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Study on the Lean Manufacturing Process to Reduce Environmental Consequences

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Abstract – Nowadays, manufacturing firms are in the position to redefine and redesign their manufacturing systems in order to meet the competitive demands raised by market challenges. The manufacturing systems exhibited a key transition from mass manufacturing to lean manufacturing. The Comparative aspects of lean production with that of mass production is presented as follows: The focus of lean production is customer whereas mass production focuses on product. Lean production is characterized with synchronized flow and pulls whereas mass production is based on batch and queue operations. The overall aim of lean Production is to eliminate waste and add value whereas mass production focuses on cost reduction and efficiency improvement. Lean production focus on worker driven continuous improvement whereas mass production focuses on expert driven continuous improvement. Lean system is flexible and adaptable whereas mass system works on economies of scale. Quality is an inbuilt function in lean system. The features of lean system include waste elimination; limited flexibility to accommodate product complexities; non-reconfigurable products and the system not suitable for turbulent market conditions.

Keywords – Lean, Manufacturing Process, Environment

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INTRODUCTION

Beginning in the mid 1900's Henry Ford "wedded reliably compatible parts with standard work and moved transport to make what he called stream creation." not long after WWI the Toyota Production System, TPS, brought lean manufacturing ideas into the manufacturing business ("A Brief History of Lean" 2007). Lean Manufacturing has progressively been applied by driving manufacturing organizations all through the world.

It has demonstrated to have numerous positive results which incorporate such ideas as diminished process duration, diminished expense, decrease of deformities and waste. Lean manufacturing intends to accomplish a similar yield with less information; like less time, less space, less human exertion, less hardware, less material and less expense. To all the more likely comprehend lean manufacturing, one first necessities to comprehend the essential rules that direct it. Some significant lean manufacturing standards include: perceiving squanders, having standard cycles, having a consistent stream, pull-creation, quality at the source and keeping up ceaseless improvement. As per the TPS, there are seven unique squanders known as "muda," which signifies "squander" in Japanese.

To establish a lean work space, these squanders should be distinguished and drained. The first muda is overproduction, which is creating more than needed, or more than is required by the costumer. The second muda is the presence of imperfections. Imperfections in items lead to more expenses and misuse of creation time, just as the exertion associated with assessing and fixing deserts. The third waste is stock. Stock could prompt added stockpiling costs just as higher deformity rates. Regardless of whether there is no "stock charge," enormous inventories cost organization cash since it expands their working expenses. The fourth muda is transportation, which could be moving merchandise starting with one production line then onto the next. Transportation, stringently seen, is a non-value added action, so organizations endeavor to bring down transportation distances. The fifth muda, pausing, is vital to lean manufacturing since this is one of the principle squanders that creation organizations

need to limit. Holding up causes exercise in futility and cash.

The 6th waste is over preparing. Over handling is inadvertently accomplishing more preparing work than the client requires, which can prompt greater expenses by utilizing a bigger number of assets than required. The last waste is pointless movement. Strolling from one activity to another or around the industrial facility floor when excessive, hinders the specialists and generally speaking hinders the progression of creation (Mekong, 2004). Identifying and decreasing these losses inside the creation cycle will in general assist with establishing a lean workplace inside an organization.

OBJECTIVE OF THIS STUDY

1. To study the lean manufacturing process to reduce environmental consequences.

2. To study the benefits of lean and process of lean manufacturing tools.

LEAN

Lean is characterized as the "end of waste in all business measures through progress activity". Lean is a particular technique, to dispose of waste inside the creation framework (Womack et al. 1990). Lean compute squander through manufacturing framework and lopsidedness of the work. The value might be depicted as certain demonstrations or training, that client is energetic to trade for cash. Having roots from TPS, the lean manufacturing reasoning in administration has stayed much respected by analysts. Lean contains different instruments and modulus activities which are helpful to recoil the inefficient activities just as enhancing value to the result to accomplish client prerequisites (Singh B et al. 2010).

Lean Manufacturing

LM intends to improve the client value and lessen the waste, accomplishing manufacturing through the making of high values with less assets. Squander is only an activity that doesn't expand value to the produced products (Achanga et al. 2006). In the disposal of waste with the whole manufacturing measure, ventures can make distinctive manufacturing measures that involve minimal exertion of people, less space just as less an ideal opportunity for the creation of better caliber and cheaper items contrasted and customary business frameworks. Lean manufacturing maximizesthe client's value and limits the waste and making of more value (Bititci et al. 2011).

Benefits of Lean Manufacturing

- Quality improvement and less deformity
- Inventory decrease
- Less space prerequisite
- Enhanced by and large manufacturing adaptability
- Good and safe work space
- Improving representative assurance.

REASON FOR COMPARING LINES OF 2 DIFFERENT INDUSTRIES:

The execution of lean standard in line 2 (line A) and 4 (linefromRane Engine valves restricted, viralimalai, pudukkottai (dt) and line 6 (line C) from Bharat Heavy Electricals Limited, trichirappalli To get exact examination results by applying lean rule, looking at 2 lines from same industry and 1 line from other industry. The 3 lines are valve creation and machining measure industry. The business to industry correlation gives the best outcomes with respect to process duration decrease, value-added and non-value added time decrease, takt time variety, rate value option and in general effectiveness when lean rule execution. So only industries are thought about.

THE SEVEN WASTES OF MANUFACTURING INDUSTRY

In lean manufacturing, there are seven destructive squanders shaped during manufacturing. They are identified as NV Activities of manufacturing industry. Notwithstanding these squanders, lean devices can be executed to lessen the wastage (Mahidhar V. 2005).

Pausing: Waste of holding up is any inactive time delivered when two related cycles are not totally synchronized. Holding up comes from helpless man machine coordination, long changeovers, temperamental cycles, time needed to perform improve.

Movement: Unnecessary movements are those developments of man or machine which are not as little or as simple to accomplish as could be expected, Excessive travel between workstations, over the top machine developments from start highlight work start point are on the whole instances of the misuse of movement.

Over-preparing: The misuse of over processing is the place where we utilize unseemly strategies, oversize gear, working to resistances that are excessively close, perform measures that are not needed by the client, etc. These things cost us time and cash. Perhaps the greatest illustration of over-handling in many organizations is that of the "super machine" that can do an activity quicker

than some other, however every interaction stream must be steered through it causing planning complexities, delays, etc.

Inventories: Inventory costs you cash, each piece of item restricted in crude material, work in progress or completed products has an expense and until it is really sold that cost is yours. Notwithstanding the unadulterated expense of your stock it adds numerous different expenses. Stock feeds numerous different squanders. Stock must be put away, it needs space, it needs bundling and it must be shipped around.

DIFFERENCE BETWEEN MOTION AND TRANSPORTATION

Movement squander implies, pointlessly moving individuals to access or deal with material or data. It is caused helpless work cell designs and area of instruments and parts. Transportation squander implies pointless development of parts and materials. It standing the danger of being harmed postponed and lost.

DIFFERENCE BETWEEN OVER-PROCESSING, INVENTORIES AND OVERPRODUCTION

Over-handling implies preparing past the standard needed by the client. Stock methods crude material, work in progress or completed merchandise which isn't having value added to it and unreasonably put away. Overproduction intends to create sooner, quicker or more noteworthy amounts than client interest. These are the fundamental distinction between them.

LEAN MANUFACTURING TOOLS

Lean manufacturing instruments are applied to lessen wastage and cost in manufacturing industries (Alvarez et al. 2009).

Cellular Manufacturing

Cell manufacturing (CM) implies gathering of activities being performed for a few item's assembling. The cell involves machines just as workstations coordinated in clear way to make a smooth progression of materials. This adaptability is accomplished with the help of masterminding like-items into families and it is done on a similar component. It additionally decreases the time taken in changeover among items. CM has numerous advantages, like diminished stock, less space usage, NVAT decrease, usefulness improvement and upgraded adaptability (MalekAn et al. 2007).

Kanban System

Kanban is a planning framework for lean manufacturing and JIT framework. It is a stock control framework to control the SCM. It shows the stock levels with real utilization. A sign advises a provider to create and convey another shipment when material is burned-through. These signs are followed through the recharging cycle, carrying perceivability to the provider, purchaser and purchaser. The TPS has formed six standards for the utilization of kanban. Postpone measure gets the quantity of things demonstrated by the kanban card at the prior interaction. Prior measure produces things in the amount and arrangement showed by the kanban. No things are made or shipped without a kanban, consistently a kanban card is joined to the merchandise and inadequate products are not shipped off the ensuing cycle. The outcomes are 100% deformity free merchandise (Meade et al. 2002).

The creation of a VSM is divided into five basic steps:

1. Identify the item.
2. Create a current VSM.
3. Evaluate the current guide, recognize trouble spots.
4. Create a future state VSM.
5. Implement the last arrangement.

Value Stream Mapping

Value stream mapping, a lean manufacturing apparatus, which started from the TPS, is known as "material and data stream mapping." This mapping device utilizes the methods of lean manufacturing to break down and assess certain work measures in a manufacturing activity. This instrument is utilized principally to distinguish, exhibit and diminishing waste, just as make stream in the manufacturing cycle. VSMs can be made simply utilizing paper and pencil; anyway further developed guides are made utilizing Microsoft Visio just as Microsoft Excel. Beneath you can see an illustration of an exceptionally fundamental VSM made with Microsoft Visio.

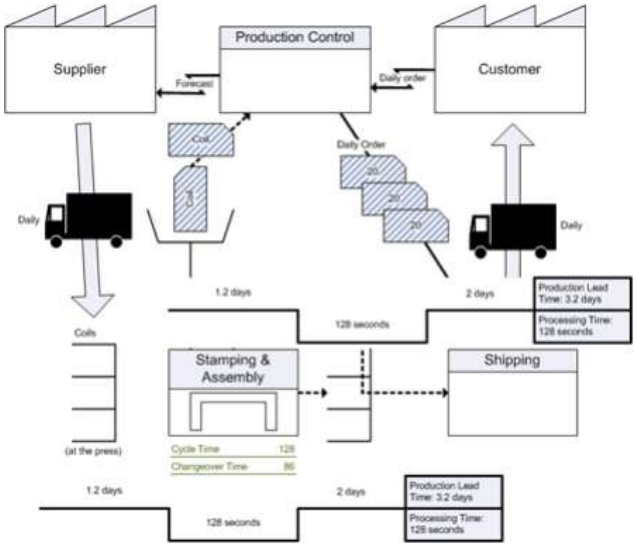

Figure 1.1: Sample Value Stream Map

5S –PRINCIPLES

The 5s term was authored from the Japanese language with words seiri and seiton being the initial two words while the last three words are seiso, seiketsu and shitsuke. Seiri infers arranging the materials, seiton hints setting to arrange, seiso addresses sparkling the materials, seiketsu represents normalized while shitsuke shows supported .The Figures 1.2 and 1.3 demonstrates when the execution of 5s standards. The 5 Japanese terms start with the beginning image of S. Seiri signifies 'take out the not required item from the line'. Seiton implies requesting the hardware and organizing them appropriately. The required materials are taken care of and different materials are put as optional. Seiso signifies 'clean the work environment', which ought to be a set up objective. The functioning organaisations should be flawless and clean. The game plan of material is significant for the smooth running of industry. Seiketsu is tied in with normalizing the above standards. These standards are applied in the customary mode. There is no trade off of the over guideline's execution. Shitsuke implies consistently applying the norms and adherence to the framework in 5s program (Myers et al. 2000).

SINGLE MINUTE EXCHANGE OF DIES

Customarily, SMED is changed for each model. The stamps are intended for each model. However, it takes a few times and burns-through more energy. At whatever point the machine changes the devices, the machine should stop and kicks the bucket are adjusted, it requires 10 hours to 2 days (Moreira et al. 2011).

Presently the different passes on are planned all the while and masterminded in precise, when one group of works are done, they are changed for the following various tasks. There are 2 exercises, named as inside and outer. In Internal exercises kicks the bucket are changed and the machines are halted. In External exercises regardless of whether there is change of passes on, the machines are not halted (Worley et al. 2006).

The overall activities of SMED are noted in Figure 1.4. First discrete the inward and outside activities. The inner activities are changed over in to outer activities (for example preheating of the apparatuses). At last the outside activities are major and decrease the arrangement time. The arrangement time is decreased under 9 minutes (single minutes= 0 to 9 mins).

CONCLUSION

The mindset that everybody ought to have in this kind of work is that all processes in their present status have potential for development. This exposition intends to the improvement of one process with the assistance of various devices for the process examination. The main objective is the productivity of time and the decrease of waste. In the current process, it was checked that in the injection action there was a misuse of about 25% as far as time; and in the mechanical production system, this value was about 55% for the main administrator. After the investigation portrayed in the current work, there was made an improvement that reduces this loss to about 10% in the injection and about 30% in the sequential construction system. The execution of this proposition addresses a saving of roughly € 35 000 every year.

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