

REVIEW OF LEAN MANUFACTURING ISSUES AND CHALLENGES IN MANUFACTURING PROCESS

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ABSTRACT

In the present business scenario, competitiveness of manufacturing companies is determined by their ability to meet and respond as swiftly as possible to the changing environment scenario and to produce and supply high-quality products at lower cost as per demand of the customer. All the manufacturing companies are striving too hard to achieve their aims, objectives and their capabilities by proper planning and skilfulness, through application of automation and innovative concepts, e.g. lean manufacturing, just-in-time (JIT), and total quality management (TQM). Among these innovative concepts, lean manufacturing is recognized by the manufacturing companies as a major driver to achieve world-class capabilities. Many large and medium-size manufacturing companies have adopted lean manufacturing concepts, and experienced reduction in manufacturing lead time and material handling cost, and improvement in quality with other benefits.

It is generally agreed that for a lean manufacturing programme to be effective, it should include a set of tools and techniques or provisions to ensure management obligation, employee association, identification of wastes, development of controls for wastes and training and education for employees. These tools and techniques are said to be typical of any comprehensive lean manufacturing implementation programme. The implementation of lean manufacturing reduced the waste in the industry and enhances the profit and production.

KEYWORDS: Lean Manufacturing, 5S, Kaizen, TQM, Kanban, Six Sigma

INTRODUCTION

Manufacturing has been recognized as the main engine for growth of the economy. Ever changing globalized environment has been posing challenges of competitiveness and survival to all the constituents of the economy. Manufacturers in the Indian industry have always faced heightened challenges such as rising customer's demand for better and improved products, erratic demand, and competition in markets. There is no disbelief that the manufacturers are always embracing changes and improvements in their key activities or processes to cope with the ever growing challenges.

To be more efficient is the only way to stay and earn profit in a global market. Industries are giving lot of attention to Lean manufacturing. Several industries in India are struggling to be world class. Principal adoption of lean manufacturing is still found to be complex. Lean Manufacturing is a set of techniques, which have developed gradually over a long period and are based on various minor to major breakthroughs that help in reducing cost and hence increase productivity.

Lean is a philosophy of manufacturing that incorporates a collection of principles, tools and techniques into the business processes to optimize time, productivity, HR, and assets, while improving the quality level of products and services to their customers

LEAN MANUFACTURING

Lean manufacturing is defined as to produce same and more than the mass production using less effort, lesser space, without any new inventory, better quality and lesser defects. There are different objectives and essentials for implementation of lean manufacturing which are discussed as below:

- Highest satisfaction of customers needs
- Total elimination of waste
- Use of less effort with same production rate

ESSENTIALS OF LEAN MANUFACTURING

Lean manufacturing uses a process layout in which the manufacturing cells are arranged in parallel. In every cell there should be no storage of materials, rather there is single piece of flow. Lean manufacturing aims at minimizing waste of following type:-

- Correction and repair of any damaged tool etc.
- Use of any waste motion for transportation purposes
- Over production or producing more than needed
- Wasted effort to transport any kind of goods
- Maintaining excess inventory of raw material and finished products.

ROLE OF LEAN MANUFACTURING FOR ORGANIZATION

Lean manufacturing techniques are beneficial to increase the profitability by reducing the production cost. Industrial major objective is profit which should be maximized. To understand the relation between cost, profit and sale we will briefly study the following diagram:-

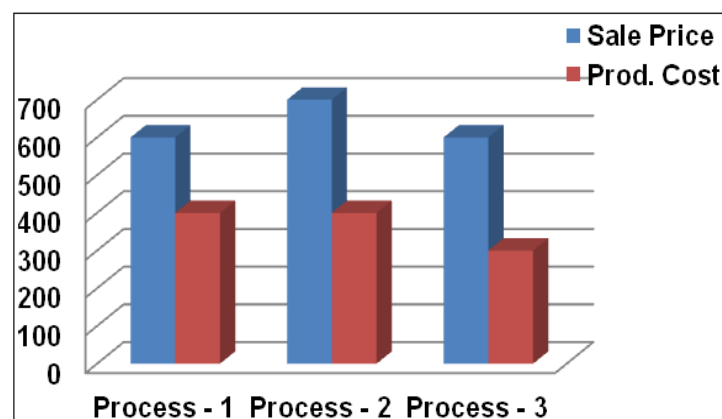


Figure 1: Distribution of Profit in Various Processes

In the above diagram the sale prize and production cost with profit is presented with respect to traditional process flow and lean manufacturing process flow. In the process I and process II the traditional manufacturing techniques are used and in the process ID the lean manufacturing approach is used. Let, we discuss the profit and satisfactions of customers and industry organizers.

Process 1

Profit = Sale Prize - Production Cost

$$\text{Profit} = 600 - 400 = \text{\` } 200$$

Customers satisfied but industry organizers will not.

Process 2

Profit = Sale Prize - Production Cost

$$\text{Profit} = 700 - 400 = \text{\` } 300$$

Industry organizers satisfied but Customers will not.

Process 3

Profit = Sale Prize - Production Cost

$$\text{Profit} = 600 - 300 = \text{\` } 300$$

Both customers and industry organizers satisfied.

When you implement and follow a lean path you should see direct cost savings by driving out the waste. Lean manufacturing is customers focused. Satisfying customer demand is considered to be the key to success in your business. Lean allows your manufacturing deeds to become more closely aligned with other company goals and activities.

LEAN MANUFACTURING TECHNIQUES

Lean manufacturing as discussed above is not easy to achieve. It requires all round improvements in almost every aspect of function of an organization. There are the number of techniques and parameters which help to maintain the lean manufacturing system for an organization. Few are listed below:

- Value Mapping
- Single Minute Exchange of Dies
- Single Piece Flow
- Inventory Control via Card System
- Concept (Separate, Self discipline, Simplify, Standardize, Sustain)
- Total Productive Maintenance
- Visual Management
- Production Line Optimization

BENEFITS OF LEAN MANUFACTURING

It is very clear from the above discussion that lean manufacturing has a lot of benefits for the growth of country. The establishment of lean manufacturing will provide the following benefits for a particular organization

- Reduction in overhead operating costs
- Saves space.
- Quality control
- Sales per employee is higher
- Sales doubles
- Profits soars enormous heights of success
- Lead time cut by 50% to 90%
- Process queues cut by 70%
- Less frustration on-the-job
- Continuous improvement

TYPES OF WASTE TARGETED BY LEAN METHOD

It is interesting to note that the “wastes” typically targeted by environmental management agencies, such as non-product geo-output and raw material wastes, are not explicitly included in the list of manufacturing wastes that lean practitioners routinely target.

Table 1: Eight Types of Waste Targeted by Lean Methods

Defects	Production of Products not as per Specification, Components or Services which Consequence in scrap, Rework, Replacement Production, going over, and/or Defective Materials
Waiting	Delays associated out of stock, delay in processing, equipment downtime, competence bottlenecks
Unnecessary Processing	Process steps that are not required to produce the product
Overproduction	Manufacturing of extra items for which no orders are there.
Movement	Human motions that are unnecessary or straining, and work-in-process (WIP) transporting long distances
Inventory	raw material in excess, or finished goods
Unused Employee Creativity	Failure to tap employees for process improvement suggestions
Complexity	More parts, complicated process steps, or requirement of time more than necessary to meet customer needs

DESCRIBED BELOW ARE EIGHT CORE LEAN METHODS

- Cellular Manufacturing / One-piece Flow Production Systems
- 5S
- Just-in-time Production

- Total Productive Maintenance (TPM)
- Kaizen
- Kanban
- Six Sigma
- Pre-Production Planning (3P)

TOOLS FOR LEAN MANUFACTURING

- **Cellular Manufacturing (CM):** Cellular manufacturing is a concept that increases the mix of products with the minimum wastage possible. A cell is made up of equipment and workstations and is arranged in an order, to maintain a smooth flow of resources and components through the process.
- **Continuous Improvements (5S):** One of the most effective tools of continuous improvement is 5S, which is the starting point for an effective lean company. 5S is a first, modular step towards serious waste diminution. 5S is made up of five Japanese words Seiri (Sort), Seiton (Straighten), Seiso (Sweep and Clean), Seiketsu (Systemize), and Shitsuke (Standardize).
- **Seiri:** Deals with moving those items that are not currently being used on a continuous basis (e.g., items which won't be used for the next month or so) away from those that are.
- **Seiton:** Has to do with having the right items in the right area. Items that do not belong to a given area must not be in that area.
- **Seiso:** Deals with cleaning and sweeping the work place methodically. The workplace should look neat and clean and ready to use for the next shift.
- **Seiketsu:** Is to maintain a high standard of housekeeping and workplace arrangement.
- **Shitsuke:** Is accountability of management to train people to follow housekeeping rules.
- And at times the sixth S for Safety is added though 5 S purists say that an effective implementation of 5 S will eventually result in safety.
- **Just - in-Time:** Closely associated with lean manufacturing is the principle of just-in-time, since it is a management idea that attempts to eliminate sources of manufacturing waste by producing the right part in the right place at the right time. It broadly consists of three elements: (i) JIT production, (ii) JIT distribution, and (iii) JIT purchasing.
- **Kaizen:** Kaizen, a Japanese term that basically translates to 'continuous improvement' or 'change to grow to be good', this is a management concept originated by the Japanese in order to continuously effect incremental changes for the better, involving each and every one within the organization from managers to workers. The aim of Kaizen is to give more and more production value with less and less wastes (superior efficiency), to attain better working environment, and develop a stable processes by standardization.

TOTAL PRODUCTIVE MAINTENANCE (TPM)

Total Productive Maintenance (TPM) is an initiative for optimizing the effectiveness of manufacturing equipment. A team-based productive maintenance which involves every level functioning in the organization, right from the top executives to the worker on the shop floor. The goal of TPM is "profitable PM." It not only requires to prevent breakdowns and defects, but also to be carried out in such ways that they are economical and efficient. To attain this goal following five techniques are to be mastered:

PREVENTIVE MAINTENANCE

It is a daily maintenance (cleaning, inspection, oiling and re-tightening), design to retain the good working condition of equipment and prevent failure.

- **Periodic Maintenance (Time Based Maintenance - TBM)** - Time based maintenance consists of inspections at regular intervals, cleaning and servicing equipment and replacing parts to prevent sudden failure and process problems.
- **Predictive Maintenance** - This is a method in which the service life of important part is predicted based on inspection or identification, in order to use the parts to the limit of their service life.
- **Corrective Maintenance** - It improves equipment and its components so that preventive maintenance can be carried out reliably
- **Maintenance Prevention** - It indicates the design of new equipment.

KANBAN PUSH/PULL SYSTEM

It is a scheduling system for lean and JIT production. The concept of pull in lean production means to respond to the pull, or demand, of the customer. Kanban is a Japanese word that means "instruction card"

SIX-SIGMA

Six-Sigma is a strict, disciplined, data-driven methodology that was developed to enhance product quality and company profitability by improving manufacturing and business processes. Statistical analysis is used by Six Sigma for quantitatively measure how a process is performing. These processes can involve business practices, manufacturing, products, or service.

- **Six-Sigma Implementation**

Two Six Sigma sub-methodologies were developed for this purpose:

- DMAIC (Define, Measure, Analyse, Improve, Control) and
- DMADV (Define, Measure, Analyse, Design, Verify).

- **Pre-Production Planning (3P)**

Pre-production is the process of planning the recording. It's to make sure that no time and money is wasted at all. Pre-production takes the form of meeting to discuss the project.

- **Production Smoothing**

In a lean manufacturing system it is important to move to a higher degree of process control in order to strive to reduce waste. Heijunka, the Japanese word for production smoothing, it is where the manufacturer try to keep the production level as constant as possible from day to day.

- **Standardization of Work**

A very important principle of waste elimination is the standardization of worker actions standardized work basically ensures that each job is organized and is carried out in the most effective manner. A tool that is used to standardize work is what called “takt” time is. Takt (German for rhythm or beat) time refers to how often a part should be produced in a product family based on the actual customer demand. Takt time is calculated based on the following formula [Feld, (2000)]:

$$\text{Takt Time (TT)} = \frac{\text{Customer Demand /Day}}{\text{Available Work Time /Day}}$$

- **Total Productive Maintenance**

Machine breakdown is one of the most important issues that concern the people on the shop floor. The consistency of the equipment on the shop floor is very important since if one machine breaks down the entire production line could go down. An important tool that is necessary to account for sudden machine breakdowns is total productive maintenance. In more or less any lean environment setting a total productive maintenance program is very important.

PRINCIPLES OF LEAN MANUFACTURING

- Identify Value
- Map the Value Stream
- Create the Flow
- Establish Pull
- Seek the Perfection

Today the lean concepts have reached many other industries which include healthcare, service providers and even armed services. The multiplicity of organizations that are practicing lean concepts in them goes to show the universal applicability of lean concepts or lean thinking.

Lean technologies might be unique to the implementation but the lean thinking is universal. In any organization, Lean manufacturing can be implemented in R and D, production, planning, engineering / maintenance, sales, marketing, store etc.

ISSUES AND CHALLENGES IN MANUFACTURING PROCESS

It is well known fact that by application of LMS any organization can reap the benefits of the existing resources. Many companies who put into practice Lean do not adequately take advantage of the improvements. Extremely successful

companies will discover how to market these new benefits and turn them into increased market share. In this age of modern technology & globalization some employees are not aware about a system that can be handy for their professional growth and betterment of working environment. With the application of LMS there is unseen danger of rejecting or overruling of certain existing technique & tools in an organization.

The success of LMS highly depends upon various factors but the key factor is perception of employees and working of the management. Despite the fact that LMS is not a very old technique to strengthen the quality & production in any organization, nevertheless it requires an in-depth understanding, knowledge and skills to apply it successfully in a given frame work. Training generally provides employees with an golden opportunity to hone their latent skills and enable them to become aware about the latest trends & technologies. Since LMS is a new phenomenon so employees require undergoing training seriously. But some times organization thinks that training is an extra financial burden that may reduce their share of profit & of no use for their employees.

LMS is considered as a very useful technique in the modern day setting of organization. it is very beneficial in reducing the cost and waste management. The success of LMS a great deal depends upon planning and implementation of plans & policies. Total quality management have been termed as the need of the hour organization like to have total quality in their management system. 6 Sigma also meant to improve the quality & production without increasing the cost of production. LMS can be very beneficial in implementing TQM & 6 Sigma.

Employees like to see their career graph moving. They always seek and like to be in constant touch with the latest technologies. They can contribute to a great deal to their working organization, if they get proper training & guidance along with healthy working environment. Many organizations consider training as a very important aspect for employee's growth. By providing regular and rigorous training to the employees organisation can easily meet the objectives of LMS. Training programmes need be planed as per the requirement of employees and the organization.

APPROACHES ADOPTED FOR IMPLEMENTATION OF LEAN MANUFACTURING

A successful implementation of any particular management practice frequently depends upon organizational characteristics, and not all organization can or should implement the same set of practice.

- **Unionization**

It is generally supposed that because implementation of manufacturing practices requires negotiating changes in work organization, unionized facilities will resist adopting lean practices and lag behind non-unionized facilities.

- **Age of Plant**

Plant age may imply either a tendency toward resistance to change or a liability of newness. The "resistance to change" view is supported by the organizational sociology literature which suggests that the age of an establishment should inversely influence the rate of adoption of innovations, because organizational forms tends to be "Frozen" at birth.

- **Size of Plant**

Large manufacturers are more likely to implement lean practices than small manufacturers [Shah & Ward, (2003)].

CONCLUSIONS

Waste minimization and improving efficiency have been identified as key objectives of lean manufacturing system implementation, it also reduces machine downtime, wastages & non value adding activities make increased productivity possible. The upper management must stay engaged and constantly challenge employees to improve and develop higher value adding work as a team for the successful implementation of lean. Thus as long as discipline is to be maintained, the lean tools continue to work and expose new opportunities for improvement. It has to be understood that unless and until the concepts of lean manufacturing are embraced and implemented, the company is not moving forward.

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