Implementation of Lean Manufacturing: A Review

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***Abstract*—Lean manufacturing is an effective tool to increase productivity of an industry by reducing wastes in the supply chain and enhancing the balanced use of manpower, machine and materials through continuous improvement. Every industry faces wide variety of challenges, which can be overcome by correct implementation of lean tools thus making production more efficient and adding more value in every part of process and sub-process.**

***Keywords*—lean implementation, lean manufacturing, lean tools.**

I. INTRODUCTION

LM was originally invented by the Toyota Manufacturing Corporation in the 1950s through its extraordinary manufacturing system, which was familiar with the Toyota Production System (TPS). In its development, the principles of TPS were then actively adopted by the US and European manufacturers under the name of "lean". Lean means "less" and at the same time "more". Less is in terms of non-value-added activities, costs, defects, lead time, space, number of employees, number of suppliers, and inventory. On the other hand, it can also mean more in terms of quality, productivity, sales, customer satisfaction, profitability, and sustainability. Due to its superior contributions, numerous corporations all over the globe endeavor to adopt the LM principles to increase their performance. Lean production is more like a guide for building a stable organization that evolves constantly and helps to identify actual problem and remove them. The main purpose of lean production is creating a value to customer by optimising resources. Lean production principally aims to create a stable workflow based on actual customer's demand. Continuous improvement is a major part of lean production, ensuring that every employee is involved in the process of improving

II. IMPLEMENTATION OF LEAN MANUFACTURING

Rebecca M. Nunesca and Aile T. Amorado, (Ref-1) Their study was focused to use and apply lean tools, at BY Garments Industries, Inc. as ways of improving manufacturing systems that lead to reduction of wastes and standardization of cycle time. Researchers used questionnaires, 5S audit checklists and time study forms in information gathering and cycle time computation. It was observed that company does not have a standard operation time and also there were some non-value activities like unnecessary transportation, manual counting. After the consideration of Lean tools the standard time was determined, non-value adding activities were reduced. Productivity was improved, the man power for the given volume demanded was reduced, work in process inventories were also reduced very effectively, efficiency increased to 100% from 74% by implementation of line balancing. The defects due to poor 5S practice were also reduced.

Singh M.P et. al.(Ref-2) their study provided insight into the current status of Lean, the reasons of Lean implementation and also the reasons for not implementing lean processes in Indian industries. This study concluded that Indian manufacturers recommend lean due to its characteristics of quality improvement and customer satisfaction, waste elimination, decreased production cost, increased demand management and efficiency. The strongest reason for not implementing lean is infeasibility to produce in small batches, unfamiliarity with lean/JIT manufacturing, lack of education and expertise on lean. It was found that automobile sector has highest degree of Lean implementation whereas electrical goods manufacturers had the lowest degree.

Shyam Lal Sharma et al.(Ref-3) investigated the implementation and analysis of Lean Manufacturing techniques and their tools, basically in Automobile Industry. The research methodology adopted here was the study of LM tool's practical analysis and improvement in the industry - Career Wheel Pvt. Ltd. This study uses the tools like JIT, JIS, 5S and continuous improvement in production line, assembly line and in quality inspection department. The main focused area in the study was to reduce the inventory waste which is the mother of waste. As after reducing inventory levels the wastage has automatically reduced and the major outcome after its perfect implementation is its teamwork and also the reduction in lead time due to which flexibility gets improved. At last the author concluded that LM helps them to maintain their products level which leads to overall upshot of development and by adopting this methodology they get to know about the principles, process and application of LM tools in auto components (wheel) manufacturing industry as according to research conducted by Lean Enterprise Research Centre (LERC) 60% of production activities in manufacturing operation are waste-they're of no value to customers. And they are going to make this approach stable in large as well as in small scale industries in near future, which will increase their productivity by using lesser input and giving more output.

Martin Pech and Drahoš Vaněček (Ref-4) discussed traditional and modern methods of lean production and their use in different sized enterprises. The approach adopted was a questionnaire survey and researches, 90 industrial enterprises (in US) were classified by size, production scope and their ownership. They have analysed the results by means of statistical methods to determine the difference in the use of lean production methods. According to their research size of enterprise is an important factor. The useof both traditional and new methods increased towards large enterprises but there is a big potential for implementation of new methods in SMEs. Regarding the specialisation, it was confirmed that enterprises generally prefer the traditional methods to the new ones. Engineering is implementing new

methods, followed by food industry and household supply production, using Electronic Data Interchange (EDI) and Computer Aided Manufacturing (CAM). Regarding the owner it was proved that the enterprise with foreign owner use traditional and new methods of Lean manufacturing more. The study concluded that four methods: Kanban, Continuous Improvement, 5S and Value Stream Management (VSM) gives better result out of the all other methods.

Ofori-Nyarko Ernest et al.(Ref-5) employed a cross-sectional correlation design, which is the most suitable for testing non-casual relationships or hypothesis. The population of study was employees of some manufacturing firms in Accra, namely Accra Brewery Ltd (ABL), Guinness Ghana Breweries Ltd (GGBL) , Coca-Cola Bottling Company Ghana Ltd (CCBCGL) and Kasapreko Ghana Company Ltd (KPCL). The study found that lean operations have a positive influence on operational performance, which means that operational performance in the beverage Company would improve when lean operations are enhanced in practice. The study however did not confirm the relationship between lean operations and marketing performance and it concludes that lean management best predicts operational and financial performance of the firm in the beverage manufacturing industry

Muthukumaran. V et al. (Ref-6) painted the picture of various lean tools which are being used in various industries and also attempted to correlate and compare the choices of Lean tools in different industries .The results obtained from this paper gave an overview of widely implemented lean tools across manufacturing verticals in different types of manufacturing industries.

Gusman Nawanir et al. (Ref-7) performed a quantitative cross-sectional study for examining the impact of LM on triple bottom line (3BL) dimensions- economic, environmental and social performance. As small and medium enterprises (SMEs) are one of them who are responsible for several environmental degradation and instability in environment have triggered society to considered sustainability issues. One of the operational initiatives related to sustainability is LM which is an imperative factor in today's volatile competitive market. So the author has performed a questionnaire survey on SMEs in Malaysia. The survey questionnaire was to predict the structural effect of LM on sustainability performance measures. A total of 159 manufacturing SMEs participated which implied that in order to enhance sustainability performance, SMEs should adopt the LM concepts holistically. The paper extends the boundary of knowledge by lessening the existing gaps in literature to support the notion of potential implications of LM on sustainability. 159 responses were used for the subsequent data analysis which leads to 22.71% effective response rate, in which 17.62% automotives and vehicles, 23.27% were electronics, 8.81% rubber and plastic products, 12.58% furniture and 15.09% textile related etc. Based on the respondents' positions in their company, the majority of them hold production managers (40.25%), head of production department (32.70%) and production directors (27.04%). Most of the respondents have been serving in the company for more than 5 years (63%) whereas 37% of them served their organisation between 3 and 5 years.

Mr. Prabhu Santhanam and Dr. P.Sapna (Ref-8) identified 24 variables that affect the implementation of Lean production system. The lead time in traditional manufacturing is very high due to various wastes in process whereas lean manufacturing focuses on shortening process, product lead time. It was found that various factors are responsible for successful implementation of Lean production, the inter and intra organisation factors of business should be given pre dominant significance 81.9% , the other important factors-environment factors(10.1%), work force factors(4.1%), technical factors(3.9%). Innovative products, processes and speed to market are important aspects for improving the competitiveness for this organisations practice programs like Kaizen, Training for employees, Brain storming, cellular manufacturing, etc. But still the organisation face various problems while starting an executing such programs.

III. CONCLUSION

It is therefore concluded that improving lean operations by investing more in it and training employees to more effectively handle its planning and execution can engender operational efficiency in the firms and increasing lean management can cause an increase in financial performance. Increasing the effectiveness of lean operations can offer the companies higher profitability. Hence, it is effective to practice Lean Manufacturing.

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