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## A Literature Review on Application of Lean Manufacturing Techniques

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**Abstract** : The motive behind this paper is to recognize the notion of lean manufacturing, its ideology, several tools and techniques, benefits gained after application and various hurdles towards lean application. As lean techniques reduce waste and increases resource utilization efficiency. There is necessity for lean manufacturing almost in every industry due to competitive environment. Due to fast changing business and its environment, firms are set to face challenges and complexities. It is a useful technique to diminish the movement of non-value-added time. This paper presents a Literature review and tries to recognize the main and handy contributions to this subject. Lean manufacturing uses a different span of methodologies and techniques. Many factors contribute to lean success; not only it is compulsory to implement most of the lean tools, but an organization's culture needs transformation too. Companies following lean manufacturing have better flexibility and a good market share.

**Keywords** - Lean Manufacturing, Lean Techniques, waste, manufacturing firms.

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### I. INTRODUCTION

Lean manufacturing assist in up gradation of production processes and also raises employees moral and job satisfaction [1]. Generally, lean means manufacturing of product without generation of excess [2]. According to lean ideology inventory is measured as waste in firm. Exploring the dissimilarity between conventional manufacturing and lean manufacturing is very indispensable for firms if they want to apply lean practices [3]. As complexity in the market is increasing day by day, so awareness about perception of market dynamics is necessary, if firms wants to implement better manufacturing systems [4]. Majority of the elements that were considered for application of lean techniques included Value stream mapping, which requires to convert natural resource into finished goods by mapping of process and flow of information specific for production line [5], Push and pull system is one where pull system depends upon customer requirements and push system depends upon fixed schedule [6], KANBAN. which is workflow management method for defining, managing and improving services [7]. Main aim of lean manufacturing is to reduce or rather dispose of wastes from the firms. Moreover, a waste in firms can be something that shall not enhance value of the product. Lean techniques when used along with swot analysis assist in removal of wastes from the organization [8]. Lean manufacturing techniques when applied successfully helps firms to increase their production and reduces the inventory [8]. The fundamental aim of lean manufacturing system is to manufacture product of best quality and at lowest possible cost in less time by removing wastes [9]. Application of Lean manufacturing techniques gives positive results by reducing waste through continuous and systematic improvements [10]. However, it is the internal desire from organizations to implement lean techniques that becomes inspiration for them [11].

According to Mahapatra and Mohanty [12] Companies in India use labor only physically and not intellectually. According to study conducted by Singh, Garg, and Sharma [13] in Indian automobile and manufacturing industries, they concluded that if any firms need to implement lean, then main focus should be on management and market issues. Sharma, Gupta, Kumar, and Singh [14] established that for accurate application of lean manufacturing principles, supplies issues are very crucial.

### II. LITERATURE REVIEW

Lean techniques are defined into several steps, they include firstly how to define customer values, second is about value streaming and lastly seeking for excellence [15]. However, there are a no. of techniques that are used while implementing lean manufacturing. According to Bayou and Korvin [16], manufacturing leanness is a technique where generally inputs are less and outputs are better. Singh et al. [17] concluded that lean deployment

techniques, for example lean tools, value stream mapping, kanban etc. have benefitted the industry. According to Bhasin and Burcher [18] lean is more like an attitude fairly than the strategy, if any firm or organization need to get rewards from lean application than supplier along with customer requirement are must. Moreover, lean manufacturing techniques are rather those which aim at unceasing improvement in order to get better results. According to Bhuiyan and Baghel [19] who studied the continuous improvement process from past to present, he stated that in continues improvement there are few diverse techniques which are used to get better results such as six sigma, lean six -sigma etc. Dhamija et al. [20] presented in his study that basically lean technique implementing firms are those which uses fewer material for product manufacturing, minimum workforce for production, reduced time for design and development and less resources as well energy. Lean firms are basically are those which focus on customer demand and hence produces goods that are of high quality in more efficient way.

According to study done by Yan-jiang et al. [21] he found that there are few distinguish factors which are indispensable for application of continuous improvement activities. Malik et al. [22] in his study compared continuous improvement techniques between two countries. Where he stated that though continuous improvement activities gave better result in both the cases, however proportional impact was different. Kuo et al. [23] in his work showed the link among doing manufacturing using lean principles and performance of manufacturing where he stated that some issues such as relationship with customer, involvement with suppliers and supply chain management have better effect on performance.

Wong et al.[24] during his study stated that education about waste management and continues improvement techniques with respect to lean manufacturing are some methodologies that are easily understood by firms owners and organizations, he also found out that technique such as 5S and kaizen remain few other significant lean tools which are additional helpful for companies. Lyonnet et al. [25], developed certain methodologies and determined their penetration level regarding lean manufacturing technique and its application. He found that few methodologies for example value stream mapping, pull system are rarely used. Nordin et al. [26], in his study in Malaysian automobile industries found that two lean techniques that is 5s and Kaizen are mostly used for getting better results from lean manufacturing techniques application. According to Eroglu and Hofer [27], where he studied the effect of inventory on the organization, his results concluded that almost more than 30 % of companies showed no notable effect of inventory leanness in performance of firms.

### III. CASE STUDIES

Lean manufacturing is the name given to a team-based systematic approach for discovering and eliminating different kinds of waste [28]. This section composed of various cases of lean manufacturing. There are numerous tools which are effectively used for removal of wastes from any manufacturing firm. These tools include just-in-time, value stream mapping (VSM), kaizen, material requirement planning, kanban, 5s, etc.

#### **Just in time**

Just in time is considered as core of the lean manufacturing. It is linked with lean techniques. Just in time production gives correct part at the correct place at correct time. Karlsson and Ahlstrom [29] in their work showed that every event and process must be processed in accurate form and according to accurate necessity to produce goods at the appropriate time, final aim is to provide each event with one part at one point and at the matching time when it is required, it is this principle on which Jit works. According to the author, decreasing lead time, lot sizes and decreasing buffer sizes are significant features of jit. Plant size, plant age and unions are some important factors that are discussed by Shah and Ward [30]. According to them Jit has positive effect on efficiency however TQM has less impact. Gunasekaran and Lyu [31] studied the application of jit in Taiwan in micro scale industry, initially training was arranged for workers and eventually after application of 5s tools Seiri, Seito, Seize, Seiketsu and Shitsuke was carried out for the betterment of the quality of products and the manufacturing of the company. Workers were given training in preventive maintenance with respect to equipment on which they use and on machine on which they operate. Initially the forecast system which was adopted was push system which was replaced by pull system so that goods can be manufactured at the appropriate time with right quantity. Gupta et al. [32] analyzed barriers faced by small scale and mid-sized companies while implementing jit, according to him bigger problem with smes while implementing jit was absence of negotiating authority of smes with outside world.

## **Kaizen**

Generally, in kaizen meaning of kai, is change and Zen indicates betterment. So, meaning of kaizen is to change unceasingly for improvement which involves each and every employee of the company [33]. Its main focus is on complete improvement of the product and satisfaction of the customer. Detecting, targeting and eradicating waste (muda) in machine operations, and different approaches used to control labor and production refers to kaizen in manufacturing companies. Rawabdeh [34], stated that housekeeping, standardization and removal of waste are the three factors on which the kaizen approach depends. Chandrasekaran et al. [35] used kaizen philosophy to find answer to the problem of part mismatching in assembly line of an automobile company, gradually kaizen approach was used to remove problems with the assistance of data and eventually finding and selecting one best solution from various other available. Some of the benefits which was achieved after implementing kaizen are complete removal of surplus and substantial savings in expenditure.

## **5S**

5S is a methodology which is adopted from letters of Japanese words: Seiri, Seiton, Seiso, Seiketsu and Shitsuke. This methodology is generally used to shape the workplace and hence increasing the efficiency. In actual scenario 5s was initially intended for manufacturing organizations only, however same methodology could be used in office or administrative environment for getting better result. Gunasekaran and Lyu [36] studied execution of 5s in Taiwan Company which were manufacturer of automobile lamps. Moreover Simmons et al. [37] while their study in medium scale companies found that more lead times, bad quality and lower efficiency to be the big problem. Basically, 5S as a tool is used by firms for standardization of their work and hence increasing the efficiency. Normally, 5S indicates clean housekeeping, standardizing and maintaining them effectively, Jadhav et.al. [38].

## **Value Stream Mapping (VSM)**

Value stream mapping as name suggest is nothing but mapping of all the current production activities. In which generally key areas are identified, where upgrading is desired and to find unnecessary events as same could be discontinued as they don't contribute in manufacturing of goods, Mangla.et.al.[39]. In Value stream mapping generally two maps are created where initial map shows present state of assembly and another one makes a futuristic path for the improvement of the operations, Jannis Angelis [40]. VSM particularly shows the inventory, process time, Lead time, waiting time, etc. According to Pattanaik and Sharma [41] all the production processes must be studied thoroughly to reduce activities that are unessential and which will contribute in decreasing lead time, cycle time, moving time and other wastes. Singh et al.[1] implemented VSM technique in a manufacturing firm and found certain benefits, after application, firm achieved reduction in process inventory almost by 80%, inventory of final goods were reduced to about 18% , lead time was condensed to about 80% and workers output was improved up to 17%. Paranitharan et.al.[42] in their study analyzed and redesigned assembly line in automobile company, Inspection of layout displayed that there is separate location for assembly and cylinder greasing operation and after doing proper analysis the layout was redesigned and trolley was arranged to overcome this problem.

## **Kanban**

Kanban is a type of lean manufacturing systems in which movements of materials in assembly line is carried through cards, it was formed to manage inventory levels the overall production and components supply.

Junior et al. [43] said that the implementer of Kanban can easily classify and analysis the variation in Kanban system with the knowledge which he acquired during application of diverse Kanban system. According to Sipper et al. [44], Kanban system can be characterized by card system which is used for signaling production and transportation activities. Abdulmalek and Rajgopal [45] made a simulation to demonstrate the condition earlier and afterwards application of Kanban system. Excessive inventories, a no. of non-essential activities, are few of

the shortcomings which were analyzed and eventually Kanban system proved to be beneficial for better production flow.

### **Waste elimination**

A view from the study of various articles indicates that about 70% of unwanted waste in manufacturing system generates due to inventories. Inventories has a vital role in any organization's turnover, A detailed literature from manufacturing companies indicated that about 30% firms attempt to rise their inventory turnover, Krisztina Demete.et.al. [46]. Moreover, target of lean manufacturing firms is comprehensive removal of waste, As stated by Sakakibara.et.al [47] excessive raw material inventory is due to poor production plan, in appropriate raw material availability, and needless transportation between different work stations.

## **IV. CONCLUSION**

Firms where Positive execution of lean technique happened shows that lean application requires collective efforts right from the workers to middle management to top management. Various lean tools and techniques which are demonstrated here through various case studies exhibited that there are lot of advantages. Various surveys were also taken to find the level of understanding of lean manufacturing tools within the organization. Nevertheless, despite of the circumstances that lean application has various advantages associated with them, but there are few barriers also which are becoming hindrance for proper application of lean techniques. Some of the barriers are financial problems, not ready to change, which is likely a psychological problem, lack of sense of responsibility and finally lack of awareness regarding lean application, but it has been proved without any dilemma that if any firm or organization needed to increase their competitive edge then adoption of lean attitude becomes almost indispensable in present scenario almost every industry has to leave conservative attitude and align their work practice which is more towards lean.

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