

Factors and Barriers Influencing Lean Production System Adoption in Manufacturing Industries

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Abstract— In Lean Production System (LPS), the central idea is the implementation of lean practices will reduce different types of unnecessary wastes. However, LPS implemented without an evaluation of respective organisations may lead to failure. In this study, the purpose is to identify the major factor influencing the adoption of Lean Production System and determine the major barrier that interrupts Lean Production System adoption in the manufacturing industry. The target location in this research is the manufacturing industry in Batu Pahat, Malaysia. This was a quantitative type of study and questionnaires were used to collect the data. In this study, the respondents were from the administrative level of employees. The SPSS software was used to analyse the data. The results of this research showed that the major factor influencing LPS adoption in manufacturing industry was process and the major barrier which interrupted LPS adoption was workers' attitude or resistance. This research provided some contributions to help the manufacturing industry, especially in production department.

Keywords— *Factors, Barriers, Lean Production System, Manufacturing Industries, Malaysia*

1. Introduction

Many Malaysian organisations have faced difficulties in adopting the Lean Production System (LPS) although it is widely utilised elsewhere [1], for instance financial constraints, weak leadership, low workers' skills and culture [2]. Lewis [3] stated that LPS is a reduced level of input resources for a given level of output by removing waste from the

system in the form of resources such as converted raw material and also includes converting resources such as process technology, people, facilities, etc. Research found that the leadership quality will influence the success of LPS implementation. Leaders are required to take a long-term view, provide the resources needed and change the management process such as managing changes to the work organisation and SOPs. They also found that barely-managed LPS initiatives sometimes lead to disorder and undermine the very process they are supposed to develop [1]. Unavailability of resources such as material, people, machine with advanced technology, time and expert guidance could be a factor that interrupts the implementation of LPS in manufacturing industries [4]. Resource constraints with reference to volume of production have discouraged machine tool manufacturers from using lean principles [5]. Some studies reported on the barriers of lean implementation such as poorly designed processes, unclear links among business strategies, deficiencies in the measurements and lack of organisation support in the restructuring project [6]. The complication and challenges of implementing LPS concepts have influenced the success rate of organisations adopting lean practices.

The concept of LPS was spread around the world and industries due to intense challenges such as unstable demand, rising customers' expectation, and competition in the globalised markets. LPS has contributed to a remarkable effect in both the academic and industrial communities over the last decade [7]. Organisations around the globe are choosing to adopt LPS to eliminate waste and increase their productivity because this approach has

demonstrated an overwhelming influence on the restructuring of the global industry. Therefore, most of the organisations have implemented LPS, as its basic purpose is to increase production efficiency via the elimination of wastes in all forms. Most of these wastes involved human factors, and organisations are required to give extra respect and empowerment to the human resources by promoting a more favourable working culture and continuous improvement in their organization [8]. LPS is a disciplined, process-oriented system which is concentrated on optimising the limited material resource and human by identifying the major sources of waste, and then using tools such as 5S, Total quality management, Just-In-Time, production smoothing, total preventive maintenance, setup reduction and others to remove the waste. The seven wastes in physical production include overproduction, waiting time, unnecessary inventory, transportation, excess motion, inappropriate processing, and defective products and quantitative and qualitative underutilisation of human resources [9]. Therefore, the selection and the implementation of the accurate lean production tools and techniques are expected to result in improved operational outcomes such as higher quality, lower inventories, and shorter throughput times which result in the improvement of operational performance [10]. This study intends to determine the major factor influencing the adoption of Lean Production System. Besides that, it also aims to identify the major barrier interrupting the adoption of LPS in manufacturing industries.

2. Literature Review

Lean Production System (LPS) is defined as a set of procedures that create or add value by eliminating unnecessary work, thus avoiding future wastes [11]. Stone [12] defined Lean Production System as a system for identifying and removing wastes that influence productivity. Atkinson [13] explained LPS as a commitment and a process of continuous improvement that can majorly affect the competitiveness of an organisation. Lean is a strategic tool for settling severe organisational problems and can bond together some of the change initiatives that are currently running in a business. According to Taj [14], LPS means the organisation must manufacture without generating wastes during processes, while wastes are anything that add no value to the end customer [15]. Anvari et al. [16] explained Lean Production System is about controlling the resources in accordance with the customers' needs and to reduce unnecessary wastes.

LPS as suggested by Shah and Ward [17] is an integrated system made up of various elements united together, and consists of different management practices such as JIT, teamwork, quality systems and cellular manufacturing. As an integrative concept, the adoption of LPS can be evaluated by a collective set of key areas or factors. These key areas encompass a broad array of practices which are believed to be critical for its implementation. They are scheduling, inventory, material handling, equipment, work processes, quality, employees, layout, suppliers, customers, safety and ergonomics, product design, management and culture, and tools and techniques [18]. There are seven wastes in LPS such as overproduction, waiting, transportation, overprocessing, inventory, rework and motion.

There are some factors influencing Lean Production System adoption, namely process, planning and control, customer relations, supplier relations, human resources management, and top management and leadership. Process management is one of the most important factors in terms of identifying nonvalue-added activities and increasing quality. Ineffective processes lead to more waste and lower productivity per employee [19]. Besides that, many authors from different research (e.g. Goodson [20]) have highlighted the importance of planning and control. According to Chong and Rundus [21], the use of quality control systems and scientific methods to solve problems, as well as visual management, help to ensure continuous improvement as it is the key for enhancing the firm's performance and eventually leading to higher levels of customer satisfaction. Furthermore, as highlighted by many authors [22;23] maintaining customer happiness is the aim of any company, since all departments are ultimately working to satisfy their customer needs. To this end, a company must understand its customer requirements [24]. Moreover, the organisation needs to respond quickly to customer complaints. According to Anvari et al. [16], LPS will not be applicable if the customer demands are unstable or unpredictable, so the organisation must have close relationships with its suppliers.

On the other hand, quality suppliers enable companies to produce quality products [25]; this is important in LPS, as the long-term relationships with suppliers will enable the company to perform JIT, which is essential for LPS [24]. With regard to human resource management, training, empowerment, involvement, and recognition are important factors in terms of LPS success [19] and are required in order to produce high-quality products. Employees are the core of a company, and therefore need to be encouraged and involved in company strategy and direction, especially when implementing LPS. Without skilled workers, LPS will not last [26]. Moreover, the level of top

management commitment and leadership is crucial for LPS. This commitment is manifested in many forms, such as providing clear vision, allocating resources and funding, and providing strategic leadership [26]. To ensure the success of LPS implementation, it is essential for top management to create a quality culture by empowering other employees [27].

There are many barriers interrupting Lean Production System adoption, i.e. lack of resources to invest, lack of top management involvement, workers' resistance, lack of communication between management and workers, lack of formal training for workers, lack of formal training for managers, incompatibility of lean with the company bonus, rewards or incentives systems, lack of consultants and trainers in the field, lack of information sharing or communication with suppliers and customers, and lack of cooperation and mutual trust between management and employees. Some of the suppliers are not willing to implement LPS because they believe that they do not have the money to invest and time to train for a lean programme [28]. One of the reasons for low level of lean implementation involves cost and time. Limitations of the resource with reference to volume are considered as obstacles in lean implementation [5]. Resources and funds are needed for effective and successful implementation of any initiatives. On the contrary, insufficient resources such as technical, financial, and human are a common barrier for implementing lean [2].

The only way to fully implement LPS is with a strong leadership at the top of an organisation – including the chief executive officer. This includes not only intellectual support but also physical engagement in the programme [28]. It is important for top management to understand and give sufficient support to sustain the LPS [18]. Lack of commitment may lead to other concerns, such as limited access to resources, lengthy decision-making processes and communication breakdowns [29]. Employee resistance might occur due to the “fear factor” of them losing their jobs if they find out that their jobs do not add values, as LPS is about eliminating nonvalue-added activities [18]. LPS implementation could lead to staffing reductions is one of the causes of reluctance by some employees [30]. Many organisations are now looking forward to implementing LPS; however, the employee on whom LPS is inflicted upon often upsets its implementation [31]. The major reason for low success of lean implementation is anxiety in changing the mindset of workers [5].

Employers need to properly inform their workers about the changes that are being implemented [32]. Scherrer-Rathje et al. [29] mentioned that lack of team autonomy and lack of organisational communication lead to the termination of the lean project and lean benefits such as cost reduction and lead time reduction which are not being

communicated effectively at all levels of the organisation. Employees in LPS and other functional areas are not aware of the success of the project and, as a result, there is little support from them. Besides that, lack of training and awareness about the lean concepts are one of the reasons for low level of lean implementation [5]. Lack of knowledgeable human resources is one of the major risk factors in lean implementation [33]. Anand and Kodali [34] claimed that many LPS initiatives have failed due to the lack of its understanding by both managers and employees [35]. If the new way of working requires new knowledge and skill, participants must be provided with the essential formal and informal training [36]. LPS training helps the practitioners to learn the basic skills and knowledge for improvements [37].

From the top management, recognition and rewards will serve as a booster for participation and continuous improvement [18]. Bonus process implementation is resulting in good performance to some organisations in that if the supplier implements LPS on certain production lines, those lines remain dedicated to that organisation [32]. Upadhye et al. [38] reported that failure to motivate the employees to become a lean organisation is caused by a poorly designed incentive and reward scheme. Incompatibility of LPS with the organisation bonus, rewards or incentive system may cause its failure. Furthermore, LPS implementation may not fully function if there are no proper training methods and knowledge transfers from consultants and trainer in the lean field [32]. Companies often find that the change is so significant that it is necessary to bring in outside experts to successfully shift to lean [28]. Moreover, Brown et al. [39] believed that the main obstacle faced in establishing an LPS is in the communication and response to the required internal downstream customer and the practicality of a one-piece flow. Communication and flows between upstream suppliers and downstream customers are critical [40]. Organisational structure can develop some barriers as the supplier management, typically separate departments, may have little or no interaction for training and operation in an organisation [32]. In addition, the difficulty of top managers is to entrust, listen, increase the decision scope of operators and set a different relationship with them [41]. Strong cooperation and mutual trust between the employees and management is one of the conditions in creating an atmosphere conducive for lean implementation.

3. Methodology

3.1 Research Design

In order to achieve the objective of the study, the researcher decided to conduct it by using the quantitative method which is also called as the

deductive approach. The basic statistics such as percentages, frequency, mean and standard deviation were analysed to explain a particular phenomenon. Quantitative method is based on a positivist philosophy and the deductive approach [42]. Cavana et al. [43] described the deductive approach as when the researcher begins by developing a theory, formulates hypotheses, then gathers or collects and analyses the data and also accepts or rejects the hypotheses where the researcher possesses empirical evidence of certain phenomena. Another research by Saunders et al. [44] found that the deductive approach is based on scientific principles, a necessity to describe the relationship between variables, and it is a highly structured approach. The quantitative method consists of the data collection with the aim that information can be quantified and put through statistical treatment in order to support or refute "alternate knowledge claims" [45]. With the quantitative method, data analysis is done by using statistical procedure. The information that were collected and results obtained from the respondents were analysed to be able to fulfil the objective of the study. The data collected were analysed quantitatively using Statistical Package for Social Science (SPSS) version 22.0.

3.2 Respondents

The population is a large collection of objects or individuals which are the core point of a scientific query in general [46]. The population size was estimated around 400 manufacturing industries in Batu Pahat, Malaysia in which this information was obtained from the Batu Pahat Municipal Council. According to Palys [47], research objectives and questions of the research were the determinants of the sampling frame. Abu-Hussin [48] indicated that the researcher needed to categorise the sample by using the right technique after identifying the target population. Furthermore, the researcher used Krejcie and Morgan's [49] table in determining the sample size for research activities. Therefore, the sample that should be taken is around 196 manufacturing industries.

3.3 Instrumentation

Several sources of data such as primary and secondary data were used to gather the information needed for this study. A survey method was used for the primary data and the techniques included the usage of questionnaire. Questionnaire in this study

was made up of three sections. The first section collected the company and respondents' demographic data. The second section collected data on the factors influencing the adoption of LPS in the manufacturing industry with a total of 30 items. The third section collected data on the barriers interrupting the LPS adoption with 10 items. The measurement was using a five-point Likert scale as measurement. The Likert scale ranged from 5=strongly agree until 1=strongly disagree with 3=Neutral. A pre-test was conducted under actual field conditions on a group of people similar to the study population, so 30 experienced employees from a manufacturing industry were recruited. The internal consistency reliability for the questionnaire was computed and the appropriate corrections were done. After that, the questionnaire was given to the target respondents in the manufacturing industry in Batu Pahat.

3.4 Data Analysis

In this study, the researcher utilised SPSS software to analyse the data collected from the respondents. SPSS is a software which is generally used as a statistical analytic tool in the field of Social Sciences. It is a comprehensive and flexible statistical analysis and data management tool for managing and analysing a large number of data. SPSS will show the results in graphical charts and tables which can help the researcher to analyse the data in a clear form. In this study, descriptive statistics were used to examine the basic features of the demographic data. Descriptive analysis was used to get information in order to describe the sample in the study (Pallant, 2010). It was also used to organise and summarise the data that have been collected. The test helped to compute the frequency of the answer given by the respondents into statistical data.

4. Results and Discussion

4.1 Major Factor Influencing the Lean Production System Adoption

From the outcome of this research, the researcher found out the major factor influencing the adoption of Lean Production System. There were six factors including process, planning and control, customer relations, supplier relation, human resource management and top management and leadership. The result showed that the most major factor influencing the adoption of Lean Production System was process. Factor of process recorded the highest average mean score of 4.5431. Process was the

major factor because ineffective processes will cause lower productivity by the employee and more waste in resource [50]. The factor with the second highest average mean score value of 4.4546 was customer relations. Key priority must be given to all customer complaints in order to improve the satisfying of customer demand [50]. The third important factor was planning and control with a recorded mean score of 4.4295. Planning and control provides information that helps to control management by process and decision-making through the proper solution and techniques [51]. The fourth significant factor was supplier relations with a recorded mean score of 4.3912. Maintaining good supplier relations could help organisations become more efficient and improve the quality of their products [52]. Human resource management was less important to influence the adoption of Lean Production System with a mean score of 4.3060. Human resource management practices of empowerment, training, and teamwork were reported to support the adoption of Lean Production System in manufacturing industries [53].

4.2 Major Barrier Interrupting Lean Production System adoption

In this study, the second objective was to find out the major barrier interrupting LPS adoption. 10 items were chosen to find out the major barrier in adopting LPS. There were many barriers that can hinder or enable the LPS implementation process [54]. From the result, it stated that worker attitude or resistance which means the unwillingness of workers was at the first rank with the highest mean score of 4.8251. The main reason for low level implementation of LPS was anxiety in changing the workers' mindset [5]. In the second place was the item of lack of resources to invest or necessity of high investments or financial constraints with the mean score of 4.6776. Obstacles in LPS implementation included resource constraints with reference to volume [5]. The third place was the item of lack of formal training for workers with the mean score of 4.4590. Eswaramoorthi et al. [5] stated that one of the reasons for low level of lean implementation was lack of formal training for workers about the LPS concepts. Next, the fourth place was the item lack of support or commitment from managerial level with the mean score of 4.3770. Nordin et al. [55] mentioned that many literatures emphasised that inconsistent and unclear communication between management and workers are the barriers of LPS implementation. Lack of formal training for managers was placed at the fifth place with a mean score value of 4.3716. LPS initiatives were unsuccessful due to the lack of its understanding by managers and employees [35]. Lack of consultants in the field and lack of information sharing between managerial level and production workers were placed at the sixth and seventh with the mean score

of 4.2787 and 4.2240 respectively. Lean implementation may not achieve its intended purpose if there were unsuitable training methods and knowledge transfers for workers in manufacturing industries [32]. According to Hines et al. [7], poor consultation sharing between managerial level and production workers was one of the top ten barriers for poor sustainability of LPS. Besides that, the ninth place was the item of incompatibility of lean or JIT with the company bonus, rewards or incentives systems with a low mean score value of 3.8306. The poorly designed reward scheme and incentive failed to bring motivation for employees to become an LPS organisation [38]. In the last place was the item of lack of cooperation and mutual trust between management and employees with the lowest mean score value of 3.8087. Lack of cooperation and mutual trust among the management and employees is a bane for successful LPS implementation [56].

5. Conclusion

This research has presented the results of the survey conducted on manufacturing industries to identify major factors influencing the adoption of LPS and determine the major barriers interrupting LPS adoption. From the results that have been analysed, the major factor which influenced the adoption of LPS was the process. Meanwhile, the major barrier which interrupted LPS adoption was the workers' attitude or resistance. The results obtained complied with most of the results made in previous studies in similar settings. This study can be continued as an in-depth research for those who are interested in this field in the future. However, the researcher will highlight some recommendations for further research. Based on the results of this study, several recommendations can be made. For the first one, this study only has a narrow focus which is on manufacturing industries in Batu Pahat. Therefore, the feedback given by respondents would be limited. The sampling frame should be broaden to cover more areas in Johor to perhaps obtain more feedbacks. Furthermore, researchers can consider adding more samples and respondents, so that the research findings will be more exact as it incorporates a larger population. In addition, future research studies should also incorporate different methods of data collection such as interview or focus groups which may provide more valuable information on the related issues. Other than that, the mix-method which is both the qualitative and quantitative methods can be used in future surveys or studies.

Acknowledgments

The authors would like to thank Universiti Tun Hussein Onn Malaysia (UTHM) for financial support.

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