Asian Journal of Finance & Accounting
ISSN 1946-052X
2013, Vol. 5, No. 1

Lean Manufacturing Practices and Environmental Performance in Malaysian Automotive Industry

Siti Norhafizan Hibadullah, Nursyazwani Mohd Fuzi, Auni Fatin Nadia Chiek Desa & Farah Izzaida Mohd Zamri

Dept. of Accounting and Finance, Universiti Pendidikan Sultan Idris

35900 Tanjung Malim, Perak, Malaysia

Tel: 60-019-456-1429 E-mail: ctnorhafizan@yahoo.com

Nurul Fadly Habidin (Corresponding author)

Dept. of Management and Leadership, Universiti Pendidikan Sultan Idris

35900 Tanjung Malim, Perak, Malaysia

Tel: 60-017-571-7027 E-mail: fadly@fpe.upsi.edu.my

Received: December 13, 2012 Accepted: June 12, 2013 Published: June 12, 2013

doi:10.5296/ajfa.v5i1.2864 URL: http://dx.doi.org/10.5296/ajfa.v5i1.2864

Abstract

Toyota Production System (TPS) a systematic approach to identify and eliminate waste activities through continuous improvement and understand the principles of lean such as identification of value, elimination of waste and generation of flow (of value to the customer). This paper explores between lean manufacturing practices (supplier management, employee involvement, just in time, customer focus and statistical process control to monitor quality) and environmental performance outcomes (operational and innovation performances). The purpose of this study is to proposed structural relationship lean manufacturing practices and environmental performance model for Malaysia automotive industries. The conceptual model using Structural Equation Modeling (SEM) has been proposed. Base on the proposed conceptual model and reviewed, research hypotheses are being develop, the paper culminates with suggested future research.

Keywords: Lean manufacturing, Environmental performance, Performance measurement, Toyota Production System automotive Industry

1. Introduction

The automotive industry in 21st century has forced most of the leaders in several sectors to implement more competitive manufacturing system. Compared with other industries in the manufacturing sector in Malaysia, the global industry has been identified to improve the industrialization process so that Malaysia can be a developed nation by 2020. Under the National Automotive Policy (NAP), to assist the transformation and integration of the local automotive industry optimally into the regional and global industrial network an increasingly liberalized and competitive.

Lean Manufacturing (LM) is a unified, comprehensive set of philosophies, rules, guidelines, tools, and techniques for improving and optimizing discrete processes. While lean was created in large volume, repetitive manufacturing for the automotive industry sector, lean principles and benefits apply to all processes such as health care and service.

LM is defined as an assembly-line manufacturing methodology developed originally for Toyota and the manufacture of automobiles. It is also commonly referred to as the Toyota Production System (TPS). Its aim is to get the right things to the right place at the right time, also to increase efficiency and decrease waste by receiving goods only as they are needed in the production process. The principles of lean manufacturing were developed by Taiichi Ohno, a Toyota engineer. In addition, principles allow the company to meet demand, reduce inventory, maximize the use of multi-skilled workers, flatten the management structure and focus resources where needed (Chen and Taylor, 2009).

LM is one of the initiatives projects have been trying to adopt in order to become more profitable and competitive in the global marketplace. Besides that, Prakash and Kumar, (2011) pointed out that LM processes are being used predominantly in the automotive industry such as TPS have since built their reputation as quality leaders and boast one of the fastest growing market shares in the automotive industry. Thus, these manufactures started using various tools and increase practices identified as key elements of lean approach such as Just-in-Time (JIT), kanban, setup time reduction, Total Productive Maintenance (TPM) , Production cells, Employee Involvement (EI), Quality circles etc.

Lean concepts on the improvements in the entire business process as opposed to incremental improvements. It is the business process system that can significantly improve a company's profitability. Besides that, in the globalization of market, the manufacturing performance balance comes from tracking not only financial performance measure such as operating income, sales growth and sales revenue, but non-financial ones as well. This is because non-financial measures are likely to facilitate organizational decisions and actions that support strategies based on the stakeholders need (Hoque and James, 2000). It has also been suggested (Kaplan and Norton (1992; 1996a, 1996b) that non financial performance measure helps manager to assess changes in the business environments, determines and evaluates progress towards the firm's goal, and a firm achievement of business performance.

2. Literature Review

2.1 Lean Manufacturing Practices (LMP)

LM is one of the initiatives that many major manufacturing plants in ASEAN, especially in Malaysia have been implement in order to remain competitive in an increasingly competition and globalization. Lee, (2008) presented a report about the automotive industry worldwide likewise face increasing pressures in the environmental arena. One of the best ways for achieving improvement in environmental performance, as well as to maintain the product quality and cost goals at the plant level, is unique partnerships with producers.

In addition, Shah and Ward, 2003 noted that LM represents a multifaceted concept that may be grouped together as distinct bundles of organizational practices. A list of bundles of lean practices includes Total Quality Management (TQM), TPM, JIT and shop floor involvement, pull, flow, low setup, controlled processes, and involved employees. LMP enhance manufacturing productivity by reducing setup times and work in process inventory improving throughput times, and thus improve environmental performance (Al Asyraf *et al*., 2012). Definitions of the construct of LMP incorporated in Table 1.

Table 1. Construct Definition

Construct	Definition
Supplier Management	Suppliers are important factors for the business success of the buying firm because they contribute, among others, to its product quality, flexibility, and costs. In order to being able to fully exploit the potential of supply market, it is necessary for a buying firm to handle its suppliers (Akamp and Muller, 2012).
Employee Involvement	Employees must be involved if they are to follow the need for creativity and if they are to be committed to changing their behaviour at work, in new and improved ways (Kuye and Sulaimon, 2011).
Just in time	Production strategy that strives to achieve excellence in manufacturing by reducing setup times and in-house lot sizes through the use of group technology for innovation, cross-training of employees, and sound preventive maintenance (Chong *et al*, 2001).
Customer Focus	Customer focus practices involve the establishment of links between customer satisfaction and their needs and internal processes (Sousa, 2003).
Statistical Process Control to monitor quality	SPC is a powerful technique for monitoring, managing, analyzing and improving process performance by statistical methods (Chen et al, 2008).

Based on the current definitions above, LM is a business improvement philosophy that has

developed over many years such as lean manufacturing tools, it is a method to better focus in business on the true needs of the customer to help eliminate waste from being built into system. A summary of LM practice benefits is given in Table 2.

Table 2. Benefit of LM practices

Item	Author	Benefit
Employee Involvement	Kuye and Sulaimon, 2011	• Improved employee's morale or job satisfaction and enhances productive efficiency; • Provides employees the opportunity to use their private information; and • Through employee involvement, resources required to monitor employee compliance (e.g., supervision and work rules) can be minimized, hence reducing costs
Just in Time	Chong *et al.*, 2001	• Reduced operating time; • Decreased unit cost; and • Improved labor productivity
	Yasin *et al.*, 1997	• Improved communication internally and externally; • JIT tends to foster organizational discipline and managerial involvement; and • Enhancing customer satisfaction
Statistical Process Control	Chen *et al.*, 2008	• Increase efficiency and reduce resistance; • Reliable measurement system; and • Establishing coordination and operation of the cross functional group
Supplier Management	Shin *et al.*, 2000 and Prajogo *et al.*, 2012	• Long-term relationship with supplier; • Supplier involvement in the product development process; • Reduced number of suppliers; and • A quality focus where quality performance is the number one priority in selecting suppliers
Customer Focus	Hongyu *et al.*, 2006	• Acquire information about the customers in large or medium sized marketplaces; • High quality service; and • To obtain a quantified data to assess the employees performance and efficiency at work

2.2 The Relationship between LMP and EP

Jusoh *et al.*, (2008) investigated the performance measurement that gave effect on performance of Malaysian manufacturing firm. In this study, they used 29 performance measure item taken from Hoque *et al.*, (2001) which was originally adopted from Kaplan and

Norton (1992) and developed nine items which were self constructed from literature. The finding result found that firm performance was positively affected from the overall performance measure usage. They also argued that when firms applied financial performance measures alone it was not sufficient to measure organizational performance.

Study by Yang *et al.*, 2011 suggest that prior lean manufacturing experiences are positively related to environmental management practices. Improved environmental performance may benefit firms with respect to their consumers such as customer firm identification, customer satisfaction and loyalty leading to improved company image. Therefore, the relationship of lean manufacturing and environmental management practices become synergistic in terms of their focus on eliminate waste and inefficiency.

Beside that, Shah and Ward, (2003) pointed out that contextual factor have been suggested as possible obstructions to implementing lean production systems. Specifically, four bundles in examining the relationship between implementation and operational performance because interested in evaluating the synergistic effects of implementation of all complementary facets of lean such as JIT, TPM, TQM and Human Resource Management (HRM).

However, in different perspective, evidence of positive effects of lean manufacturing on innovation performance is presented by Chen and Taylor 2009, this study highlight that lean organizations to instill creativity and improve innovation capability. Techniques and strategies for an organization to achieve balance between successful lean practices and continuous product innovation will also be presented. Ideologies that appeared prior to it, including TQM and JIT production. An organization that effectively accommodates both lean and innovation will benefit the most and be competitive in the long term. A research finding of LM performance is given in Table 3.

Table 3. The research finding on Lean Manufacturing performance

Elements	Authors	Findings
Environmental	Loureiro *et al.*, (2012)	• These consumers valued environmental performance much more than activities related to labor practices and community development; and • Reducing costs and increasing productivity and also increasingly consumer satisfaction
	Yang *et al.*, (2011)	• Enhanced environmental performance; and • Reduces the negative impact of environmental management practices on market and financial performance
Operational	Prajogo, (2012)	• Increase long-term relationship; and • Improve supplier assessment and logistic integration
	Machuca *et al.*, (2011)	• Manufacturing strategies play a fundamental role in the assessment of new technologies; and • Increase in the use of technology in manufacturing plant
	Jabbour, (2012)	• Environmental issue tends to influece Operational Performance(OP) in a positive; • Reduction in production costs; and • Improved organization of the productive environment
Innovation	Brio and Junquera, (2003)	• Leadership style; and • Increase size on the company's competitive activity (innovative activity)
	Cordero, (2005)	• Motivate employee; and • Increase financial rewards

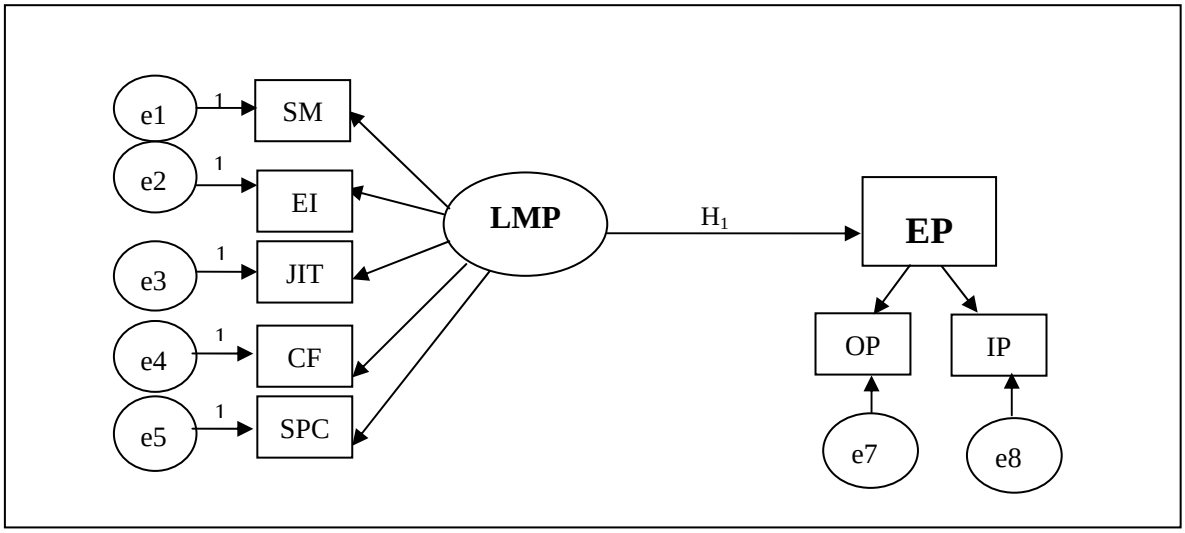
2.3 Hypotheses Development

Figure 1 showed research framework that represent how LMP and environmental performances are related. In brief, lean manufacturing implementation (e.g., Supplier Management, Employee Involvement, Just in time, Customer Focus and Statistical Process Control to monitor quality) assist organizations to improve environmental performance. Thus, we hypothesize,

H_1: There is a positive and direct significant relationship between LMP and environmental performance in Malaysian automotive Industry.

3. A Proposed Research Model

This paper proposed a conceptual model has been used to present the relationship between LMP and EP as presented in Figure 1. This proposed model has adopted the conceptual proposed by Yang *et al.* (2011). However, some amendments especially on LMP and EP constructs have been made.



*Note: LMP= Lean Manufacturing Practices, SM= Supplier Management, EI= Employee Involvement, JIT= Just in Time, CF= Customer Focus, SPC= Statistical Process Control, EP= Environmental Performance, OP= Operational Performance, IP= Innovation Performance

Figure 1. A Proposed Conceptual Model for SME Framework

4. Methodology

In this study, sampling method by using structured questionnaire. A survey is considered as the most economical among methods available for data collection due to its ability in performing efficient data collection (Moser and Kalton, 1971). In general, a survey typed questionnaire approach is relatively low cost of money, time saving, and simple approach. Moreover, by using survey methods, it can clarify the question the survey respondents and recording their responses to be used as data for analysis (Chang, 2002). Therefore it had been used by the authors.

The population of this study comprised in Malaysian automotive industry. Questionnaires will distribute to respondents from the listing of automotive industry obtained from Malaysian Automotive Component Parts Association (MACPMA), Proton Vendors Association (PVA), and Kelab Vendor Perodua. To analyze the data, two statistical techniques were adopted.

The statistical Package for the Social Sciences (SPSS) version 17 was used to analyze the

preliminary data and provide descriptive analyses about thesis sample such as means, standard deviations, and frequencies. SEM using AMOS 6.0 will use to test the measurement model.

Structural Equation Modeling (SEM) techniques was utilize to perform the require statistical analysis of the data from the survey. Exploratory factor analysis, reliability analysis and confirmatory factor analysis to test for construct validity, reliability, and measurements loading were performed. Having analyzed the measurement model, the structural model was then tested and confirmed.

5. Conclusion

On the whole, the aim of this paper is to explore the extent of LMP in Malaysian automotive manufacturing industry. The main contribution of this paper was to persuade managers to take an attention on the relationship between LMP and environmental performance. In general, LM is an arrangement of techniques and activities for running a production industries or service operation. In addition, they have the same core principle: the elimination of all non value adding activities and waste from the business. Hence, the top employee should understand and emphasis the importance to overcome this resistance for the successful implementation of lean manufacturing tool in their firms.

Acknowledgement

The researchers would like to acknowledge the Ministry of Higher Education (MOHE) for the financial funding of this research thought Fundamental Research Grant Scheme (FRGS), and Research Management Centre (RMC), UPSI for Research University Grant (RUG).

References

Akamp, M., & Muller, M. (2012). Supplier management in developing countries. *Journal of Cleaner Production xxx,* 1-9.

Al-Asyraf, M., & AR, R. (2012). Production Flow Analysis through Value Stream Mapping: A Lean Manufacturing Process Case Study. *International Symposium on Robotics and Intelligent Sensors,* 1727 – 1734.

Brio, J.A., & Junquera, B. (2003). A review of the literature on environmental innovation Management in SMEs: implications for public policies. *Technovation, 23,* 939–948. http://dx.doi.org/10.1016/S0166-4972(02)00036-6

Chang, T. L. (2002). Six Sigma: A Framework for Small and Medium Sized Enterprises to Achieve Total Quality. PhD Dissertation, Cleveland State University.

Chen, H., & Taylor, R. (2009). Exploring the Impact of Lean Management on Innovation Capability. University Of Minnesota Duluth.

Chen, S.H., Yang, C.C., Lin, W.T., & Yeh, T.M. (2008). Performance evaluation for introducing statistical process control to the liquid crystal display industry. *International Journal Production Economics, 111,* 80–92. http://dx.doi.org/10.1016/j.ijpe.2006.12.055

Chong, H., White, R.E., & Prybutok, V. (2001). Relationship among organizational support, JIT implementation, and performance. *Industrial Management & Data System, 101*(6), 273-280. http://dx.doi.org/10.1108/EUM0000000005576

Cordero, R., Walsh, S.T., & Kirchhoff, B.A. (2005). Motivating performance in innovative manufacturing plants. *Journal of High Technology Management Research, 16*, 89–99. http://dx.doi.org/10.1016/j.hitech.2005.06.005

Hoque, Z., & James, W. (2000). Linking the balanced scorecard measures to size and market factors: impact on organizational performance. *Journal of Management Accounting Research, 12*, 1-17. http://dx.doi.org/10.2308/jmar.2000.12.1.1

Hoque, Z., Mia, L., & Alam, M. (2001). Market Competition, Computer Aided Manufacturing and use of Multiple Performance Measures: An Empirical Study. *British Accounting Review, 33*, 23-45. http://dx.doi.org/10.1006/bare.2000.0149

Jabbour, C.J.C., Jabbour, A.B.L.S., Govindan, K., Teixeira, A.A., & Freitas, W.R. (2012). Environmental management and operational performance in automotive companies in Brazil: the role of human resource management and lean manufacturing. *Journal of Cleaner Production xxx*, 1-12.

Jusoh, R., & Parnell, J. A. (2008). Competitive Strategy and Performance Measurement in the Malaysia Context: An Exploratory Study. *Management Decision, 46*(1), 5-31. http://dx.doi.org/10.1108/00251740810846716

Kanji, G. K. (2002). Measuring Business Excellence. Routledge Advances in Management and Business Studies. London, Routledge.

Kaplan, R.S., & Norton, D.P. (1992). The Balanced Scorecard-Measure that Drive Performance. *Harvard Business Review,* January-February, 71-79.

Kaplan, R. S., & Norton, D. P., (1996a). *The balanced scorecard-translating strategy into action*, Boston: Harvard Business Scholl Press.

Kaplan, R. S., & Norton, D. P. (1996b). Using the balanced scorecard as a strategic management system. *Harvard Business Review, January-February, 71*(1), 75-85.

Kuye, O.L., & Sulaimon, A.H.A. (2011). Employee involvement in decision making and firms performance in the manufacturing sector in Nigeria. *Serbian Journal of Management, 6*(1), 1–15.

Lee, C.W. (2008). Green Suppliers with Environmental Performance in the Supply Chain Perspective. *Asia Pacific Management Review, 13*(4), 731-745.

Loureiro, S.M.C., Sardinha, I.M.D., & Reijnders, L. (2012). The effect of corporate social responsibility on consumer satisfaction and perceived value: the case of the automobile industry sector in Portugal. *Journal of Cleaner Production, 37*, 172-178. http://dx.doi.org/10.1016/j.jclepro.2012.07.003

Machuca, J.A.D., Jimenez, C.H.O., Vega, P.G., & Rios, J.L.P.R.D. (2011). Do technology and

manufacturing strategy links enhance operational performance? Empirical research in the auto supplier sector. *International Journal Production Economics, 133,* 541–550. http://dx.doi.org/10.1016/j.ijpe.2010.12.010

Moser, C. A., & Kalton, G. (1971). *Survey Methods in Social Investigation.* 2nd Edition, Heinemann Educational: Landon.

Prajogo, D., Chowdhury, M., Yeung, A.C.L., & Cheng, T.C.E. (2012). The relationship between supplier management and firm's operational performance: A multi-dimensional perspective. *International Journal Production Economics, 136,* 123–130. http://dx.doi.org/10.1016/j.ijpe.2011.09.022

Prakash, D., & Kumar, C.T.S. (2011). Implementation of Lean Manufacturing Principles in Auto Industry. *Industrial Engineering Letters, 1*(1).

Shah, R., & Ward, P.T. (2003). Lean manufacturing: context, practice bundles, and performance. *Journal of Operations Management, 21,* 129–149. http://dx.doi.org/10.1016/S0272-6963(02)00108-0

Shin, H., Collier, D.A., & Wilson, D.D. (2000). Supply management orientation and supplier/buyer performance. *Journal of Operations Management, 18,* 317–333. http://dx.doi.org/10.1016/S0272-6963(99)00031-5

Sousa, R. (2003). Linking quality management to manufacturing strategy: An Empirical investigation of customer focus practices. *Journal of Operations Management, 21,* 1–18. http://dx.doi.org/10.1016/S0272-6963(02)00055-4

Yang, M.G., Hong, P., & Modi, S.B. (2011). Impact of lean manufacturing and environmental management on business performance: An empirical study of manufacturing firms. *International Journal Production Economics, 129,* 251–261. http://dx.doi.org/10.1016/j.ijpe.2010.10.017

Yasin, M.M., Small, M.H., & Wafa M.A. (1997). An Empirical Investigation of JIT Effectiveness: an Organizational Perspective. *Omega, International Journal Management Science, 25*(4), 461-471.

Yasin, M.M., Small M.H., & Wafa, M.A. (2003). Organizational modications to support JIT implementation in manufacturing and service operations. *Omega, 31,* 213–226. http://dx.doi.org/10.1016/S0305-0483(03)00024-0

Yu, L.H., Jian, L., & Xian, G.E. (2006). Design of Customer Satisfaction Measurement Index System of EMS Service. *The Journal Of China Universities Of Posts And Telecommunications, 13*(1).

Copyright Disclaimer