.

Define

Brainstorming session was conducted between the team members and management for identifying the existing problems and developing the problem statement. This had also lead to clearly defining the goal of the organization. This was done because if we set the goal then it becomes much easier to identify the processes or things which do not contribute towards the achievement of the goal.

Measure

According to the process flow chart the plan creation and collection of various data was done. Firstly, the area and the capacity of the industry was determined. Non-value added time was calculated for representing it on value stream map. Time calculation was also done to calculate the Takt time. The figure 4.2.1 shows how the processes were performed in the industry before the implementation of the lean manufacturing. It can be clearly seen that there are some process which take much time in completing due to which the non-value added time increases and which effects the production time. The calculation for the Takt time was done by this formula.

$$\text{Takt Time} = \frac{\text{Effective working time per shift}}{\text{Customer requirement per shift}}$$

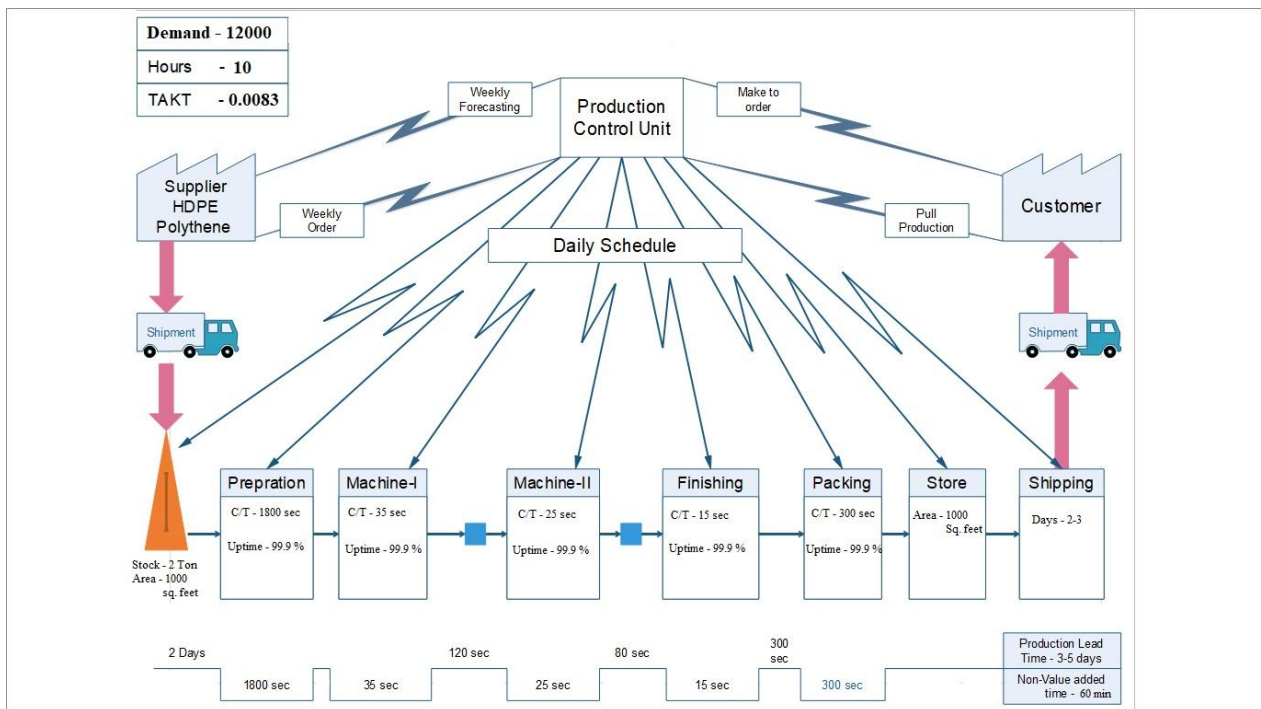


Fig 4.2.1 Current value stream map

Analyse

After completely analyzing the value stream map, it is clear that besides other factors the main root cause of the problem is non-value added time which resists the growth thereby decreasing the productivity and increasing the overall cost of the industry. The main causes of the problem are loss of motion and increase in finishing and packaging time.

Improve

To overcome the problems which were found in analyze stage, a new future state map is recommended. In this future state map figure 4.4.1 the non-value added time is been eliminated by combining the two processes which are finishing and packing. These were very time consuming stages because while the worker is performing the finishing operation the finished goods wait until the packaging is done which consume much of the working area. This result in less space utilization and becomes more troublesome for packing the finished goods.

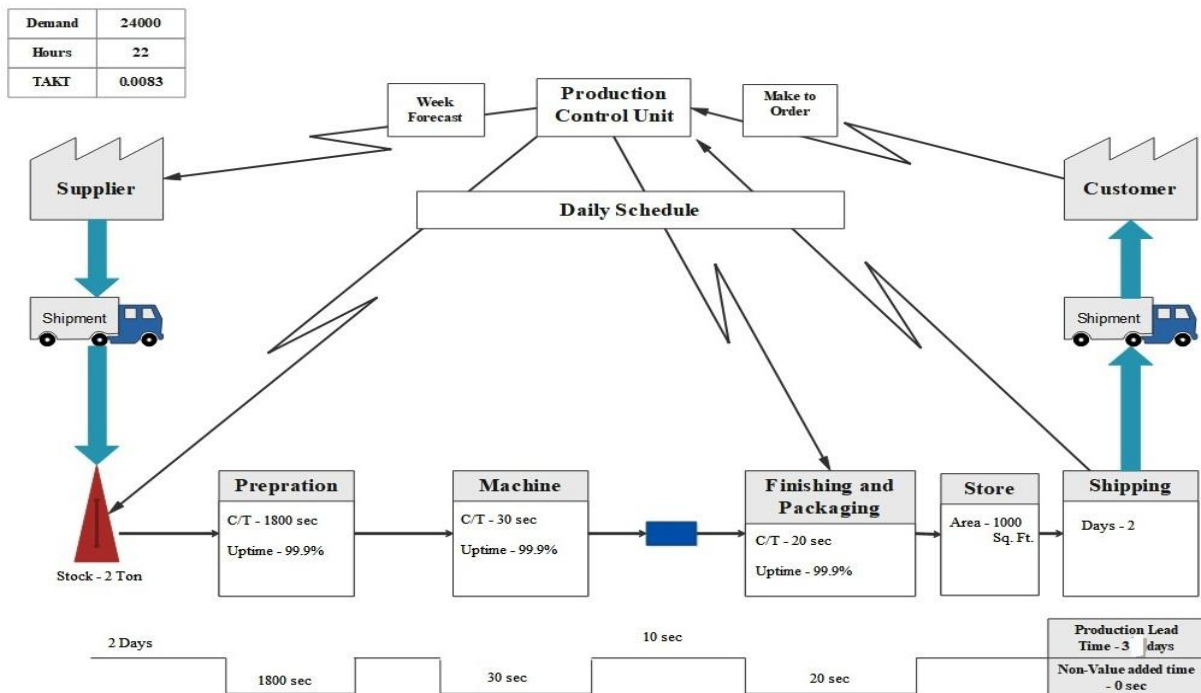


Fig 4.4.1 Future state map

Control

Now when the DMAIC six sigma is successfully implemented within the industry, the management needs to make strong commitment towards continuously controlling over the process using lean principles. Managing and monitoring is very essential to sustain the changes in future. This is to be done by Control charts like X bar chart, B chart etc. for continuous data, Control plans, Proper documentation is needed to keep the every bit of information regarding the process which would result in maintaining the project on the track. Adding new improved technology machines to the production may definitely contribute to growth of the production rate. More time should be given to make better turnover from the machine.

RESULTS AND DISCUSSION

The successfully implementation of the lean manufacturing using DMAIC six sigma approach was done. This helped the selected industry to improve their production system and reduced the wastes like non-value added time. More space utilization was made by arranging the production line according to new future state map. Effective utilization of plant resources was made in the industry. Workers are now encouraged to work with industrial safety devices and equipments like apron, gloves, eye glasses etc. Lean manufacturing is not only limited to reducing the waste but, if used effectively may give better productivity and more customer satisfaction. It is seen as the best practices to be performed not only in the manufacturing organizations but also in services industry.



International Journal OF Engineering Sciences & Management Research

CONCLUSION

Implementation of lean manufacturing enabled HDPE polythene bottle manufacturing industry to gain the improved processes, elimination of waste, increased productivity and customer satisfaction. The team work of the management and the workers was appreciated for their contribution. While carrying out the research, it encouraged other small scale industry owners to implement the same in there industry.

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