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A Review On Lean Manufacturing Principles , Barriers, Company Involvement And Application Of Industries

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ABSTRACT: Nowadays, industries are aimed to improve their productivity without compromising quality of the product. In order to achieve that, industries are used to implement new management philosophies like lean manufacturing, agile manufacturing and total quality management etc. This paper mainly focussing review on lean manufacturing principles, barriers, company involvement and application of industries while implementing lean manufacturing.

KEYWORDS: Lean manufacturing, principles , application.

I.INTRODUCTION

Lean manufacturing/production has been a term that has been in widespread usage since the early 1990's when Womack and Jones first used it to describe the Toyota Production System. Similar to its predecessors of craft/job shop production, mass production and batch production, lean production is a generic term that is used to imply a particular way of going about the manufacture of a particular product. Henry Ford's insight of lowering the expense associated with making a product by shorting the production cycle times is similar to that of lean production. A lean production manager is challenged to find new ways to increase the productivity and efficiency of their business.

Because manufacturing environments vary due to differences in their purpose, design and control, there is no single set of management procedures that can be universally adopted to govern them (Hayes, Pisano, Upton, & Wheelwright, 2005). However, lean production provides us with a starting point for viewing a company's operating practices with the final goal of seeking operational improvement. Manufacturing managers are responsible for demonstrating a sound understanding of their manufacturing systems, in order to create work environments that are creative, competitive, and continuously improving (Hopp & Spearman, 2001). It therefore means that operations managers hoping to join to workforce will have to be able to replace their ageing counterparts and also continue the lean revolution (Linford, 2007). The college of technology, at Purdue University, has developed an introductory course to lean production/manufacturing for freshmen and sophomore students in hopes that a better educated workforce will be present to undertake the continuation of the lean revolution. [1]

II. LITERATURE REVIEW

Lean manufacturing is defined as "A philosophy, based on Toyota Production System, and other Japanese management practices that strives to shorten the time line between the customer order and the shipment of the final product, by consistent elimination of waste". All types of companies, manufacturing, process, distribution, software development or financial services can benefit from adopting lean philosophy. As long as a company can identify a value stream, from when the customer's order product to when they receive it, lean principles can be applied and waste removed. Also,

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lean manufacturing is: "Adding value by eliminating waste, being responsive to change, focusing on quality, and enhancing the effectiveness of work force". Another definition for lean manufacturing: "it is a systematic approach to identify and eliminate waste (non-value added activities) through continuous improvement by following the product at the pull of the customer in pursuit of perfection" .

The lean manufacturing paradigm, discussed in an extensive manner in the literature, is considered applicable to the majority of the industrial and service processes, bringing benefits like productivity improvement, more aggregate value in the products, waste reduction and higher level of customer's satisfaction.

The term "lean" was introduced by Womack et al. (1992) to describe a "better way of organizing and managing our relationships with clients, supply chain, product development and production operations", based on the Toyota Production System (TPS). The lean principles can be briefly stated as value – enhancing value to the customer, value stream – identifying where the value is created and removing the waste where it is not present, stream – making the product to flow in line, without interruptions, pull – producing only what the customer or next process solicits, and perfection – to pursue the perfection,removing more waste continuously .

Kasul and Motwani (2) studied the Toyota Production System (TPS) implementation strategy at a medium-size automotive manufacturing corporation, located in the Midwest region of the USA. Motwani discussed the strategic implementation of lean manufacturing paradigm and also the lean manufacturing concepts, requirements and success factors of implementation.

Vijaya Ramnath et al (3,4) analysed the use of Kanban system for implementing lean manufacturing. They also evaluated suitability of lean kitting assembly using fuzzy based simulation model for a automotive industry in India.

Forza (4) studied the difference between lean productions in traditional plants, with more critical view on work organization practices in relation to lean production. He proposed a framework which would be useful to Lean manufacturing paradigm in the foundry industry research linkages between work organization and lean production practices, emphasizing the importance of human resources.

Lee and Oakes (5) discussed some templates for change in smaller component suppliers, as world-class manufacturing (WCM), lean production (LP), total quality management (TQM) and business process re-engineering/redesign (BPR). They stated "the smaller firms at first and second-tier levels in the manufacturing sector supplier chain appear to be becoming more aware that in order to remain competitive they must implement new methods in one form or another".

Vijaya Ramnath et al (6) proposed a model to optimize inventory of a assembly shop using Kanban based system aimed to implement lean manufacturing.

Venkatraman et al (7) used value stream mapping (VSM) tool for new machining process to reduce cycle time in a manufacturing process and found that using value stream mapping the process ratio was increased as compared to the existing setup.

Baker (8) focused on material conversion value chain and the problems regarded organizational environment. To show us the impacts in the social aspects of manufacturing process by taking a case industry.

Harrison and Storey (9) analysed Just-in-Time (JIT), Total Quality Management (TQM), Lean Production (LP) and Word Class Manufacturing (WCM) and explored that the subject through their concept of New Wave Manufacturing (NWM), with an approach of the unsuccessful implementation factors of these manufacturing paradigms, as well as the implications in the social field of production.

Conti et al. (10) presented a study about the lean implementation and the possible stress on workers with this new form of work. In attention to buffers and work pace control, they stated that are not so related to more stress but the cycle time reduction can increase the workers stress level.

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Chakravorty and Atwater (13) compared through simulation, the performances of lines designed using the line balancing based on traditional western approach and based on the Just-in-Time (JIT) approach. They found that the just-in-time lines are based on the philosophy of continuous improvement through the elimination of waste and a pull system of production. They developed a simulation model the result of which indicated that when inventory in the system is low, the balanced line performs better than JIT line, and when the inventory in the system is high, the JIT line performs better than the balanced line.

Toni and Tonchia (14) explored the lean production paradigm leading to the adoption of management by process and emphasized the necessity of creating some performance measurement Lean manufacturing paradigm in the foundry industry indicators, treating each stage or process as a sub-factory, each with its own management criteria and responsibilities.

Muffatto (15) studied the similarities, influences between and evolution of the lean production model and the Volvo production system, from the point of view of assembly design, work organization and automation. He concluded that the lean concepts applied in Japanese industries have changed to refine and perfect the various techniques (or mechanism) of this philosophy and are been adopted by many European and American firms.

Vijaya Ramnath et al (16,17) used VSM for evaluating material productivity in an manufacturing shop. Also, used multi criteria decision making tool for selecting optimal assembly line in a two wheeler manufacture assembly line. The result shows that lean kitting is a suitable method for the same.

Neumann et al. (18) presented a study comparing parallel and serial flow strategies in design of production system. They explored the advantages and disadvantages in changing of parallel cell based assembly to serial line assembly in Swedish company, focused on productivity and ergonomics.

Garg et al. (19) examined the need of multi-skilling of workers in an assembly line under probabilistic demand conditions to solve the line balancing problem at different production rates, and illustrated the model created by simulation in a real life case of assembly operations of an engine plant. They found the benefits like reduction in overtime costs, greater employee versatility, leading to job enlargement, increased worker awareness and participation in the manufacturing process and flexibility in operations.

Gerwin (20) discussed the flexibility needed to support the uncertainty generated owing the variability of demand for the kinds of products, different product life cycles, machine downtime, meeting raw material standards and others uncertainties. They also suggested that flexibility as mix, changeover, modification, rerouting, volume, material and sequencing flexibilities.

Schmenner and Tatikonda (21) revisited the Gerwin's work to update based on the changes occurred like as machines capabilities, computer based controls improvements, machine and process flexibility. The lean manufacturing paradigm literature has been concentrated in the area of automobile industry, but some authors have researched the application in different sectors.

Lee and Alwood (22) proposed a lean response to the problems encountered in temperature dependent processes during interruptions, such as metal forming, food manufacture and chemical processing. In their study, they attempted to verify the lean manufacturing concept of stopping the production line to find the "root cause" of the problem, when an interruption occurs. They created a script, implemented in a simulation, which provides a means of establishing standardized practices adapted for temperature dependent process, where the operators participate directly in a decision-making process.

Lapierre and Ruiz (23) customized the commercial software MsAccess97, to solve the problem of balancing and management of complex assembly lines. Starting with a simple heuristic approach, the researches offered a good solution on a real industrial case. Applied in an assembly line of appliances, with Lean manufacturing paradigm in the foundry industry two sides and two different heights, achieved determine the number of workstations and workload distribution, and compare the heuristic to the handmade solutions.

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Simons and Zokaei (24) discussed the application of lean paradigm in a new sector – the United Kingdom red meat industry and explain how some lean techniques applied in industries can improve productivity and quality, specifically in the red meat cutting plants. They focused on some lean techniques such as "takt time" and "work standardization".

Rajakumar et al. (25) proposed a model to solve the assembly parallel planning problem of a textile machine in a shop floor, with precedence relationship. aimed to determine strategies of sequencing (random, shortest processing time and longest processing time) to allocate assembling operations to workers, in a way of obtaining better balancing in their workloads, using a computer simulation program. They also addressed application of lean paradigm at the small to medium sized foundry industry in Brazil, in a way to improve the industrial lay out and line balancing, using a simulation model developed to test the concepts.

A. Lean barriers

To implement lean manufacturing system is not an easy task. For any change in organisation to take hold and success, the resistance forces or barriers need to be identified and understood. Failure to access organisational and individual change readiness may result the management to spend significant time and energy. Dealing with resistance to change requires a lot of risk and hard work .The lean barriers are analysed based on the status of lean implementation by the respondent companies.which are indicated from the previous section. The three main barriers in non-lean firms are the lack of lean understanding, lack of senior management and middle management attitudes. On the other hand firms which are in-transition towards lean system, most of their barriers are in the lack of lean understanding and employees' attitude. Again for lean firms, lack of lean understanding is identified as the main barrier to implement LM system successfully. Interestingly, all firms recognize the main barrier is the lack of lean understanding. This is because LM requires new knowledge and cultural change during the transition. LM should be applied comprehensively and holistically in principles and concepts. The ability of people to respond and adapt is critical when they face any change in situation. Appropriate communication and training on the concept and basic principles of LM system would give greater level of understanding about the system and encourage motivation and innovation in the work culture and employees attitudes. [26]

B. Employee Involvement

The employees' responses showed that the LE implementation had a generally positive. The finding of this study indicates that LE plays a significant role in company's performance. The overall benefits from the implementation of the LE included the following: enhanced company competitiveness, reduction of costs, a shorter lead time, elimination of waste, and improved product quality. Essentially, the researcher found that increased work intensity and stress to which employees referred were not necessarily reflected in their responses to other questions. The employees' work became more regular due to the implementation of the LE, and employees believe that the LE is assisting their work in the correct way at SMC. The organization should consider establishing an internal monitoring body to evaluate the efficacy of LE. Management support is crucial in this regard, and corporate strategy and written policies underpinning LE play a significant role as well. It should be noted that the findings pertain specifically to the organization at which this research was undertaken. This small sample is a consequence of the size of the organization as well as of the exploratory nature of the study and the restrictions on its nature. [27]

C. Top Management Commitment

Customer involvement in quality program, Quality of human resources, Collaborative decision making, Capability & competence of sales network have been proved the hypothetical test with Top management commitment in lean manufacturing system implementation in Indian automobile industries. Literature review and discussions with experts have helped to findings the correlation among factors applicable to lean manufacturing system implementation based upon their importance. Top management is the
initiative variables which has leadership relation with the other variables to implement lean in automobile industries. Literature review and subsequent discussions with experts have helped to sort the factor relevant to lean manufacturing system implementation based upon their importance. There is relationship between the top management commitment and Capability and competence of sales network that was shown by the p-value which is less than 0.001. We can say

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that if we want to a waste free and value added manufacturing environment then these variables (Top management commitment, Customer involvement in quality program, Quality of human resources, Collaborative decision making, Capability & competence of sales network) are very useful for in implementing lean in Indian automobile industries. [28]

D. Lean Benefits to Bangladesh Garment Industry

Study and Implementation of lean manufacturing in a garment manufacturing company is carried out in this research. This research is implemented in a Bangladeshi garment manufacturing company. For the first few weeks we tried to learn the processes in the garments finishing department. Then study and analysis those processes are performed using some lean manufacturing tools and techniques and found some problems. Eventually some layouts and process flows are proposed that improves the productivity and reduces cost. The better utilization of manpower and factory floor space is also ensured by implementing the proposed layout. At the same time proposals help to develop a good relationship among the workers and will provide an easier way for the management to coordinate and integrate the factory production with the current level of resources. [29]

E. Lean Benefits to Indian Garment Industry [30]

Finally, this research has the proof of advantages when applying lean principles to the garment shop floor. According to our familiarity, it is the prime time that lean thinking has successfully implemented in the garment shop floor. We hope that this paper contains its worth for practitioners in the garment industries. Due to increased customer expectations and severe global competition, the Indian garment industries try to increase productivity at lower cost and to produce with best product and service quality. Under these considerations, the authors have implemented lean manufacturing techniques to improve the process environment with reasonable investment. In this paper, the effectiveness of lean principles is substantiated in systematic manner with the help of various tools, such as Value Stream Maps and SMED. Even though, the complete success of the application of lean thinking in the extensive run depends on close understanding between the management and shop floor personnel. Effective management information systems are required for instilling proper organizational values and continuous improvement programs. If these management principles are fully integrated with shop floor principles, then lean systems can be applied efficiently to attain the maximum output. The uneven supply base creates barriers in attaining integration between the links in supply chain. Therefore future studies can be made on supply chain management, to achieve good control, reliability and consistent performance.

III. CONCLUSION

This paper dealt with various literatures related with lean manufacturing principles and applications and concluded that the exposures on lean topics is the interface between employee and top management commitment and together applying the concept of lean.

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