

A LITERATURE REVIEW ON HOW LEAN MANUFACTURING USED AS A TOOL IN SERVICE INDUSTRY

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Abstract - Lean manufacturing is a concept that is purely used for a manufacturing industry but can also be applied to service industry so this paper is about a review how lean manufacturing helps service sector to overcome the problem. In a service sector day by day, there is an increase in customer demand for quality service and cost reduction. This paper shows the use of lean production in pure service context and the role of lean techniques for service improvement. Research findings say that lean thinking has a valuable addition to the service industry from their way of traditional approach. Lean thinking has already well-established in the manufacturing industry and less in the service industry when compared to the manufacturing sector. Thus the review shows how lean thinking helps to increase better quality service and cost reduction to meet customer demand.

Key Words: lean manufacturing, service, Hospital, Education, Telecommunication centre

1. INTRODUCTION

Lean manufacturing is a new technology or concept that is used in manufacturing industry to eliminate waste industrial waste which in turn reduces the cost of operation, lead time of a product. Normally this concept is widely used in the secondary sector. When compared to manufacturing industry service industry uses this lean manufacturing concept in low level but when used in service sector the industries can be very much successful in customer satisfaction and customer retention. This is because the service industry mainly concentrates on customer satisfaction and customer retention. The main aim of lean manufacturing industry is to make customer delight. Hence this lean manufacturing concept helps service sector in customer satisfaction and retention. Customer retention is more important than customer satisfaction. Retaining the customer is more important than gaining new customer.

1.1 SERVICE SECTOR IN INDIA

Service industry in India concentrates 66 percent in India's GDP in the year 2015- 2016. This sector has attracted much foreign investment flow and has provided large employment to many citizens in India. The service sector in India are

- Information technology
- Trade
- Education

- Financial services
- Media
- Hospitality, accommodation and food services
- Entertainment
- Transportation
- Communication
- Tourism
- Financial services
- Public utilities

1.2 HISTORY OF LEAN MAUFACTURING

Many of the concepts in Lean Manufacturing originate from the Toyota Production System (TPS) and have been implemented gradually throughout Toyota's operations beginning in the 1950's. By the 1980's Toyota had increasingly become known for the effectiveness with which it had implemented Just-In-Time (JIT) manufacturing systems. Today, Toyota is often considered one of the most efficient manufacturing companies in the world and the company that sets the standard for best practices in Lean Manufacturing. The term "Lean Manufacturing" or "Lean Production" first appeared in the 1992 book 'The Machine that Changed the World'. The Lean Production concept, introduced by Womack, Jones, and Roos (1990) Based on a comparative study in the automobile industry from Japanese and other parts of the world, could be seen as a quantification of earlier "world class" and just-in-time (JIT) manufacturing studies (Schonberger 1982; Monden 1983; Shingo 1981, 1985). Womack, Jones, and Roos (1990) described the supply co-ordination system from the Japanese point of view. Lamming (1993) developed the concept of the Lean Supply Model, describing supply-chain management practices within lean production. The origins of lean thinking can be found on the shop-floors of Japanese manufacturers. In particular, the early work of Toyota has been highlighted. Lean production was first defined by Womack, Jones, and Roos (1990) as a system that create outputs using less of every input, similar to the traditional mass-production system but offering an increased choice for the end user. This definition of lean production was based on the concept of waste ("muda") introduced by the Toyota Production System (Shingo 1981). Waste means non-value adding activities that, in the eyes of final customer, do not make a product or service more valuable (Hines and Taylor 2000). The main pillars of lean production are management of processes and the integrated logistics flow; management of relationships with employees, teams, and suppliers; and

management of the change from traditional mass production (Hines 1994). After 1990, lean production focused away from the shop floor. The value-stream concept evolved and was able to extend beyond manufacturing to the single company stretching from customer needs right back to raw-material sources. Womack and Jones (1996) crystallized Value as the first principle of lean thinking. They define the Lean Enterprise as a “group of individuals, functions and legally separate but operationally synchronized companies. The notion of value stream defines the lean enterprise.” As such, lean had moved away from a merely “shop-floor-focus” on waste and cost reduction to an approach that sought to enhance value (or perceived value) to a customer by adding product or service features while removing wasteful activities (Hines et al. 2002).

2. LITERATURE ASSESSMENT

The review was done from journals collected from last one decade on lean implementation on service industries.

MANISHA BALAJI [1] has proposed in his case study in which an educational institute implemented business process engineering. In the research the reasons for BPR implementation was due to customer relationship enhanced, gain competitive advantage, for better improved change, financial risks, global business trends, cost reduction. After implementing the impact for the organization was good customer satisfaction, Standardisation of enrolment and enquiries procedures, reduction of cost in operation, improved lead time, Able to overcome and maintain profitability during industry downtime in 2003. The success of the project was due to the prior planning and understanding of the processes led to integration with the project goals.

ALBERTO PORTIOLI-STAUDACHER [2] has given an idea how lean manufacturing implemented in different context of application in service industries. The research was done on logistic companies and financial sectors which concentrated on implementing high volume and low variety and focus on back office activities. The author found that the lean implementation in service has been just started so it is very much important to make it successful and therefore he decided to brainstorm through structured questions in few service companies that were going to implement lean. The author believes that for a successful implementation it is important not to focus only on the differences among industries, but, most of all, on differences among processes (value streams in the Lean terminology). The result is shown how the companies involved in lean transformation in their process.

NIALL PIERCY ET AL [3] has given a suggestion how lean manufacturing is used as an application on improvement techniques on service sector and evaluated the contribution on lean on service improvement. The research was observed on the British financial sector, tracked the

process of lean improvement and highlighted that the adoption of lean service tool, service call centers can serve both of the traditionally competing priorities of operational cost reduction and increased customer service quality. The study on the British financial sectors such as Policy Co, Bank Co, and Claim Co of their core business has been described. The results have been identified based on Average Number of calls per day, Average number of letters per day, Average employee productivity, percentage of failure, longest time to complete customer request, Number of steps in total cycle, number of departments involved in total cycle, Average number of policy holders as work-in-process has been tabulated and shown the percentage of reduction.

TOM JOOSTEN ET AL [4] have given an idea on a health care service on the application of lean thinking. They believe that lean thinking evolved from an automotive manufacturer to management approach on operational aspects and sociotechnical aspects. They found the value added activities and Non value added activities in a health care Centre. After implementation of lean thinking they have concluded that the lean message is 100 percent positive and Lean can improve safety and quality, improve staff morale and reduce costs—all at the same time. They also concluded the results based upon the operational aspect of lean thinking and sociotechnical dynamics aspect of lean thinking.

TAMER H. HADDAD [5] has suggested a solution for hospital facilities based on the implementation of total production maintenance. Since Total Production maintenance is used as an implementation methodology which is developed for increasing medical devices utilization and decreasing their failure. The case study was done in a hospital located in Jordan using in-depth interviews coupled with observations and documents collection. The maintenance activities involved in the hospital is classified into several branches such as medical device, civil building, mechanical device, electrical device so the research is concentrated on the medical device branch of the health care industry. The methodology for the research was done by depth in interviews such as thirteen interviews in total were conducted in research site, eleven were front-line employees from the maintenance department, and two senior managers in the maintenance department. The author concludes that TPM principles have a dramatic result when compared to the traditional maintenance principles found in most of the health care industry.

ABEER I. ALDAYEL ET AL [6] proposed a case study on the success factors of ERP in an education sector. ERP is enterprise resource planning which plays a major role in managing business process. The paper deals on implementation on ERP and the critical success factors of ERP in a education service sector. This research was done in a higher education system in Saudi Arabia and used certain ERP system named Madar developed by King Saud University in Riyadh to measure the success factors of ERP. The methodology of the research was conducted using two

questionnaires that were designed based on the chosen CSFs (ERP Critical Success Factors section). The CSFs are op management commitment and support, Change management, Project management, Business process reengineering and customization, Training, ERP team composition, Clarity vision/ goals & objectives, consultant participation, Departments (Stakeholder) participation, ERP system selection, ERP systems integration, Resources support, Scope of implementation, choosing of the supplier & its support, Outsider competition. The conclusion of the research, the most important critical success factors of ERP implementation in Higher Education sector in Saudi Arabia is in the area of project management.

VLACHOS ET AL [7] have discussed about how lean practices are implemented in service sector. Since lean is used widely in manufacturing and there is evidence for the application of lean in service industry especially in hospitals so the research was done in a European hotel industry to look how lean practices are applied and the performance of the industry. The survey was done by preparing a questionnaire and sent to 19 members of small and medium hotels in the European state union and value stream analysis for finding the value added activity and non-value added activity. The author used 7 value stream techniques such as Process activity mapping, Supply chain response matrix, Production variety funnel, Quality filter mapping, Demand amplification mapping, Decision point analysis, and Physical structure and used 2 value streams: Reservation and procurement value stream for the analysis. The examination of the seven value stream mapping tools resulted to significant findings. In particular, Process Activity mapping tool revealed high percentage of operational time of both "value streams", indicating that waste largely depends on external factors. so the study examined show lean techniques which are being successfully applied in manufacturing industries, could offer benefits and solutions in the hotel industry.

NGAI AND WAT [8] presented a common critical success factors (CSFs) for ERP implementation that are shared across 10 different countries/regions. Eighteen CSFs were identified with more than 80 sub-factors for the successful implementation of ERP. They found the most CSFs are as follows: appropriate business and IT legacy systems, business plan/vision/goals/justification, business process reengineering, change management culture and programme, communication, ERP teamwork and composition, monitoring and evaluation of performance, project champion, project management, software/system development, testing and troubleshooting, top management support, data management, ERP strategy and implementation methodology, ERP vendor, organizational characteristics, fit between ERP and business/process, national culture and country-related functional requirement.

BOZENA POKSINSKA [9] has presented lean production on healthcare service industry. The paper deals about the current state on the implementation of lean

production and also focuses on healthcare, implementation process, barriers, challenges, enablers and outcomes of implementing lean production methods in healthcare. The approach was done in a comprehensive search of literature on lean thinking of health care, quality management, operational management. The research findings show that the process improvement approach is used in lean production area and focuses on 3 main areas such as define value, values stream techniques and eliminating the waste. Value stream mapping is one of the lean tools which are widely used in health care industry for lean implementation. The results have been taken and the outcomes have been classified into the performance of the healthcare system and the development of employees and work environment. The study concludes Using Value Stream Mapping, all steps in the patient journeys are analyzed as a whole from start to end: from diagnosis, through treatment, to discharge. This allows for reducing waiting times and duplicate work and ensuring that the interrelated steps connect and with some challenges which face the implementation of lean in health care.

FADI TAHER QUTAISHAT ET AL [10] has given an empirical study on ERP implementation and its effect on productivity, service quality and innovation. The research was done on a telecommunication service sector in Jordan to identify the effects on successful implantation of ERP. The methodology of the research was done through Data collection via questionnaires from 129 employees working in the Jordanian telecommunication organizations. The collected data were analyzed using descriptive statistics and structural equation model to test the study hypotheses using AMOS 16.0. The research model was based on two variables such as organizational impact and satisfaction interconnected to productivity, service quality and employees' innovation and also hypothesis test is structured based on the variables. The results were obtained by two types of data analysis, Descriptive statistics including means and standard deviations and zero-order correlations between study variables were computed. Structural Equation Modeling (SEM) was used to assess the direct relationships among the study variables. AMOS version 16.0 was used to perform these analyses. The results show that there is a significant effect on the successful ERP implementation on the organizational impact and satisfaction.

ROBERT R CIMA ET AL [11] has done methodology on improving operating room (ORs) efficiency in medical center. The case uses lean and six sigma methodology to improve ORs efficiency. A hospitals financial success is based on the operating room and it is also the costly units inside the Medicare center. Normally lean and six sigma is used to increase the efficiency in a manufacturing industry by eliminating waste and in this case it is used to improve efficiency of the surgical suite. The case study was done by constructing a multidisciplinary team including surgeons, anesthesiologists, nurses, administrators and IT programmers and value stream analysis is done on the basis of personnel, information processed and time for the entire

surgical process from decision for surgery to discharge. There were five work streams formed using lean six sigma methodology. The results were obtained based on the work streams which shows there is a change in substantial increase in OR and concluded that process mapping, leadership support, staff engagement and sharing performance metrics are keys to enhance the operating room efficiency.

A.GUNASEKRAN ET AL [12] has given a study on how information technology used in business process reengineering (BPR). BPR concerns the fundamental rethinking and radical redesign of business process to obtain dramatic and sustaining improvements in quality, cost, service, lead time, outcomes, flexibility and innovations. A process improvement team should be established to find the value added and non-value added in business process reengineering. In the case of information technology BPR can be viewed in two forms i.e. the role of IT function and the role of technologies. A conceptual model is created on the role of IT in business process reengineering which shows a major business process and their role in BPR such as order flow, strategic process, product, marketing, services, accounting, and personnel. A successful BPR process should enable the firms to define process, model and analyze, identify opportunities, implementation and monitoring. The study examines there is a substantial commonality of processes across industry types. To control the flow of goods must be tracked and backed up with accurate and timely information system.

HIGOR DOSREIS LEITE ET AL [13] has suggested a bibliographic study on lean implementation in service sectors. The study is about the creation, principles, evolution, and practices of the lean philosophy oriented to the services sector. This study is also about also lean service which also suffers resistance and there are some limitations when evaluating lean practices and some due to scarce articles in the literature. The author also discussed on the tool that is applied in lean service, application areas where lean service is applied, best practices that are done. Value stream mapping is an important tool which is used to find the value added activity and non-value added activity. Value stream mapping is done based on the minimum time taken to manufacture based on the customer demand in the available working hours. The results can be said that lean does not have a single model of tools or practices and standards for service.

HENK DE KONING ET AL [14] has proposed a study on financial sectors in which lean and six sigma is applied. This study shows lean six sigma has a significant effect on cost reduction, improvement on efficiency, innovation, quality management and service operations. The research is done on two Dutch financial companies. The article shows the integration of lean thinking and six sigma in which this integration has breakthrough improvements in financial sectors. The methodology is done through DMAIC process. The two case study deals with the reduction of information

requests, the reduction of the number of defects in the process of issuing new insurances, the transfer of pension rights, the rework of external communication. In case A the results after the implementation were the percentage of errors in the internal check decreased to 8% and produced estimated savings of €180,000/year. Similarly, the errors in the external check decreased to 12%. In case B the implementation processes the overall annual savings of these actions were estimated to be approximately €175,000. The combined Lean Six Sigma approach discussed in this article provides a useful framework for systematically developing and managing innovations that are particularly applicable in the financial services industry. Indeed, Lean Six Sigma integrates the organizational infrastructure and diagnosis and analysis capabilities of Six Sigma with Lean's tools and best-practice solutions for problems dealing with waste, rework, defects and unnecessary time consumption, problems we have found in great supply in the financial services industry. The approach in two Dutch insurance companies provides illustrations of the significant benefits that can be accomplished by this combined approach.

SANG M. LEE ET AL [15] has proposed a research theory on the applications of entrepreneurial in service sector through lean approach. This paper examines how lean manufacturing helps service sector in quick rapidly changing global economic conditions. Today an information system plays a wide role in all the sectors such as primary, secondary, tertiary. This paper examines whether the information system that enables the benefits of the tertiary sector and is compared with the supply chains. The research is done on the South Korea supply chain to describe the entrepreneurial applications on the tertiary sector. The supply chain systems were coordinated into several systems such as traditional, efficient consumer response, vendor managed inventory, continuous replenishment, collaborative planning, forecasting and replenishment (CPFR). Contemporary supply chain management has benefited from a number of efficient concepts. JIT principles have been widely successful in some manufacturing operations, based on the principle of not stocking inventory at a point until it is needed (Takahashi, **Myreshka, & Hirotoni, 2005**). The results show that Lean methods work best to level upstream production. Agile methods focus on assuring the ability to respond to volatile customer demand downstream. These systems have also been applied to service industries. IT is a very important enabling tool in lean systems. Supply chains represent the global linking of the best organisations available to support collaborating firms. ERP is not just for manufacturing. Since 2000, ERP vendors have vastly expanded services offered to service industries, to include governments, universities, hospitals, etc. Supply chain coordination is a feature of newer, more open ERP systems.

BRADLEY R. STAATS ET AL [16] has examined application on lean principles, knowledge and learning which aids to software service provider. In this case study a comparison of work is done between a lean software project and non-lean software project. The case study is done in one

of the Indian software service industry. The methodology was done through the four principles of Toyota production system propose by Spear and Bowen (1999). The rules are

Rule 1: All work shall be highly specified as to content, sequence, timing, and outcome.

Rule 2: Every customer–supplier connection must be direct, and there must be an unambiguous yes-or-no way to send requests and receive responses.

Rule 3: The pathway for every product and service must be simple and direct.

Rule 4: Any improvement must be made in accordance with the scientific method, under the guidance of a teacher, at the lowest possible level in the organization (Spear and Bowen, 1999, p. 98). Based on the above rules the methodology was discussed on task specification, streamlined communication, simple process architecture, Hypothesis driven problem. The data collection was done using multiple methods, including interviews, meeting observation, inspection of internal documents, and analysis of archival project data. The results of the case study says that the lean production system has significant effect and the core process have been altered which lead to improve the operational efficiency. The study also extends the lean production framework by highlighting the need to identify problems early in the process and keep problems and solutions together in time, space, and person.

OSAMA M. ERFAN [17] has suggested a research on the lean tools application on a healthcare industry. This paper attempts to implement lean techniques in a healthcare industry hence to eliminate the waste. The purpose is to increase the capacity and efficiency to eliminate the waste. The study is done in a healthcare industry located in Libya and the emergency department (ED) is considered based on the data collection of patients visit regularly. Value stream mapping is a tool taken in this research to identify the value added activity and non-value added activity. The research is started with the takt time analysis. A current state value stream mapping is done from the registration of the patient to results evaluation. Based on the results of current state mapping the therapy has high cycle time so it is considered as bottleneck process. A future state mapping is drawn to reduce the cycle time of the therapy process. So the results after implementation show that lean tools has a very good effect on reducing the effect and the development of future state mapping in varying degree helps to achieve the improvement of overall performance of the emergency department of the healthcare sector situated in Libya.

SIMON DENNIS ET AL [18] has done a research on the applications of business process simulation and lean techniques in a telecommunication sector. Business processes are increasingly key to the success of companies in the service industry. These business processes is done to maintain cost effective and efficient results. For this lean technique is used to evaluate the business processes to bring

out the hidden waste to the surface and from this simulation is used to evaluate the improvement plans of the new business process. The case study is done in a British telecommunication sector to find the use of lean techniques in business process simulation. Due to the globalisation and development of new technologies this leads to a need to minimise inefficiencies and waste while at the same time maximising the flexibility and speed of processes and systems to deliver new services to customers. In order to meet this challenge a variety of business process modelling techniques has been used to identify strategies for improvement. So value stream mapping and simulation is used to find out the challenges in the business process techniques in the telecommunication sector. The first step of the research starts with a value stream analysis by mapping the current state to bring out the waste and based on the current state a future state mapping is done in order to reduce the waste. From solution incurred by the value stream analysis a simulation model is done provision process and repair process. Thus the study shows how simulation model is used for a business process redesign and how lean techniques aids to business process simulation.

3. CONCLUSIONS

Lean Manufacturing is becoming an increasingly important topic for manufacturing companies as they try to find ways to compete more effectively against competition. The main benefits of this are lower production costs; increased output and shorter production lead times. There are 3 major sectors Primary sector, secondary sector and tertiary sector. The paper shows the bibliographic study on how lean manufacturing is used in the tertiary sector which shows the principles and practices oriented to the service sector.

This paper shows that the most of the lean thinking process have been done on hospitals in service sector. Future researches shall study in more details each business service sector to where lean has been (or can be) applied. Areas such as government (public administration), logistics, offices, teaching, retail and others have been applying lean practices. One can now do a specific study in each of these areas and translate the benefits from one service area to another. Perhaps even propose an implementation methodology, for each specific area and/or to “services in general”.

Since Service sector need to keep ahead of other business by understanding their customers want and be in a position to give it to them quickly and at low cost. The service sector plays a major role in an economy of a country. The good understanding of lean principles and practices is required for successful implementation of lean as lean practices without knowing lean principles can give short term success but may fail as long term strategy. When lean is implemented and used properly it can become an effective tool to drive the service sector towards continuous improvement. Once integrated into the organizational

culture of the company, it becomes the standard for daily operations. When there is a successful implementation of lean practices it automatically drives the service sector to achieve their organization objectives such as increase better quality service and cost reduction to meet customer demand. Lack of awareness to implement lean, company culture, lack of communication, and employee resistance are the main obstacles faced by service sector during the implementation of lean. Though lean manufacturing evolved and used in automotive if the barriers are being focused in the implementation process lean manufacturing could give an efficient and effective improvement in a goal oriented organization.

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