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Lean and Agile Manufacturing System Barriers

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ABSTRACT

Due to rapid globalization and faster growth of world market, there is always a need of modification in the present mode of manufacturing system; these modifications increase the viabilities of manufacturer to move ahead in competitive market. These changes also improve the manufacturer and consumer relation by meeting the latest demand of consumers.
The concept of Agile Manufacturing system is the new in era of twenty first which covers the responsive and time saving strategies design and adopted by the manufacturers to dominate the market. Agile Manufacturing system (AMS) proves to be advancement over other manufacturing systems which are like Flexible Manufacturing System (FMS) and Lean Manufacturing System (LMS). Although many industries and companies in India are still in the phase of FMS and still need to cover advance strategies.
For this it is needed to identify the barriers which coming in between the implementation of AMS. This paper is based on the Lean and Agile Principles, in which these problems has been tried to remove the barriers. This paper is the effort to identify and remove the barriers with the help of case study.

Keywords: *Agile Manufacturing System; Flexible Manufacturing System; Lean Manufacturing*.

1.0 Introduction

Agile manufacturing is an approach to manufacturing which is combination of Lean manufacturing and flexible manufacturing system. This overall approach is concentrated on meeting the needs of customer and industry. It is a technology which is combining all the technologies i.e. Lean, flexible system, JIT, TPM, CIM, TQM and Taguchi. Agile Manufacturing systems have evolved from job shops, which feature general-purpose machines, low volume, high variety, and significant human involvement, to high volume, low variety dedicated manufacturing lines driven by the economy of scale [4].

Agile manufacturing is an approach to manufacturing which is focused on meeting the needs of customers while maintaining high standards of quality and controlling the overall costs involved in the production of a particular product[3]. This approach is geared towards companies working in a highly competitive environment, where small variations in performance and product delivery can make a huge difference in the long term to a company's survival and reputation among consumers.

This concept is closely related to lean manufacturing, in which the goal is to reduce waste as much as possible. In lean manufacturing, the company aims to cut all costs which are not directly related to the production of a product for the consumer. Agile manufacturing can include this concept, but it also adds an additional dimension, the idea that customer demands need to be met rapidly and effectively. In situations where companies integrate both approaches, they are sometimes said to be using "lean and agile manufacturing."

Companies which utilize an agile manufacturing approach tend to have very strong networks with suppliers and related companies, along with numerous cooperative teams which work within the company to deliver products effectively. They can retool facilities quickly, negotiate new agreements with suppliers and other partners in response to changing market forces, and take other steps to meet customer demands [8]. This means that the company can increase production on products with a high

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consumer demand, as well as redesign products to respond to issues which have emerged on the open market.

2.0 Lean and Agile Principles

The Toyota Production System was the first organization to create the foundation for the development of the Lean manufacturing principles. The broad idea of lean principle is to eliminate or reduce the non-value added services or the wastes in the given process. This elimination or reduction can be achieved by analyzing the whole process and finding the activities where wastage of time occurs, or unwanted usage of space, or reducing the inventory [2]. The typical advantages of lean principles in a production firm are: single piece production, just-in-time, short cycle times, quick changeovers, multi-skilled and flexible workforce, high quality and low defect rates.

To achieve the above situation wastes are identified and tools for eliminating these wastes are employed. Just by employing these tools does not necessarily mean lean benefits. There must be a change in the organizational structure as well as the infrastructure whilst employing the lean tools for maximum and continuous improvements.

3.0 Barriers in AMS

A product when produced has many features and the values of these features are determined by the customer. To produce these features it may need material, equipment, facilities, manpower, utilities, expenses, motion, and other activities. All the above activities are not valued by the customer and hence are categorized under waste [5]. Thus, anything that does not add value to the customer is waste. There are seven barriers:

3.1 Overproduction

Rate of output is greater than the rate at which it is sold to the customer. This increases the inventory of finished goods and in the process the cost for handling. Overproduction leads to other types of waste like waiting, motion, and inventory and hence is known as the mother of all waste [7]. Overproduction can be due to incorrect forecasting, high production machinery, poor production planning etc.

3.2 Processing waste/over-processing

Any process that does not add value to the customer is a processing waste. This waste leads to unnecessary processing cost, time and energy [11]. The cause's maybe incorrect problem definition of customer specification, continuous engineering changes, excessive quality, unclear work instructions.

3.3 Transportation

The movements of goods or materials within or outside an organization are classified under transportation waste. Goods or the materials can be people, equipment, tools, supplies or documents [1]. The causes maybe due to poor route planning, line imbalance, distant suppliers, poor layout or disorganized workplace.

3.4 Waiting/delays

If any processing work stops or has to wait due to unavailability of man or machine is a waste [10]. The delay can be caused due to setting up tools, unscheduled machine downtime, line imbalance, manpower shortage, material shortage etc.

3.5 Inventory waste

Storage of goods or materials which may or may not be used is inventory waste [2]. The materials stored can be raw materials, tools, work in progress, finished goods and so on. Inventory waste can occur due to high lead times, wrong forecasting, high rework rate, big batch size, large minimum order quantity.

3.6 Motion waste

The unnecessary movement of workers to perform a work falls under motion waste [9]. This type of waste happens due to poor layout, unsystematic workplace, non-standardized work process, undecided material flow.

3.7 Defects

Any process involving reworking, repairing or replacing comes under waste due to defects. The quality of the product is compromised due to defect rectification. The defects occur due to lack of process control, unskilled personnel, incapable processes, and incompetent suppliers [3].

4.0 Tools and Techniques for Eliminating Wastes

There are various tools and techniques for eliminating the wastes discussed earlier [7]. The same tools and techniques can be used for eliminating variety of waste or a combination of tools and techniques can be used to as specific waste.

4.1 Pull system/KANBAN

The pull system relies on the actual customer demand rather than forecasting. For this to be implied in a manufacturing firm, KANBAN cards are used [8]. The cards identifies the how much an item, part should be manufactured or consumed.

4.2 Value streaming

This a process of sketching of all the material flows and the information related to it [4]. All the present information's are collected to help in redesigning the current layout to the design that is needed by the organization for faster communication and better implementation of the process.

4.3 5S

There are five stages namely: Seiri (Structurize), Seiton (Systemize), Seiso (Sanitize), Seiketsu (Standardize), Shitsuke (Self-discipline) which is help in removing the waste.

4.3.1 Seiri/ structurize

This stage is to identify the parts used for manufacturing according to their frequency of usage [6]. They are categorized in terms of three categories namely: daily, rarely and never. The parts under the daily category are situated close to the workers, rarely are specially tagged to be easily identified and never are discarded from the system.

4.3 2 Seiton/systemize

It's a visualization technique in which the whole shop floor is sketched and the locations of each part are represented [5]. Then the parts are classified according to their importance and re-designed to help the personal's in the shop floor retrieve the required parts in the least amount of time.

4.3 3 Seiso/sanitize

This is related to the cleanliness of the workplace [9]. An unclean workplace makes it hard to identify the required parts and location of the parts. Haphazard workplace may lead to stoppages; hence it is of utmost importance that when a work is done the worker is trained to clean his/her workstation in a timely manner.

4.3 4 Seiketsu/standardize

This is a form of visual control, i.e. all the processes, routes, information etc are represented by color, codes and symbols [1]. The workers must be trained to understand what the symbols, codes and colors denote, thereby enabling them to quickly understand what that particular process must do.

4.3 5 Shitsuke/self-discipline

This stage is the final parts of 5S, in which the workers undergo a training procedure to familiarize them with the above mentioned parts of the 5S [1]. This is to create an innate knowledge in the workers to implement the above stages without any supervision.

4.4 Single minute exchange die (SMED)

This is four stage activities to reduce the set up time for any process. The ideal set up time needs to be equivalent to one-minute. This is achieved over the course of time by analyzing the process [10]. In the first stage the setting-up process is identified. During the second stage, the set-up is divided into internal and external set-up time.

The internal set-up is categorized as those processes which require the machine to be halted whereas the activities which can be carried out without the stoppage of machine is categorized under external set-up. The third stage is analyzing the categorized activities, especially the internal activities. Any activities that can be avoided or discarded are removed and if possible convert as many internal activities to external activities. The final stage is the documentation of the above analysis. All the activities are streamlined in such a manner with minimum internal set-up activities.

4.5 One piece flow system

The cycle time of the product is calculated and then each work station is allotted with processes which when combined equals the cycle time [3]. This is done to avoid inventory build up at each work station and as well as for creating a stoppage free environment.

4.6 Poka-yoka

This ideology is adopted to create processes which are defect free [2]. That is, defects are avoided from the manner in which the processes are conducted and eliminating factors which could produce defects.

5.0 Conclusion

By applying the lean and agile principles of one piece flow, pull system and value streaming the production rate of the lower frame was increased. The pull system utilized to understand that there is need to increase the production rate. Value streaming was done to identify the constraints and one piece flow to achieve the required cycle time.

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