Review Paper on technology and tool of Lean Manufacturing

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Abstract: *Lean manufacturing also called lean production is very famous philosophy of waste reduction in manufacturing. Many organizations adopted it to enhance quality and productivity. Many researches describe different tools and methodologies to achieve lean. This report describes lean manufacturing, implementation and methodologies. It shows how to change traditional method into new lean method. Lean production focuses on reduction of waste, work standardization, internal logistics improvement, workstation designing. Very positive results are stems from adoption of lean manufacturing philosophy. The role of JIT, TQM and TPM is also described in this report. Ergonomics constitute main part of lean manufacturing. Goal of ergonomics is to design workstations according to human comfort so that productivity is achieved. Currently lean is implemented in various sectors including military, health sector, service sector, food industries etc. various future work are described as industry 4.0 [1],and additive manufacturing.*

Keyword: *lean, Ergonomics, industry 4.0, manufacturing, Waste.*

Introduction: The aim and objective of lean implementation are to achieve competitive advantage by cost reduction and efficient service of customer demand. Its main aim is not only to reduce cost but also to improve company's culture and improve its working style and continuous improvement by eliminating non-value added things and works. The basic aims are:

- Waste reduction
- Inventory reduction
- Cost reduction
- Total lead time reduction
- Waste space reduction
- Bottleneck reduction
- Cellular manufacturing
- Better quality

It is a multidimensional approach includes management practices including JIT, TQM, cellular manufacturing and involvement of supplier. It is focused on waste elimination and non-value added process elimination. Implementation of lean is not an easy task .there are many issue which restrict the implementation of lean i.e customer issues, organizational issues, supplier issues, market issues, top management issues etc. [2,3,4]. It can be used in service sectors and

manufacturing sector. It is widely very famous philosophy, but several manufacturers yet to take the advantage of this philosophy.

Literature Survey: The lean manufacturing stems at Toyota, Japanese automaker which is leading name in automobile sector. TPS also named Toyota production system originated in 1988. This philosophy produced to survive in harsh economic conditions. Due to this philosophy Toyota sustained in difficulties.

It is a set of tools and methods which reduce waste. It eliminates those wastes which do not add value to the product.

It mainly consists of basic tools like:

1) Just in time (JIT)
2) Total preventive maintenance (TPM)
3)Total quality management (TQM)
4) Human resource management (HRM)

Lean implementation is not very easy process; there is not fix process to implement it. Unsuccessful implementation affects company's resources. And also affect employer's confidence. Many plans and process are suggested to implement it.

Very less study on failure of lean is reported, because the companies don't want to share their loss in implementation failure. So it is accepted many companies' fails to implement lean. The cause of failure may be leadership, suppliers, employer's involvement, managerial mistakes etc. Also resistance is there, against change, lack of resources. Management plays an important role in it. It can enhance chance of success as well as failure by its focus many consulting firms provide lean to industries,

Just in time (JIT): It is used to decrease waste and to increase efficiency .according to JIT goods are only received when they are actually needed in the production system. By this technique inventory cost is reduced to great extent. For this good forecast is needed. It makes any company very flexible so that it adapts the new changes in market. But it only works when the supply is continuous without breakdown.

Total preventive maintenance (TPM): it is foundation block of lean production. It place responsibility on workers to routine maintenance. It does not support employment of extra workers. It says check yourself. Those workers who operate the machine itself check machine on daily basis

Total quality management (TQM): it is a long term plan and customer satisfaction centered. All member of organization take part in improvement process. It is process centered. Human resources include empowerment, six sigma, job security, training, participation, job rotation etc. so culture change and company's support is major challenges in adopting lean manufacturing. Human resource management plan or manage labor relations, problems related in implementing lean etc. Human resource management is setup to improve performance of employees .it manage employees within company. It mainly focuses on system and policies. Human resource is responsible for

training, recruitment, development, and rewards. It secures industrial strategic relations and industrial change.

Basic tools of lean manufacturing:

One-Piece Flow: One piece flow is a concept of movement of single work piece at a time on workstations in a cell. It improves work balance and quality [5].

Inventory: Inventories are reduced by improve quality, rejections, inspection. Raw materials are called only when there is requirement.

Quick Changeover/Single Minute Exchange of Die: It is to reduce waste .It is used to decrease the changeover time. However it is not possible to setup in single digit time but it is goal. The aim is to move task from internal to external system [5].

Line balancing: Line balancing is the process to maintain workload equal for every workstation so that bottleneck and non-value added process eliminate

U-line manufacturing system: U line formed when both of ends are at same position [6].

Group Technology: Group technology is about to make group of parts which are similar in looking or manufacturing attributes. Those parts which are same in functional feature, geometry or manufacturing are produced in same location by same process and same machines

Bottleneck process: Bottleneck is the maximum time taken by any operation in manufacturing or assembly line.

Lot size reduction: Initially the lot size should be low to better working of process and to eliminate excess stress on inventory

TAKT time: It means the maximum time in which a component or part must manufactured to meet customer demand

Cellular manufacturing: Its goal is to move quickly, made similar product of wide variety, little waste .it include use of multiple cells in assembly line.

MRP: It is termed as material requirement planning. It is used to scheduling of production and to create material plans. It helps in minimize inventory and better production system.

7 waste reductions: These wastes are defect, overproduction, transport, waiting, inventory, motion, over processing. These wastes must be reduced using lean [7,8].

KANBAN: These cards are used to show steps in manufacturing. Due to its visual nature the easiness of doing work is increase. It is used to control inventory, production and supply of various components.

3M: 3m means MUDA (waste), MURA (unevenness), and MURI (overburden).

5S: 5s mean sort (seiri), set in order (seiton), shine (seiso), standardize (seiketsu), sustain (shitsuke).

KAIZAN: It is a Japanese term which means good change. It is used to improve quality and efficiency through regular small changes

Just in time: It is used to decrease waste and to increase efficiency .according to JIT goods are only received when they are actually needed in the production system. By this technique inventory cost is reduced to great extent.

Employee perceptions: Employee's perception is important factor which influence most. The proper training and confidence is the key to success [9]. Due to changing work culture and process the employee must bear that change in a right faith

Value stream mapping (VSM): VSM is process of make a map which includes material and information flow, to control the activities of supplier, manufacturer and distributor. it identify value addition process [10].

Scheduling: It is very important to have a clear production plan in which resources allocations and service orders are mentioned.

Advantages & Disadvantages-

Advantages

- Fewer infrastructures
- Limited waste
- Strong customer relationship
- Cost reduction
- Easy monitoring
- Flexibility
- Time reduction

Disadvantages

- Missed deliveries
- Negative perception by staff

Scope-

- Industry 4.0
- Additive Manufacturing
- Transfusion of TPM &TQM

Conclusion- The manufacturing era is gaining momentum and continuously spread in upcoming years. Not only manufacturing but other service sectors and production sectors moving toward lean. Due to its principles, lean philosophy is implemented by service sector, health care, government, education, military etc. every company wishes to adopt lean due to low labor cost, low waste, improve production, improve Profitability, flexibility etc. there are various tools to implement lean and various methodologies as well. For successfully implementation of lean manufacturing the various tools are applied very carefully and in proper way. Lean manufacturing is very useful in competitive business because its main focus is on good quality and customer satisfaction and reduction of production divergence.

It use following principle:

- It defines value of product from customers view point.
- Eliminate everything which doesn't add value.

- Create flow of value continuously and evenly.

Above steps pave path of implementation of multi-faceted vision of lean manufacturing. This is a very broad field with new technologies such as additive manufacturing and industry 4.0[11], which further broaden this field more and laid path for new innovations.

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