Lean Manufacturing Implementation- Factors Affecting

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Abstract:- AVIZA TECHNOLOGIES is a company that specializes in manufacturing of Sheet metal components and assemblies for many companies such as GVR, SIEMENS, and HCL. Our project focuses on a GVR product called the “SIDE FRAME” which is used in assembly of petrol bulks. For this product manufacturing, it will take 200 no’s/shift. Our goal for this project is to understand different lean manufacturing methods and apply them to reduce lead time by 20% as well as improve overall process efficiency.

INTRODUCTION

In today’s business world, companies are constantly competing with one another to produce the products with the best quality while at the same time increasing their profit. One way to increase a company’s profit, reduce cost and remain competitive in the market is to eliminate the unnecessary factors involved in the manufacturing process. This can be done using a variety of methods. One method, known as lean manufacturing, is a process which is designed to reduce the time and effort it takes to make a product, taking into account issues such as time, wasted material, man power, and idle equipment. AVIZA TECHNOLOGIES is a company that specializes in manufacturing of Sheet metal components. This project was aimed to assist aviza, using lean manufacturing tools, to reduce the manufacturing time process by 20% as well as improving overall process efficiency. Tools of lean manufacturing used in the project include Value Stream Mapping (VSM) and time studies. Value Stream Mapping is a lean manufacturing technique that is used to by companies to depict and analyze the flow of materials and information currently necessary to bring a product or service to a consumer. It accomplishes this by first identifying any wastes, which is any activity that does not add value to the final product, then demonstrating these wastes to the company followed by taking the necessary steps to decrease these wastes. VSMs are used to depict current operational processes, and then after identifying, analyzing and reducing wastes, a future or ideal VSM can be made which should show quicker and more efficient operational processes. Time studies are used in order to decrease the number of tasks in completing a process, therefore improving production and efficiency. The product we focused on reducing lead time from the press shop to coating is the “SID FRAME” that is used for manufacturing petrol bulks. The “side frame” is a type of product which is considered class components by customer due to quality and aesthetic requirement. On average, aviza currently produces 150 no’s of products per day. There are three processes for making the “side frame”: stamping/forming/metal fabrication, and coating. All processes such as stamping/forming/metal fabrication, and coating done in-house, whereas hardwires such as sheets, weld nut, powder are outsourced to an external vendor. The side frame consists of 3 items; side cover/top & bottom cover and Rid. For one side frame, the cycle time in the stamping process is about 3 minutes. It takes 3 to 4 minutes, as it varies by different member, to go through the subsequent whole production process. In order to reduce the lead time we had to identify all wastes in each member’s process and from there recommend methods that could be used to eliminate these wastes. On average, current lead time from the first process(stamping) to finish (coating) is 160 numbers/per shift.

From the research, it is observed that the VSM method was used last year by company. This was the first time the VSM method was used at AVIZA to help reduce lead time. We used this method again to make an initial state VSM, or Current State Map (CSM), for SIDE FRAME and from there conducted time studies and analyzed data sheets. To improve overall process efficiency, we had to look at the whole production process, from order placement to shipping. We looked at and analyzed data sheets, conducted interviews, and made group observations. This allowed us to see where there were problems and provide solutions for AVIZA to use to remedy these issues. Once we had all collected all the data and analyzed it, we developed a future VSM showing the
total reduction in lead time should all our recommendations be implemented.

LEAN MANUFACTURING

The process of Lean Manufacturing has been the main concern and issues of many manufacturing companies throughout the world. Many processes leading up to lean manufacturing have influenced this greatly such as Interchangeable parts, Just in Time Production, the Ford Assembly line, and the Toyota Production Systems. Eli Whitney is considered to be the founding father of this process with his idea of interchangeable parts. Later on in the 1900s, Henry Ford introduced the idea of the assembly line, which rapidly produced automobiles. From this, there have been greater advancements in technology which have lead to faster production times and reduction of ineffectual materials. Below is a timeline showing how lean manufacturing has progressed since Eli Whitney introduced Interchangeable Parts.

This specific process of Lean Manufacturing has been implemented and used by all types of leading manufacturing companies. Lean means “manufacturing without waste.” Waste (“mud” in Japanese) has many forms. Material, time, idle equipment, and inventory are examples. Most companies waste 70%-90% of their available resources. Even the best Lean Manufacturerers probably waste 30% (Strategizing, 2008). ‘LEAN’ has always been important to manufacturers. When you reduce inventories, assets, overhead, wait times and out-of-specs, you generally increase profits. Simply put, lean manufacturing is a key contributor to high performance - the ability to consistently outpace competitors across economic cycles, industry cycles and generations of leadership (Russell, 2006). Overall, this process improves the manufacturing time, reduces costs and the reduction of wastes and defects. The Japanese began to look into improving the processing of lean manufacturing in depth. They repeatedly used the word “Kaizen” which means improvement in Japanese. This strategy consists of continuous improvement of a system involving a whole company, or industry. This strategy, known as the Kaizen event, consists of using all members of a company, mapping the existing process, brainstorming on improvement and implementing these new ideas.

Another variable in the lean manufacturing process is called cellular manufacturing. Cellular manufacturing, also called work cells, represents an alternative organizational structure that seeks to reduce manufacturing lead times, improve product cost, quality and delivery and create an atmosphere of employee involvement and continuous improvement (Granite-bay cellular manufacturing,2008). Cellular manufacturing consists of a series of product focused work groups, which controls all operations to manufacture a product. The cell is dedicated to manufacturing those products requiring similar operations. While the normal manufacturing environment is organized functionally with similar machines in one area cellular manufacturing operates like a series of plants-within-a-plant, each starting with raw materials and ending with finished product, with all operations being performed in the cell. Machines in manufacturing cells are located within close proximity to reduce transportation time, a type of waste and to maintain continuous flow with zero inventory between operations. The manufacturing cell is operated by a team of skilled technicians who have sole responsibility for quality and delivery effectiveness in the cell. The godfather of lean manufacturing was the Kaizen-based Toyota Production System (TPS). This system's underlying philosophy of continuous improvement became a blueprint for others - most notably Danaher Corporation, which turned it into the Danaher Business System (DBS). DBS operates on two levels. (Russell, 2006) In the Toyota Production System, the main goal is to reduce waste. This waste consists of Material, time, idle equipment, and inventories are examples. TPS emphasizes the identification of waste (often problematic) followed by specific tools and techniques to eliminate it. TPS emphasizes the participation of all employees. It uses teams integrated with work cells for motivation, work management and problem solving (Strategizing, 2008). First, methodologies such as Six Sigma and value-mapping are used on a daily basis to curtail excess inventory, long waiting times, overproduction and defects in quality. Kaizen events run continuously, closely examining business processes to cull waste and develop standardized approaches to avoiding it in the future. (Russell, 2006) Six Sigma at many organizations simply means a measure of quality that strives for near perfection. Six Sigma is a disciplined, data-driven approach and methodology for eliminating defects (driving towards six standard deviations between the mean and the nearest specification limit) in any process -- from manufacturing to transactional and from product to service. The statistical representation of Six Sigma describes quantitatively how a process is performing. To achieve Six Sigma, a process must not produce more than 3.4 defects per million opportunities. A Six Sigma defect is defined as anything outside of customer specifications. A Six Sigma
opportunity is then the total quantity of chances for a defect. (Goyal, 2008) In a case study done by Six Sigma, a magazine whose goals are to study the Six Sigma process, a process was determined to note application of lean manufacturing to six sigma. In this study, work was carried out in a large company based in the US and India in the business of converting printed paper from customers into electronic copies. It is a continuation of the earlier case study entitled "Six Sigma Case Study: Converting Paper to Electronic Documents." In this case study, seven stages were identified, which clearly related to lean manufacturing. The steps included, defining and measuring the problem, analyzing the problem, idea generation, idea modification, implementing change, checking the result, and standardizing the control. In conclusion, the combined effect of Lean Manufacturing and Six Sigma has led to improvements in product quality (98% reduction in errors) and turnaround time (50% reduction). These improvements have resulted not only in cost reduction, but also the possibility of presenting these improvement stories to the customer, building the reputation of the company as a leading supplier of quality, and thereby increasing the probability of getting higher volumes of business.

2.2 Value Stream Mapping

Value Stream Mapping (VSM), also known as Material and Information Flow Mapping, is a lean manufacturing technique that is used to analyze the flow of materials and information currently essential to bring a product or service to a consumer (Wikipedia contributors, ). It originated from the TPS and while it is most commonly used in manufacturing it is also used in logistics, supply chain, service. The VSM method visually maps the flow of materials and information from the time products come in the back door as raw material, through all manufacturing process steps, and off the loading dock as finished products. There are several steps used in VSM and these steps are:

1. Identify the target product, product family, or service.

2. Draw a current state value stream map, which is the current steps, delays, and information flows required to deliver the target product or service. This may be a production flow (raw materials to consumer) or a design flow (concept to launch).

3. Assess the current state value stream map in terms of creating flow by eliminating waste.

4. Draw a future state value stream map.

5. Implement the future state

EXAMPLE OF A VALUE STREAM

The first step, identifying the product, pertains to choosing what product the VSM will focus on. After having chosen the product to focus on, the next step is to draw the current state VSM, also known as a Current State Map (CSM). This CSM contains all the steps and the parameters used in these steps. These parameters include but are not limited to cycle times, TAKT time, Work-In-Progress (WIP), production rate, number of operators, and waiting time. Having compiled the CSM with all the information deemed necessary to perform analysis, the team then assesses the current situation. A VSM identifies where in the manufacturing process value is added and where there are non-value added steps. Upon assessing the current situation and determining where there might be non-value added steps, or wastes, the next step is to develop methods to eliminate these wastes. Upon developing these methods, a final VSM known as a Future State Map (FSM), can be drawn with these wastes removed. The final step is to implement the changes so that the drawn FSM can be followed as closely as possible. This will in turn make a more efficient lean manufacturing process (Emerald Full Text article: The seven value stream mapping tools).

3.0 ANALYSIS

Below shown VSM is mapped for the product SIDE FRAME in aviza technologies.
4. CONCLUSION

Value Stream Mapping was very useful in being able to visually see how the entire production process worked, as well as seeing how the individual processes worked. By being able to combine information and material on one map, this allowed us to see where the big issues were in regards to lead time. We were able to then analyze the big issues and make recommendations to remedy these problems. By using lean manufacturing methods we were able to give solutions to reduce the time lead time to 20%.

REFERENCES


