Improving Production Performance through Lean Manufacturing Techniques in a Manufacturing Firm

Cigil Sebastian¹, Nidhin Babu AV², Rajneesh P³, Sinosh NK⁴, Sreeraj E⁵, Jibi R⁶

¹,²,³,⁴,⁵Graduate Student, ⁶Assistant Professor Department of Mechanical Engineering, AWH Engineering College Calicut, Kerala, India

Abstract—Lean manufacturing is a systematic approach to identifying and eliminating wastes (non-value added activities) through continuous improvement by conveying the product at the pull of the customer in pursuit of production. In a more basic term, more value with less work. Lean manufacturing appears to hold considerable promise for addressing a range of simultaneous, competitive demands including high levels of process and product quality, low cost and reductions in lead times. In this work, the existing layouts were studied and utilization of each station is analyzed, the efficiency of production depends on how well the various machines, production facilities and employee’s amenities are located in a plant. This project also addresses the mechanics of kanban for the use of product movement in manufacturing cell.

Keywords—ARENA, Kanban, Lean manufacturing, simulation, Utilization.

I. INTRODUCTION

Lean is a term to describe a system that produces what the Customer wants, when they want it, with minimum waste.

It is based on the Toyota production system. Lean thinking focuses on value-added lean and consists of best practices, tools and techniques from throughout industry with the aims of reducing waste and maximizing the flow and efficiency of the overall system to achieve the ultimate customer satisfaction. Lean manufacturing is a manufacturing philosophy that shortens the time between the customer order and the product build/shipment by eliminating sources of waste. Another way of looking at lean is that it aims to achieve the same output with less input - less time, less space, less human effort, less machinery, less material, less costs. The aim of this project is to explore some lean manufacturing concept in a manufacturing firm situated in Kerala.

This work mainly includes two concepts in lean manufacturing. Analyzing the product, process and work flow and exploring kanban technique for work movement in the manufacturing cell. The first work involves analysing utilization of each work station in the factory lay out. Attempt is made to simulate the factory layout using the software ARENA (student’s version).

Utilization of each machine is calculated. This paper tries to illustrate how the plant layout problem can be solved using simulation technique. It also helps to think how the efficiency can be improved. Second work involves exploring kanban technique for work movement in the manufacturing cell. Pull system of work movement is introduced in the manufacturing department.

II. LITERATURE REVIEW

The lean manufacturing (LM) or Toyota Production System (TPS) was pioneered by a Japanese automotive Company, Toyota, during 1950’s. Due to its global superiority in cost, quality, flexibility and quick respond, LM was transferred across countries and industries [1]. LM has become an ideally acceptable and adoptable best manufacturing practice cross countries and industries [1]. The primary goals of LM were to reduce the cost of product and improve productivity by eliminating wastes or no value added activities [1]. Lean is a term to describe a system that produces what the customer wants, when they want it, with minimum waste -it is based on the Toyota production system. Lean thinking focuses on value-added lean and consists of best practices, tools and techniques from throughout industry with the aims of reducing waste and maximizing the flow and efficiency of the overall system to achieve the ultimate customer satisfaction. Lean manufacturing is a manufacturing philosophy that shortens the time between the customer order and the product build/shipment by eliminating sources of waste. Another way of looking at lean is that it aims to achieve the same output with less input - less time, less space, less human effort, less machinery, less material, less costs [2]. The wastes are commonly referred to as non-value-added activities, and are known to Lean practitioners as the Eight Wastes, over production, waiting, transportation, non-value added processing, excess inventory, defects, excess motion, underutilized people. [3].

The concept of pull in Lean production means to respond to the pull or needs of customers. Lean companies design their operations to be more responsive to the varied and changing needs of their customers.
Lean companies that are able to create such an operation can avoid the more traditional batch-and-queue method, which is generally acknowledged to be the worst way to process material through a factory. A more continuous flow results in items being moved immediately from one workstation to the next as soon as they are ready. Planning for the delivery of a product to customers becomes more efficient and demand from customers becomes more stable. The word Kanban is Japanese for instruction card or sign board. The Kanban is used to signal the need for replacing or refilling materials necessary for production. There are a variety of ways that the signal can be sent. Actual cards that accompanies goods though the production process can be used to keep track of current inventory. However, something as simple as the arrival of an empty container at an upstream processing station is a clear signal that the parts that were in the container have been used and more are needed. Kanban can be used in manufacturing systems where the product is manufactured to the pull of market demand [4].

Simulation is the dynamic representation of a real system by a computer model which behaves the same manner as the system itself. In the manufacturing industry, simulation represents the dynamic manufacturing process in the computer model, and shows graphically and over simulated time the effects of a potential scenario to support the decision-making process. Manufacturing simulation converts the detailed operational data into the management information. It enables various scenarios to be tested without large investment on setting up a pilot line or disrupting the production. It eliminates the common problem in manufacturing industry: bottlenecks. [5] In the present, there are several methods for plant layout design such as systematic layout planning (SLP), algorithms, and arena simulation can apply to design plant [6]. In this work attempt is made to simulate the factory layout using the software ARENA (student’s version). Utilization of each machine is calculated. The efficiency of production depends on how well the various machines; production facilities and employee’s amenities are located in a plant.

III. OBJECTIVE OF THE PROJECT

Analysing the utilization of each work station in the manufacturing cell. Enhancing the productivity for manufacturing using lean manufacturing technique and thereby reducing the total cost of production and exploiting the kanban technique for work movement.

IV. SCOPE OF THE PROJECT

Enhancing the productivity of a manufacturing firm by exploring the lean manufacturing techniques. Reducing the waste of production thereby decreasing the total cost increasing the profit.

V. PROJECT METHODOLOGY

![FIGURE 1: PROJECT METHODOLOGY](image)

Methodology is one of the most important elements to be considered to make sure the fluent of the project and get expected result. In other words the methodology can be described as framework where it contains the elements of the work based on the objectives and a scope of the project. A good framework can get the overall view of the project and get the data easily. This included literature study, implementing lean strategies on production line, line layout work station utilization simulation, managing work flow with kanban, and finally performance monitoring using check list.

VI. WORK DONE

A. Simulation of existing layout using ARENA. 9

The case manufacturing cell selected is turret assembly section. The lay out of the existing system is given below.
The work flow in turret assembly section is given below

The current layout of turret assembly is studied and analyzed, and it is found that the layout is product layout. Each and every work station is noted and the time required for the process in each station is collected. The current layout of the industry is created in ARENA.9 and utilization of existing machines is calculated.

<table>
<thead>
<tr>
<th>SL NO</th>
<th>WORK STATION</th>
<th>PROCESSING TIME (MIN)</th>
<th>INTERARRIVAL TIME (MIN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ASSEMBLY STATION 1</td>
<td>186</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>ASSEMBLY STATION 2</td>
<td>757</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>ASSEMBLY STATION 3</td>
<td>813</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>FINAL ASSEMBLY</td>
<td>175</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>CLEANING STATION</td>
<td>15</td>
<td>5</td>
</tr>
</tbody>
</table>

The figure: 4 show the layout that created using the arena software and its simulation. From the software itself we can found the utilization of the machines in the existing layout. The figure: 5 show the utilization of the machines in the existing layout. The figure: 6 shows the total number of parts seized in each work station.
B. Suggestion to Improve the Work station Performance

- Remove nonmoving item which have piled up in the factory floor.
- Orderly arrange the work station which will reduce the transportation time.
- Arrange the inventories and tools properly and orderly it will reduce the time consume in searching for tool and inventories.
- Maintain the record and stock properly.
- Provide a material handling system.
- Improved lay out design would help the company to reduce production cost.

C. Implement a KANBAN work movement system

A discrete manufacturing system is well suited for the implementation of kanban methodology. The most important objective in attaining lean is the execution of pull system the figure 7 shows the manufacturing unit at time zero there is no action at all. Figure 8 shows order for a product placed by a client. Details of the order are transmitted to all the work stations. Therefore something must be one up stream.
VII. CONCLUSION

By analyzing utilization of each workstation, it is identified that utilization some workstation are very small so some action should be taken to improve the utilization. Kanban work movement makes pull system of work movement in that manufacturing cell.

REFERENCE