

A Conceptual Model for Full-Blown Implementation of Lean Manufacturing System in Malaysian Automotive Industry

Eida Nadirah Roslin and Shamsuddin Ahmed Muhammad Shahadat
Department of Mechanical Engineering
Faculty of Engineering, University of Malaya
50603 Kuala Lumpur, Malaysia

Abstract

Lean manufacturing strategy is a one of the known systems that is acknowledged to be capable and effective towards achieving tremendous growth and improvement. Implementations of lean within the automotive industry in Malaysia is not far-reaching as expected and is currently being adopted as a pick-and choose system and being applied only in certain stages and known areas. This approach does not allow these organizations to fully explore and exploit the system's effectiveness; neither do they experience any massive improvements when measured against lean manufacturing success standards. However, factors affecting the lean manufacturing implementation in Malaysia is still seldom debated or being discussed in literature reviews. In this paper, the current level on the implementation of Lean Manufacturing System in Malaysia is discussed. The obstacles of the implementation also are highlighted. The aim of this paper is to propose a conceptual model on implementation of a lean manufacturing system for manufacturing industry in Malaysia, specifically for the automotive parts manufacturing industry. This model is expected to be contributed as a comprehensive guideline for lean manufacturing system implementation within an organization.

Keywords

Lean manufacturing system, Malaysian Automotive Industry, Productivity Improvement, Product Quality, Implementation Barriers.

Introduction

Automotive industry in Malaysia currently faces a variety number of challenges in order to be classified as a world class manufacturing as well as to be sustainable in the global competitive automobile manufacturing business. The current focus is mainly through competing with others via competitive pricing, including the fast time-to-market of products. However, by only focusing on a pricing strategy while having a looser stance on quality could have its drawbacks.

As global customers are becoming highly educated and more open to new ideas and types of information, the preference has shifted to ingenious design forms; high quality materials used and build-up; technological advancements related to Research and Development (R&D); branding and image; as well as country of production. In line with this thinking, it is prevalent for manufacturing entities to address these needs accordingly, whilst striving for quality but still making their products attractive and affordable.

In order to sustain in this competitive scenario, many manufacturing companies have started-off to adopt or wanting to change their current manufacturing system to more productive strategies that can improve their performance, increase efficiency and thus competitiveness. Lean manufacturing strategy was implemented by many companies especially in Japan and elsewhere in the world, and had achieved tremendous growth and improvements. The ultimate goal of lean manufacturing is to create a smooth and high quality organization that is able to produce finished products concerning to the customer's demand in the quality-looked with no waste and with competitive pricing.

Lean Manufacturing strategy is being supported by the Malaysian government, towards creating world class manufacturing industry, and one that could face a sustained high competitiveness in the global market. The implementation of lean manufacturing system (LMS) is considered to be very useful in the automotive industry in Malaysia, in order for the industry to improve their operational performances as well as to remain competitive

(Noor Azlina Mohd Salleh et al. 2011). However, the implementation of LMS in Malaysia specifically in the automotive industry can be categorized as in 'a beginning stage'. There are a few studies focusing on the implementation strategy of this system, this includes a study on the barriers of implementing the system. Without proper implementation strategies and adoption, the advantages of the system could not be gained by the Malaysian automotive industry. In this regard, a total systems approach ensures that sustainability and the ultimate goals of the lean manufacturing system could be achieved. To the best of our knowledge, there are no clear guidelines or step-by-step procedure in effectively implementing a full-blown application of lean manufacturing system (Noor Azlina Mohd Salleh et al. 2011, Bhasin and Burcher 2006, Abdullah et al. 2006 and Shah and Ward 2007). In order to solve these problems and to ensure having a successful implementation, a set of implementation guideline is needed to be formed as a basis for guidance, comparison of performances over time and settings factors for those desiring to implement and adhere to the LMS.

Thus, in the next section, the previous studies pertaining to the LMS implementation in Malaysia and the implementation barriers is discussed and the conceptual model on the total or full-blown implementation of LMS is proposed.

Current Implementation of Lean Manufacturing System in Malaysia

In this age of business, researches that are based on LMS in Malaysia are becoming popular and are expanding on a high rate. Multiple ways and techniques have been introduced to LMS implementation in Malaysia and in the automotive industry. These hard works, is to ensure to have LMS success in Malaysia and the implementation should be sustainable. Summarization of some of the relevant studies in the implementation of LMS in Malaysia is described in Table 1.

Table 1: Research Studies on LMS Implementation in Malaysian Automotive Industry

Author(s) and Year	Objectives	Methodology	Results/Findings
Wong et al. (2009)	- Investigate the level of adoption of LMS in Malaysian electrical and electronics industry. - Examine the tools and techniques used and obstacles in implementation.	- Survey Based study - total of 350 questionnaires were distributed (12.6 % respondent rate (rp)). - Questionnaire based on 14 key areas identified from literature review.	- The level of LMS implementation = between moderate to extensive. 14 key areas were implemented.
Norani Nordin et al. (2010)	- Investigate the LMS implementation in Malaysian automotive industry. - Determine the impact of organizational change to successful lean implementation.	- A survey based study - total of 150 questionnaires was distributed. (40% rp). - Questionnaire is adapted and modified from the literature review to suit the objectives of study.	- Organizational change has a positive relationship with lean implementation. - The 11 factors (except 1 only) of organizational change have a significant impact towards the LMS implementation level in the organization. - Company under "lean" category implemented most of the factors compare to "non-lean" and "in-transition" category.
Baba Md Deros, et al. (2010)	- Investigate the LMS implementation stages in Malaysian manufacturing firms, - Determine the obstacles in implementing the LMS in the organization.	- A Case study based - selected 3 companies of large and medium sizes. - The study focuses on 3 important area : (a) Company background information	- The lean technique was implemented systematically but with different approaches. - The benefits from LMS - eliminate waste and those activities do not add value in process

		(b) Lean implementation approach in case companies (c) The benefits gained from lean implementation	•Employee resistance is the main obstacle in lean manufacturing.
Rasli Muslimen et al. (2011)	Investigate the implementation strategy and suitable approach for successful implementer of LMS in Malaysia.	- A case study based– performed in one of the automotive components manufacturer in Malaysia. - Selected based on its achievement as a TPS model company awarded by MAJAICO -Interviewed two executives that have direct experiences in implementing LMS in the organization.	Shows the concept of project-based was used extensively in implementing the LMS by selecting a production line (as model line) and be the base line for the LMS implementation throughout the total implementation of LMS within the organization.
Meysam et al. (2012)	- Identify the general pattern/practices in implementation of LMS within the automotive and heavy industry. - Develop the framework in LMS for both industries.	- A survey based study performed in automotive and heavy machine industries in Malaysia with 45 distributed questionnaires (34 completed returned). - Use 13 activities of JIT practices.	- The implementation of activities is varies between types of industry. - Automotive industry showed the implementation of more than a single activity.

Based on the literature review, the initial study pertaining to the LMS implementation in Malaysia was reported in 2009 (Wong et al. 2009). The study was conducted in the Malaysian electrical and electronics industry. In the study, 14 key areas were used as a useful guideline for the organization in implementing the LMS (*Customers, Management and Culture, Safety and Ergonomics, Material Handling, Employees, Works Processes, Inventory, Tools and Techniques, Equipment, Layout, Scheduling, Quality, Suppliers and Product Design*). This study also claimed that the LMS has been widely implemented in electrical and electronics industry. Perhaps the result showed that the average of organization implementation level was rated as “moderate-to-extensive” implementers. Overall, the study suggested that by implementing the 14 key areas in LMS, the results were more successful compared to the single key area or tool implementation. Due to this, this study has become one of the most important research studies that are referenced pertaining to the LMS implementation in Malaysia, and subjected to parallels against the automotive industry.

Other related studies pertaining to the implementation of LMS in Malaysian automotive industry were also done by Norani Nordin et al. (2010), Baba Md Deros, et al. (2010), Rasli Muslimen et al. (2011) and Meysam et al. (2012). Norani Nordin et al. (2010) successfully identified 11 factors of organizational change that had a positive relationship with LMS implementation in the organization. The study summarized that company under “lean” category implemented most of the factors as compared to 'non-lean' and 'in-transition' category.

One study undertaken by Rasli Muslimen et al. (2011) had identified the strategy of LMS implementation within an automotive parts manufacturer organization. To implement the LMS, this company had formed a team to perform this mission, then identifying the needed improvements; they identified the waste reduction as a major activity. Project-based strategy was used, coupled with the full support and a clear direction from the top management in order to have some indication of success. Unfortunately, the study did not describe in detail of those activities that were applied in that company. Overall, this case study suggested that the company can be a benchmark for others that want to start their journey towards implementing the LMS.

The study done by Meysam et al. (2012) had identified the general practices in implementation of LMS within the automotive and heavy industry. Both industries were selected and the results obtained were compared. The framework for LMS implementation in Malaysian heavy industry and automotive industry were developed based on the used of 13 activities of JIT practices. Automotive industry gained more benefit from LMS implementation through multiple activities during the implementation stage.

A case study conducted by Baba Md Deros, et al. (2010) pertaining to LMS implementation in Malaysia on the other hand, explains on the approaches and barriers that exist during an LMS implementation in 3 companies that they had looked at. The companies were chosen from different types of industries. Basically, the study showed that every company had set their own framework based on their industry background, needs or aims. The companies had also given great attention to equip the worker with the understanding and knowledge through training and realized that training is an important element for implementing LMS. All of the companies gained high commitment from top management for these changes to take place. However, the implementations of Lean tools were limited and only utilized a “pick and choose” concept based on the suitability of their production processes and products. Generally, the study provided some basis on the level of LMS implementation in Malaysia especially within the automotive industry, but not on a company-wide approach or as a total encompassing concept adoption.

In general, the explained researches or works in LMS implementations, mostly mentions the need to have a total approach towards LMS, and not by applying only one factor or only a single activity, or as only a pick-and-choose system to achieve any beneficial gains (Wong et al. 2009, Norani Nordin et al. 2010, Baba Md Deros et al. 2010, Rasli Muslimen et al. 2011, Meysam Salimi et al. 2012). In fact in Malaysia, full blown implementation is not yet studied, while most organizations were found to have tried implementing lean manufacturing their own way without any proper guideline on how to implement the LMS properly and also effectively. It is found also, the study on performances and the effects of LMS implementations are very limited and mainly done in a general basis of the industry, without going deep into the specifics of LMS. This is due to the LMS being in its infancy and needs time to have any bearing on their measured performance (Bhasin and Burcher 2006, Pius et al. 2006, Andrew 2006, Jannis et al 2010, Jostein 2009, Papadopoulou and A-zbayrak 2005, Shah and Ward 2003). Moreover, studies pertaining to the barriers of LMS implementation in Malaysia have also been undertaken. These identified barriers are also discussed in this paper.

Barriers in Implementation of Lean Manufacturing System in Malaysia

The barriers of LMS implementation in Malaysia, especially in automotive industry are none the less significant, few studies have been conducted in order to identify the obstacles that hinders the LMS implementation in Malaysia (Wong et al. 2009, Baba Md Deros et al. 2010, Norani Nordin et al. 2011, Anvari et al. 2011). According to Norani Nordin et al. (2011), the major challenge in implementing LMS in Malaysian automotive industry was in understanding the real essence of LM concept and its philosophy. In their studies, they have identified the “lack of lean understanding” as the main barrier to be faced by 3 types of organization (non-lean firms, in-transition firms and lean firms) and this was because LMS required new knowledge understanding and cultural change adaptations during the implementation process. Besides, in order to have a successful LMS implementation in an organization or a company, LMS should be applied comprehensively and holistically in its principles and concepts (Shah and Ward 2003 and Norani Nordin et al. 2011).

The study done by Wong et al., (2009) also investigated the obstacles of LMS implementation within the electrical and electronics industry in Malaysia. The major obstacle identified was “backsliding to the old ways of working”, due to employee resistance in implementing LMS and a resistance to change or unwilling to follow new methods from an LMS implementation.

On a study completed by Baba Md Deros, et al (2010) on the other hand showed that resistance from the middle management was another main obstacle in a LMS implementation. This was based on an earlier research made by the Lean Enterprise Institute (Lean Enterprise Institute 2005), their studies highlighted, this middle resistance occurred due to the lack of knowledge and understanding of LMS' main principles.

In general, the lack of knowledge or understanding of LMS concept (philosophy) is regarded as an obstacle in LMS implementations in Malaysia. Therefore, in efforts to implement this invaluable but revolutionary system within an organization, the knowledge pertaining to LMS has to be provided to the entire workforce, in order to create the fundamental knowledge base or understanding about LMS, thus creating an easier path in its implementation throughout the organization. Table 2 shows the summary of the identified barriers from the previous studies.

Table 2: Summary of the Obstacles of Lean Manufacturing System Implementation in Malaysia

(Source: Norani Nordin et al., (2011), Baba Deros et al, (2010) and Wong et al., (2009))

The Obstacles of Lean Manufacturing Implementation in Malaysia		
Attitude of shop floor employees and middle management	Inability to quantify benefits	Lack of top management /senior management commitment
Backsliding to the old ways of working	Lack of implementation know-how	Lack of understanding of LMS concepts
Budget constraints	Lack of communication	National culture
Company culture	Investment cost	Nature of manufacturing facility
Failure of past lean projects	Lack of time to implement	View as “flavor of the month”
Does not practice what is preached	Lack of know-how to implement	Resistance from middle management, supervisors and employees

A Conceptual Model of Lean Manufacturing System in Malaysia

Based on the review of multiple literatures that are available, several gaps were identified in the field of Lean; its influencing factors versus its application or implementation, its performance measurement- in engineering, financial and also other dimensions and the lack of the development of a structured framework available for LMS implementations. Thus the conceptual model for the study of the full-blown implementation of LMS in Malaysian automotive industry is proposed. Further study on identifying the relevant influencing factors and LMS dimensions via development of hypothesis testing will be needed in achieving the aims of the study. Figure 1 shows the conceptual model of full-blown implementation of LMS in the automotive industry.

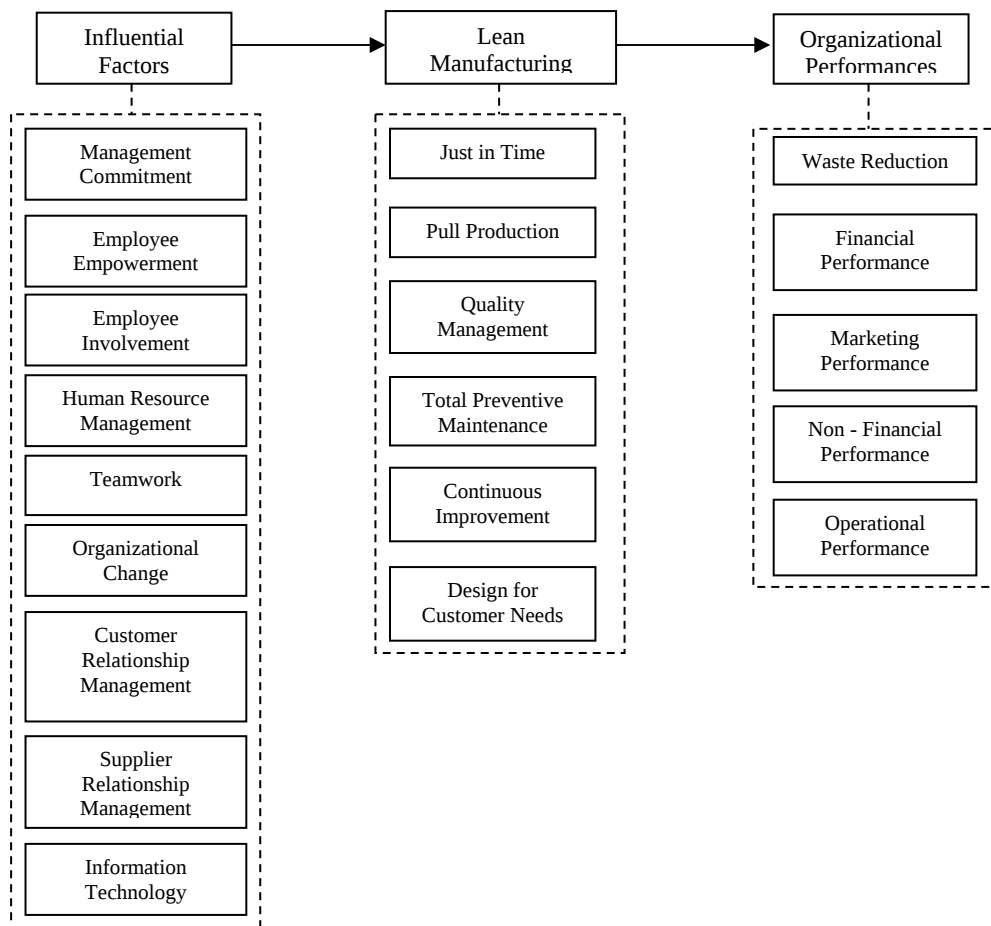


Figure 1: Conceptual Model of the Full-Blown Lean Manufacturing System Implementation

Conclusion

Overall, based on the previous studies consolidated and presented in above, it is feasible to derive elements that need to be looked into and scrutinized further in order to tackle the idea of having successful LMS implementation in Malaysia. These known factors are not only present in the Malaysian automotive industry but has been cited by numerous research, to have studies conducted on the LMS within the Malaysian context. Thus, understanding of these issues directs researchers to investigate further the relevant issues pertaining to LMS implementation in Malaysia, its difficulties, perceived barriers, work culture, monetary restraints, knowledge and its understanding. The study should also focus on the philosophical approach behind lean, which is harder to define and understand, as compared to more measureable performance indicators brought about by Lean approach improvements. The proposed conceptual model will be the initial start-off point and is expected to be contributed as a comprehensive guideline for lean manufacturing system (LMS) implementation within an organization specifically for the Malaysian automotive industry.

Acknowledgements

This paper acknowledges the financial support from the University of Malaya Research Grant, UMRG Project RG139/12AET for this research.

References

- Abdullah, F.A., Rajgopal J. and Needy K.L., A Classification Scheme for the Process Industry to Guide the Implementation of Lean. *Engineering Management Journal*, 2006. 18(2).
- Andrew, L.-M., A Lean Route to Manufacturing Survival. *Assembly Automation*, 2006. 26(4): p. 265-272.
- Anvari, A., N. Zulkifli, R.M. Yusuff, S.M.H. Hojjati, and Y. Ismail, A Proposed Dynamic Model for a Lean Roadmap. *African Journal of Business Management*, 2011. 5(16): p. 6727-6737.
- Baba Md Deros, Thong Chin Nu, and Norani Nordin, A Case Study on Lean Implementation Stages in Malaysia Manufacturing Industry, in *International (Summer) Conference on Asia Pacific Business Innovation & Technology Management*, 2010.
- Jannis, A., C. Robert, C. Cary, and G. Colin, Building a High-Commitment Lean Culture. *Journal of Manufacturing Technology Management*, 2010. 22(5): p. 569-586.
- Jostein, P., Defining Lean Production: Some Conceptual and Practical Issues. *The TQM Journal*, 2009. 21(2): p. 127-142.
- Lean Enterprise Institute. "The Lean Survey". 2005; Available at: www.lean.org (Access date: 5 Dec 2012)
- Meysam Salimi, H. Hamid Reza, and S. Shahryar, A Lean Production Framework for Malaysian Automotive and Heavy Industry. *Journal of Applied Sciences*, 2012. 12(13): p. 1402-1407.
- Norani Nordin, Baba Md Deros, and Dzuraidah Abdul Wahab, Lean Manufacturing Implementation in Malaysian Automotive Industry: An Exploratory Study. *Operation and Supply Chain Management*, 2011. 4(1): p. 10.
- Norani Nordin, Baba Md Deros, and Dzuraidah Abdul Wahab, Relationship between Organisational Change and Lean Manufacturing Implementation in Malaysian Automotive Industry, in *The 11th Asia Pacific Industrial Engineering and Management Systems Conference (APIEMS)*, 2010: Melaka, Malaysia. p. 7.
- Noor Azlina Mohd Salleh, Salmiah Kasolang, and Ahmed Jaffar, Lean TQM Automotive Factory Model System. *World Academy of Science, Engineering and Technology*, 2011. 79: p. 7.
- Papadopolou, T.C. and M. Ā-zbayrak, Leanness: Experiences from the Journey to Date. *Journal of Manufacturing Technology Management*, 2005. 16(7): p. 784-807.
- Pius, A., S. Esam, R. Rajkumar, and N. Geoff, Critical Success Factors for Lean Implementation within SMEs. *Journal of Manufacturing Technology Management*, 2006. 17(4): p. 460-471.
- Rasli Muslimen, Sha'ri Mohd Yusof, and Ana Sakura Zainal Abidin. Lean Manufacturing Implementation in Malaysian Automotive Components Manufacturer: A Case Study. 2011.
- Sanjay Bhasin and Peter Burcher, Lean Viewed as a Philosophy. *Journal of Manufacturing Technology Management*, 2006. 17(1): p. 56-72.
- Shah, R. and P.T. Ward, Defining and Developing Measures of Lean Production. *Journal of Operation Management*, 2007. 25(4): p. 785-806.
- Shah, R. and P.T. Ward, Lean Manufacturing: Context, Practice, Bundles, and Performance. *Journal of Operations Management*, 2003. 21(2): p. 129-149.

Wong, Y.C., K.Y. Wong, and A. Ali, A Study on Lean Manufacturing Implementation in the Malaysian Electrical and Electronics Industry. *European Journal of Scientific Research*, 2009. 38(4): p. 521-535.

Biography

Eida Nadirah Roslin is currently a PhD Candidate in the Department of Mechanical Engineering at Faculty of Engineering, University of Malaya. She obtained her Bach. Engineering from International Islamic University Malaysia and Master of Engineering in Manufacturing System from Universiti Putra Malaysia. She was an Engineer at Production Engineering Department, PROTON Berhad and a Project Engineer at TNB Engineering Corporation Sdn Bhd. Her research interests include manufacturing system, operation management and Lean.

Shamsuddin Ahmed Muhammad Shahadat is currently an Assoc. Professor in the Department of Mechanical Engineering at Faculty of Engineering, University of Malaya. He obtained his BSc Eng (Mech) from the reputed Bangladesh University of Engineering and Technology (BUET) and secured 1st class. He obtained Master of Engineering degree from renowned Asian Institute of Technology (AIT), and PhD from University of Malaya. He joined the University of Malaya in March 1997. He designed and delivered a good number of subjects for both undergraduate and postgraduate classes. He produced six (6) PhD, and more than a dozen of masters' candidates. To his credit, he published about 75 journal papers and 105 conference articles. About 40 of them were published in ISI-indexed journals/proceedings. His overall h-index is 12 (i10-index is 21) He received a total citation of 730. His research interests are in areas of renewable energy, manufacturing planning & control, supply chain management, operations research, quality & reliability engineering, and maintenance engineering. Currently 4 PhD and several masters' students are working under his supervision. He gave several invited lectures including key note lectures, and examined a good number of postgraduate theses from different universities. He administered several research projects as project leader (PI). He reviewed about 30 papers for reputed Elsevier, Emerald journals (UK), IMechE, and some other journals. He holds CEng (UK) certification, IET (UK) Membership, and IEB Life Fellowship(since 2000).