

Discover Lean Manufacturing Practices and Manufacturing Performance: Lead to Sustainability

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ABSTRACT

The ability of lean manufacturing practices (LMP) and manufacturing performance (MP) was able to boost a firm's manufacturing competitive capabilities and leads to sustainability. Correspondingly, this study was aimed to discover the relationship between LMP and sustainability among Malaysia's manufacturing organizations. Specifically, it aimed at investigating the mediating role of manufacturing performance on the relationship between LMP on sustainability. This research is conducted through the collection of data from 335 manufacturing organizations in Malaysia. The data collected were analyzed by performing the PLS-SEM technique. Results indicate the positive relation between Lean Manufacturing Practices and sustainability. It is also demonstrating positive mediating role of manufacturing performance between LMP and sustainability. This study has contributed to literature a few novelties such as: (i) to test all these constructs relations in manufacturing organizations in Malaysia and; (ii) to investigating the possible mediating role of manufacturing performance on these constructs more different than previous studies have already done. Additionally, the findings also have contributed theoretically, practically and methodologically with imperative implications to academicians, policy makers and manufacturing organizations specifically.

INTRODUCTION

Sustainability is becoming an important element and a key business imperative in an organization [1]. Moreover, the manufacturers need to take proactive steps by incorporating sustainability concepts into their company's strategy and actions [2]. Sustainability is gradually more vital component of most company strategies in the organizations. However, the invention and employment of operations strategies that embrace sustainability still ambiguous and become remain open issues. For instance, it was obviously can see that the challenging relating the orientation of a traditional lean manufacturing operations system with environmental and social sustainability goals and practices in the current manufacturing organizations [3,4]. Besides, the impact of company's activities on the physical environment, society and economy is inarguable and most of the companies are being driven by the profit objective rather than concern about sustainability holistically (three pillar model) [5]. Nowadays, the adoption of lean manufacturing is needed in order to improve financial and environmental results due to customers' demand for social responsibility from firms [6].

In addition, stakeholder theory highlighted that the common of stakeholders (clients, suppliers, governments, employees, etc.) are drive for sustainability [7]. This study will employ MP to mediate the relationship between LMP and sustainability in the manufacturing organizations as proposed by previous scholars [8,9]. The role of Manufacturing Performance as potential mediator between LMP and sustainability has been explored in manufacturing organizations in Malaysia. Study by previous scholar defines and evaluates the MP indicators based on production quality, processing time and cost [10]. The indicators that had been used were able

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to measure performance of the company. Performance measurement can help public organizations to establish organizational efficiency. Besides, the capabilities of manufacturing performance can be improved by reducing manufacturing outputs such as the cost, quality, delivery time and delivery time reliability, flexibility and innovativeness [11]. Therefore, the proposing MP as mediator variable would have significant implications on sustainability.

LITERATURE REVIEW

The term “sustainability” is referred as the growth of the corporate perspective which considers environmental, social and economic [2]. While the most accepted definitions of sustainability offer accessible dimensions, such as the triple bottom line, the applicable domains of human activity are subject to interpretation. As a result, professions differ in their conceptualization and application of sustainability depending on how they approach the question of what is sustained. A major motive for divergence is found in the different levels of analysis. For example, management thinkers are focused on variables that deal with sustaining organizational systems, sociologists on individuals or groups, and political scientists on even broader populations, defined around geopolitical borders. At the same time, it is telling that the environmental movement was initiated in close connection with the sciences, specifically, biology, also the study of life [12].

Sustainability has turn into the strategic vital of the twenty-first century. While most of the organizations have set their strategic course in order to lead to sustainable, the successful employment of these strategies requires making an infrastructure that reflects and reinforces these initiatives. Sustainability is considered continuing or long-term aim that should be planned in nature. Various companies only contemplate sustainable business practices to improve their worth over a shorter term. In fact, the long-term perspective that sustainability should be approach from must be much considered [5]. The triple bottom line can be viewed as a measurement tool that concurrently accounts for a firm’s economic, ecological and social performance [13]. There were lot of research regarding sustainability and the articles in literature have been maturing for the past two decades and very rapidly in the past decade [14]. However, there seems to be very little literature available which identifies manufacturing industry’s engagement in the application and implementation of manufacturing resiliency and sustainability models, tools and techniques [15]

LMP and Sustainability

Particularly, companies today are seeking to compete through quality management for improved efficiency in business performance. Such strategies allow manufacturing firms to advance quality, eliminate costs and enhance customer service [16]. Consequently, LMP has been the most important practice in an organization. It is important driving force for conserving the environment and sustainability [17]. Furthermore, lean practices are managerial actions that reduce or remove wastes in all forms [3,18]. Hence, lean practices are supportive for particular organization to eliminate pollutant and dangerous emissions by means of decrease in logistic and as a result reduce non-value-added activities. In addition, lean practices also play the role in order to sustain the environmental performance [3,19]. Consequently, lean also leads in the direction of sustainability initiatives [20]. Lean tools apply to any kind of problem, including environmental ones. Meanwhile, lean manufacturing can also have an impact on environmental and social sustainability practices [21]. In addition, sustainability is about not only concerning about to sustain current operational levels and penetrating new markets in order to replace lost ones, likewise attempt to achieving development so that organization can be well growth. Therefore, the present study hypothesizes that:

H1: Lean Manufacturing Practices positively relates to Sustainability.

Manufacturing Performance as a Potential Mediator on The Relationship between LMP and Sustainability

The terms of MP have been used in the manufacturing company for a long time. However, the term operational performances also been used in the previous research, yet still remain the same definition. MP usually discussed in multi facet base on particular research. Operational performance and MP using the same metrics in order to monitor and measure the performance and efficiency in the particular organization [22,23]. In addition, LMP and MP are interlinked each other [24]. Most of the manufacturing company implemented LMP in order to boost the performance. In fact, a set of lean tools used to improve manufacturing performance thereby it is responding to market demands in various dimensions, such as enhanced product quality, faster delivery and lower cost. On the other hand, previous scholar highlighted the key tools and techniques within the lean [25]. Furthermore, the capabilities of manufacturing performance can be improved by reducing manufacturing outputs such as the cost, quality, delivery time and delivery time reliability, flexibility and innovativeness [26].

It is common to adopt third variable such as moderator perspective or mediator perspective when hypothesizing the effect of one variable on another variable is contingent on a third variable [27]. Study conducted by [8] in the manufacturing organization found that there is positive relationship between lean practices, operational performance and business performance. Likewise, it indicated that operational performance was partially mediated the relationship between lean practices and business performance. In addition, the mediation finding may give a clear view on the consistent result of prior studies that examine the associations between financial performance and lean practices. Consequently, on the part of manufacturing executives, tends to strengthen the relationships between the selected model of business, targeted competitive strategy and the MP need to sustain the competitive market [28]. Hence, it shows that MP plays the important role as a mediating effect. Likewise, [29] mentioned that the greater MP leads to competitive advantage. Thus, the present study hypothesizes that:

H2: Manufacturing Performance relates to the LMP

H3: Manufacturing Performance mediates the relationship between LMP and Sustainability.

Underpinning Theory

The stakeholder theory has been in use since 1984 and is one of the most crucial theories in discussing value creation and trade in the business world [30]. The proponents of a “stakeholder model” is explain that businesses are accountable to everyone who has a stake in their activity [31]. The roots of stakeholder theory attract on four main academic fields for example sociology, economics, politics and ethics. Stakeholder theory draw the literature on corporate planning, systems theory, corporate social responsibility and organizational theory [32]. The book entitled Strategic Management: a Stakeholder Approach by [33] commonly recognized as launching the stakeholder theory concepts it also describes how stakeholders with alike interests or rights form a group. The conception of stakeholder management was developed so that organizations could identify, evaluate and examine the characteristics of individuals or groups influencing or being influenced by organizational behavior [32]. The main query related to this study is the connection between organization and stakeholder interests, especially regarding sustainability, and in what way this connection affects the way company conducts business. For the common of stakeholders (clients, suppliers, governments, employees, etc.), the drive for sustainability continues to be tough to reconcile with their interests, and this places a burden on the company to reconcile them all [7]. Therefore, based on the literature from the previous studies, the stakeholder theory is suitable to use in this study and will be used to explain the research framework.

METHODOLOGY

The data of this study gathered using survey method. This study involves collecting the perceptions of respondents within manufacturing organizations. According to [34], the survey method is able to designate the phenomena or to learn the reason for any specific activity. Furthermore, this kind of method also a versatile method that had been used in many research [35].

This study also involves with empirical data from the manufacturing organizations which implemented lean practices in the production through questionnaires. The structured questionnaires were developed to get the data needed in order to analyse the variables as depicted in the research framework. Then, pre-testing the questionnaires has been done in order to test the validity of that particular questionnaire so that it clear, complete and able to understand by the respondents.

Therefore, this study was a survey study which is the respondents must be involved by those who involved directly in lean practices management and implementation from supervisor level up to top management. Hence, these questionnaires focus those who involved with lean manufacturing practices and decision making in the manufacturing organizations. The present paper intends to use quantitative method which is a primary data has been collected using questionnaire. The focus of this study was among Manufacturing organizations in Malaysia. The sample has been used was 335 from the total population of 2368 based on [36]. Meanwhile, PLS SEM will be use in the data analysis.

ANALYSIS AND FINDINGS

Figure 1 illustrated the measurement model assessment, whereby there were only three latent variables (i.e. LMP, MP and SUS). In this stage, the dimensions of LMP, MP and SUS have been transformed into manifest variables (indicators). The numbers noted on the arrows represented the outer loading (factor loading) values while numbers appeared inside the constructs indicated the AVE values

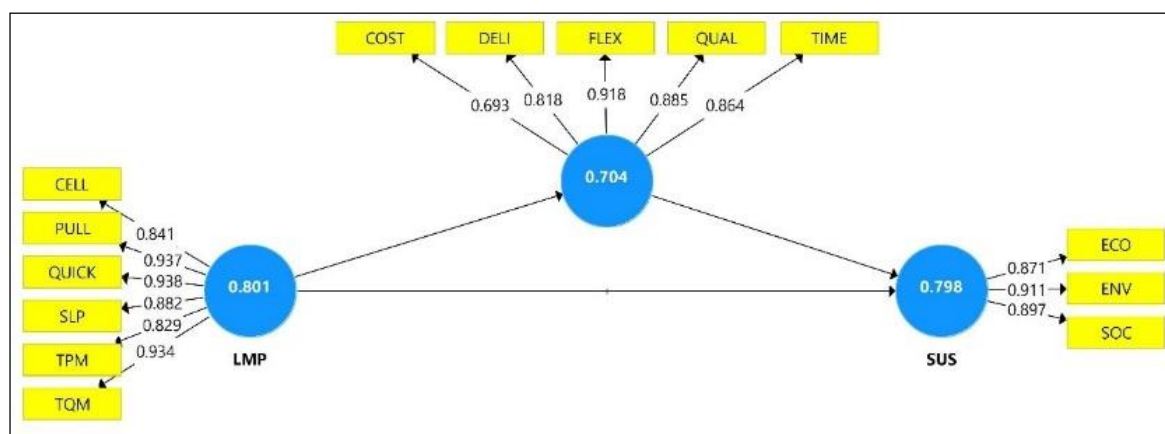


Figure 1. Measurement model.

The results in Table 1 conclude that LMP ($\beta = .323$, $t = 3.623$, $p < .001$, $f^2 = .215$) and MP ($\beta = .593$, $t = 6.919$, $p < .001$, $f^2 = .723$) were positively influenced sustainability, explaining 67.6% ($R^2 = .676$) of the variance in sustainability. Meanwhile, LMP was also positively influenced MP at $\beta = .392$, $t = 4.104$, $p < .001$ and $f^2 = .226$.

Table 1 Results of hypotheses testing

Hypotheses	β	Std. Dev	T Stats	Confidence Interval		Decisions
				2.5%	97.5%	
H1: LMP->SUS	.323	.089	3.623***	.152	.501	Accepted
H2: LMP->MP	.392	.095	4.104***	.200	.571	Accepted
H3: LMP->MP->SUS	.232	.065	3.589***	.112	.363	Accepted

Note. Two-tailed test. Significant at $p < .05^*$, $p < .01^{**}$, $p < .001^{***}$

In the same vein, confidence interval values also prove that H1, H2 and H3 can be accepted, with all confidence interval values in Table 1 were positive for both lower limit (2.5%) and upper limit (97.5%). The confidence interval provides an estimated range of values that was likely to include an unknown population parameter [37]. It was determined by its lower and upper bounds, which depend on predefined probability of error and the standard error of the estimation for a given set of sample data. When zero does not fall into the confidence interval, an estimated parameter can be assumed to be significantly different from zero. In simple words, upper limit (UL) and lower limit (LL) values must be either both positive or both negative which indicates zero does not fall into the range of upper and lower bound values.

Table 1 also has demonstrated that t-statistics of H1, H2 and H3, were above 1.96 and p values were less than .01 which means there were significant and positive relationship between LMP and sustainability as well as MP and sustainability. Thus, H1, H2 and H3 were accepted. These findings are consistent with the study of [38], where it was found that there was a positive impact lean manufacturing practices toward sustainable performance. Furthermore, lean operations meet a wide range of sustainability [40]. Meanwhile, manufacturing performance contributes to sustainability in the organization [41, 42].

DISCUSSION AND CONCLUSION

The first hypothesis was tested and the result indicated that positive relationship was found between LMP and sustainability which demonstrated a variable was significantly important in manufacturing organisations. Thus, lean operations meet a wide range of sustainability [40]. Previous researcher believes that significant relationship between LMP towards sustainability due to importance role of lean manufacturing to enhance companies' performance, not only performance at the operations levels but also at the business level and at once led to sustainability in the organizations [43]. Likewise, LMP has been proven to be a valuable manufacturing strategy far beyond its original industry (i.e. automobile industry); it has recently been applied in a wide variety of industries, not only automobile industry, but also other sectors like textile, machinery equipment, electrical, electronics, and even wood and furniture industries [43].

The second hypothesis was tested and the result also indicated that positive relationship was found between LMP and MP which demonstrated a variable was significantly important in manufacturing organisations. This result was also consistent with the study of [40] which was found the significant relationship between LMP towards performance in their research. They believe that lean has received attention from academics and practitioners alike as a competitive advantage source in both developing and developed economies.

Table 1 also exhibits that H3 which represented the indirect relationship between LMP and sustainability was significant at t-value equals to 3.589 and p value was less than .01, which means MP does mediate the relationship between LMP and sustainability. Hence, H3 was accepted. The same finding was also evident in reflection upon on the result of MP, number of

respective scholars like [44],[8] and [9] supports MP as a role of mediator to examine the relationship between lean and other performances such as business performance and financial performance.

Predominantly, LMP provides a better insight to Malaysia's manufacturing organizations by taking into account MP and sustainability of economic, social and environmental aspects. In line with a strong call from the government, a reputable image for Malaysian manufacturing organization locally and internationally will be projected. As a result, other than able to stabilize the manufacturing industry, at once it also can encourage foreign to invest in Malaysia and put the country in the eyes of the world.

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