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Research paper

The Effects of Lean Management in Life Cycle Management Practices towards Sustainability Performance in Indonesia Pulp and Paper Industry

Mohd Haizam Mohd Saudi[1]*, Arry Hutomo Mustika Djaya[2], Nissa Syifa Puspani[3], Obsatar Sinaga[4]

[1]*Faculty of Business and Law, International University of Malaya-Wales, Kuala Lumpur, Malaysia*
[2]*Faculty of Business and Management, Widyatama University, Bandung, Indonesia*
[3]*Faculty of Engineering, Widyatama University, Bandung, Indonesia*
[4]*Department of International Relations, Padjadjaran, University, Bandung, Indonesia*
**Corresponding author E-mail: haizam@iumw.edu.my*

Abstract

Lean management practices become incredibly important for organizations to associate with lifecycle management practices. This is due to the facts that financial statement alone would not be sufficient, but it is also vital for companies to analyze the economic, social and environmental aspects of the company's operations. Researchers produced a conceptual framework by using Stakeholder and Legitimacy theory. The Life Cycle Management (LCM) is being measured by using lean management to improve the production of the firms. The research tested 62 companies from pulp and paper industry from Indonesia. This research also consists of 248 samples utilizing primary and secondary data. Finding reveals, a phenomenon with role of sustainability report disclosure and lean management practices adoption have significant effects on products lifecycle management practices towards enhancing sustainability performance. Moreover, our results yield insights to optimize the employees' sustainability performance in the pulp and paper industry. The result of the research indicates that lean management has been identified, as the mediator for the enhancement of sustainable performance in the pulp and paper industry in Indonesia.

Keywords: *product lifecycle management practices; lean management practices; sustainability report; sustainability performance.*

1. Introduction

Many organizations start to shift from traditional way of reporting financial aspects, transformed into modern reporting in all aspects, both financial and non-financial (social and environmental dimensions) to stakeholders. The Indonesian government has disseminated information to industry players in 2002 that timber companies, wood processers and paper manufacturers always to pay attention to availability, stability of natural resources and to improve their productivity in various aspects. Based on demand market pressure, the sustainability report publication has become a trend, one of which is encouraged by the annual award for sustainability report initiated by National Centre for Sustainability Reporting (NCSR) [1]. Furthermore, the increasing demands of stakeholders encourage companies to provide information that is transparent, accountable, good corporate governance practices [2]. Companies are dealing with their stakeholders responsibly and to be responsible to their activities that gives strong impact towards the society, and they are consequently elevating their company social responsibility. Lean practices derived from production strategies, which represent working guidelines regarding JIT and TQM [9]. The recent literature knowledge reiterated that JIT and TQM are tools derived from sustainable control philosophies to have adopted for many years and nevertheless keep featuring price to organisation performance [8, 10]. Most companies have the desire on applying lean management practices to be achieved because with a lean system, the companies will certainly gauge a lot of benefits and to gain from the efforts and elimination of waste that occurred [11].

Due to increased competition, companies try to eliminate various activities unnecessary costs and reduce performance [12]. Companies try to identify and eventually eliminate all activities that are not needed and at the same time will improve the efficiency of the required activities [13-14]. In the previous research, pulp and paper industries are inefficient in carrying out its activities that had been consumed resources or greater costs to produce output. Thus, in a certain amount and in carrying out its activities had been consumed resources or greater costs to produce output in small quantities, with the addition of activities that are not high added value then increase cost [6-7].

The main concern in the pulp and paper industry in Indonesia is about the polluted environment [9]. The pulp and paper industry has three critical and unresolved problems [7]. One of the main concern is the impact of environmental pollution due to pulp industry production.

In developing countries, some industrial plants do not have sufficient waste management resulting in environmental pollution of water, air, and serious biological species [10]. According to [15], the pulp industry produces about 50-60% of pulp and the rest if dumped into the river will pollute water quality to the detriment of the surrounding community. Based on the results of research from experts, many actual processes can be optimized by using lean system [12]. Hence, this will have a direct impact on the company's performance both in economic and environmental value [1-12].

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A comprehensive life cycle management (LCM) approach is eventually required [16], which assures that operational methods are consistent and there is effective sharing and coordination of resources, records and technology. One of these holistic LCM techniques inside the production area could require an effective integration of three existence cycles in the corporation [17]. In a previous study, LCM significantly affect the performance of the company and also sustainability performance. But, in some conditions, previous study also found that there are many companies produce waste that is large enough [18-19], thus it will reduce the company's performance and the performance of sustainability [20]. There are several things that can be raised through sustainability report has not been considered, which would help organizations to measure and understand the performance of economic, environmental and social [18]. Hence, companies would be able to set goals and manage change more effectively by implementing lifecycle management practices [17]. Green product lifecycle must take into consideration in this crucial stage, as it would curb the mismanagement of the liquid and solid wastes [16]. The real problem is to translate this approach in the private sector and the responsibility of public studies organization is to promote movements to construct the preliminary blocks for changing the organization culture and define concrete actions [18]. With those concerns, it is a need for a new technology of green factories to optimize today's resources and facilities through viable a sustainable future. Based on research background above, the researcher's hypotheses reveal that not only lifecycle management practice but also the effect of lean management practices and sustainability report disclosure towards the enhancement of sustainability performance (economics, social and environmental) in Indonesian pulp and paper industry [6-7].

2. Theoretical Background

2.1. Stakeholder theory

Stakeholder theory is one of the main theories that are widely used for the underlying research on the sustainability report. The initial thoughts about the stakeholder theory. A stakeholder approach suggests that managers should formulate and implement a process that is satisfying and only to those groups who have an interest in business.

The main task in this process is to manage and integrate relationships and the interests of shareholders, employees, customers, suppliers, communities and other groups in a way that ensures the long-term success of the company [21]. The main interest of stakeholders must be integrated into the company's main objectives and stakeholder relationships should be managed in a coherent and strategic [2]. Hence, it concludes that the company should be able to manage and maintain its relationship with stakeholders on an ongoing basis. In [1] explains one of the strategies to maintain relationships with the stakeholders of the company is to disclose sustainability report covering economic, social and environmental [21].

2.2. Legitimacy theory

Another theory is used to study the underlying sustainability report is the theory of legitimacy. According to [23] revealed that the theory of legitimacy believes that the organization will continually seek to ensure that they operate with the boundaries and norms of each society. It reiterates that, the company will continue to work to ensure that its operations are within the norms that exist in the environment in which the company operates. In [24] argued that the company seeks to ensure that outsiders as a legitimate [25] accept the activities (the company). The theory of legitimacy encourages companies to ensure that the activity and performance can accepted by society [26].

This paper refines the theoretical reasoning related to the two theories and provides empirical evidence for reconciliation via shifting the focal point of inquiry from the quantity of sustainability disclosure in the direction of its quality satisfactory [24, 27]. It presumed that the presence and activities of the company accepted by society.

2.3. Product lifecycle management

Through collaboration among organizations, there may be a possibility to arrange the information on sustainable development subjects, permitting the organization to be more resource-green. Hence, through this collaboration, the employer may be a "green" or "ecological driven" organization [20] not only in product design but also in production-manufacturing and in product give up life cycle [17] which means the entire product is concerned in product improvement [18]. Consequently, a network of organization with a green product life cycle management (PLM) method as a beyond thinking [28]. Control and management of all data and processes associated with the product or service throughout its product life cycle (from the design phase to turnover and consumption by consumers) [16].

Technically, PLM brings together all single applications that support the product creation process. Currently, the manufacturing and services industries face challenges and competition is very large [20]. Product life cycles are getting shorter, the products are more varied and customized, competitors increasingly competitive, tighter regulation and operations that cover a wide range of countries makes the need for a system that is able to manage the pile of data from each stage of manufacture of the product and supporting applications become very important thing [17, 20].

Based on critical of PLM; (1) maturity of standardized product information and meta-records models and standardized engineering and enterprise methods, (2) The emergence of provider-oriented architecture for information sharing and (3) the availability of a robust middle-ware to implement them [17, 20, 29]. A knowledge management factor supports different approaches on PLM, at some stage in the product lifecycle inside the extended organization [30]. Researchers also mentioned the reasons why in the present day, product development practices and knowledge control are becoming a need. [18]. In previous research, coping with PLM from a conceptual perspective inside the previous sections, the function of knowledge management within the aggressive fulfilment of companies became mentioned [18, 28]. Furthermore, no matter how unique lifecycle knowledge management helps tactics, its underlying goal is always the equal. Knowledge control, in its core is ready integrating one of a kind strategy and their corresponding retailers through a shared frame of expertise to analyse why this type of integration is essential trouble for the corporation, an ancient perspective on the evolution of design and manufacturing is beneficial.

2.4. Lean management practices

Based on Toyota Production System (TPS), efficiency has been an imperative objective of producing. Lean production makes a specialty of the systematic elimination of wastes from an employer's operations through a fixed of synergistic work practices to provide services and products at the rate of demand. Lean production represents a multifaceted concept that could be group together as distinct bundles of organizational practices. A listing of bundles of lean practices includes JIT, total quality management, preventative overall preservation and human useful resource control, pull, flow, low setup, controlled strategies, effective preservation and worried employees [32].

The researchers define examine lean manufacturing as a set of practices focused to eliminate of wastes and non-value activities brought from a firm's production operations [32]. All kinds of waste often go unnoticed and it have been considered as something natural and common, when in fact it is very harmful, especially frequent cause increase operating costs that it should really be avoided. Therefore, the application of lean can help organizations to cut unnecessary costs and increase revenue.

2.5. Sustainability performance

Sustainability Performance of the company consists of economy, financial, social and operational, sustainability performance management as one of the guidelines for managing the resources entrusted to it. Sustainability performance reflects the firm's fundamental performance to be measured using data derived from financial statements. Statement of sustainability performance prepared to describe the sustain condition of the company's past and used to predict future sustainability. This study adopted a modified version of the definition developed so that environmental performance refers to the ability in the capacity and capability of an organization to reduce various air emissions, waste and the ability to reduce the consumption of hazardous and toxic materials and reduce the frequency of environmental accidents and environmental uncertainty [31]. The study used a modified version and a definition for operational performance [32]. The study adopted an expanded definition version for economic performance.
Financial improvements include increased costs for material purchases, reduced costs for energy consumption, reduced costs for waste disposal and reduced environmental accident costs. Marketing-based improvements include an increase in average sales, average profit growth and profit growth and an increase in average market share; (2) Sustainability Performance Indicators are: (1) Environmental Performance; (2) Operational Performance; and (3) Financial Performance (4) Social Performance.

3. Hypothesis Development

3.1. Product lifecycle management practices to sustainability performance

The framework of Product Lifecycle Management (PLM), sustainability ought to provide by way of continuous sharing of information a few of the specific product lifecycle stages [17-18]. A device presents lifecycle PLM understanding generated by way of PLM structures through product lifecycle activities. The paper's objectives are to prove on how PLM systems represent a total crucial foundation for accomplishing a greater paradigm for sustainable lifestyles, an extra sustainable improvement, engineering, manufacturing and use of disposal products [29]. Researchers has yet to discover that the pulp and paper industry the relationship between PLM and sustainability performance. This research postulate the following the first hypothesis:
H1: Product Lifecycle Management Practices (PLM) in Indonesian Pulp and Paper industry have a positive significant impact towards sustainability performance (SP).

3.2. Lean management practices to sustainability performance

Lean Management Practices (LMP) is beneficial for adopting environmental concepts and improving environmental effects. LMP brings approximately an improvement to environmental outcomes, particularly those linked to resource efficiency and preventing environmental pollutants.
LMP's impact on results is a complex phenomenon that could not be streamlined into only states, sustainable effects and non-sustainable consequences, but there could be a number of intermediate states, the human component and cultural change are critical for maintaining the consequences that comes from LMP [32].
Sustainability of the results of a tight recognition on the cultural and organizational exchange that LMP entails, though not conceiving LMP as a comprehensive management system or with the aid of defects in the tracking and manipulate of the consequences of LMP [33]. Techniques advances to be round of closing hassle that encompass the continuous assessment of LM effects and consequently make it simpler for the companies to sustain throughout the years.
The LM implementation method must managed towards accomplishing sustainable outcomes over time and to determine the essential elements that affect the sustainability of the results distinguishing amongst various levels of the LMP implementation method on sustainability performance [33]. Hence, the relationship between Product lifecycle management practices (PLM) through LMP important in improving performance for analysis and tested by researchers [12, 32].
The second hypothesis:
H2: Indonesian pulp and paper industry adopting lean management practices enhance sustainability performance on product lifecycle management.

3.3. Sustainability report disclosure to sustainability performance

The sustainability dimension shows the impact of the company's operations to the economic situation for the stakeholders [2]. Information contained in the report of the economic/financial, social, operational dimension of sustainability (SP) can convince potential competitive capital resources low level of risk to stakeholders [12]. Stakeholders in this case, investors need transparent information related to the economic performance of the company as a consideration before making investment decisions. With good sustainability performance, it will be profitable for investor accomplish profitable investments. As for the investment, decisions made can be a request for the purchase of shares of the company. When demand is high, then the stock would have resulted in the number of shares outstanding in the market will be more. Disclosure sustainability reviews definitely would affect the cost of the organization through economic, environmental, operational and social performance.
The hypothesis states that:
H3: Indonesian pulp and paper industry has a positive significant relationship between product life cycle management practices and sustainability performance (SP) mediated by lean management practices in the structural model.

4. Methodology

As shown in Figure 1 proposed the final hypothesized measurement model this study examines the extent to which parts of Product Lifecycle Management Practices affect sustainability performance. The researchers investigate the effect of lean management practices and sustainability report disclosure towards sustainability performance with Smart PLS 3.0 software. Smart PLS created as a project at the Institute of Operations Management and Organization as a tool of analysis techniques in the social sciences. Systematic random sampling the sampling frame is first, divided into a number of segments called intervals. Then, from the first interval, using the SRS technique, one element selected. In this research, a systematic random sample relies on some sort of ordering to choose sample all selected manager from each region 62 pulp and paper industries. While, the first individual chosen by a random method, subsequent members are chosen by means of a predetermined process. The selection of subsequent elements from other intervals is dependent upon the order of the element selected in the first interval. This random sampling use to eliminate bias by giving all individuals an equal chance to be chosen.
Conceptualization Model is the first step in PLS-SEM analysis. At this stage, the researcher has to perform the development and measurement of the construct. Procedures for the development and measurement of constructs through procedures (1) as specified as domain constructs; (2) specify the items that present the construct; (3) data collection for pre-test test; (4) purification of constructs; (5) new data collection; (6) reliability test; (7) validity test and (8) Determine the constructed measurement scores adopted [33].

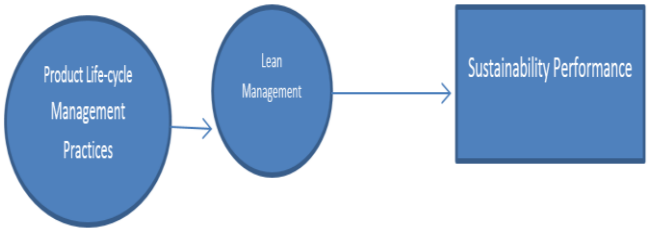


Fig. 1: Conceptual framework

Likert scales is used to measure the responses, since this scale is widely used in product lifecycle practices research and has been extensively tested in social science. The present study used a seven-point Likert scales for measuring all variables in this study. The data analysis technique is the ideal information for analysis, screening the facts [33]. To identify statistics entry errors, data screening performance which includes (missing data, outlier, normality, linearity, homoscedasticity, multi collinearity, validity, reliability, descriptive information and check of response bias).
Smart PLS 3.0 software program implemented to perform some of the statistical tests [33]. The Smart PLS 3.0 Structural Equation Modelling (SEM) smart to test hypothesis testing and do analyse information.
The hypotheses have been using 62 companies from pulp and paper industry in Indonesia. This research consists of 248 samples utilizing primary and secondary data meet criteria statistical validity and reliability.

5. Results and Discussion

The researcher evaluates the PLS model based on the prediction orientation that has non-parametric properties. The researcher considers that the PLS evaluation model as shown in Figure 2 proposed the final hypothesized

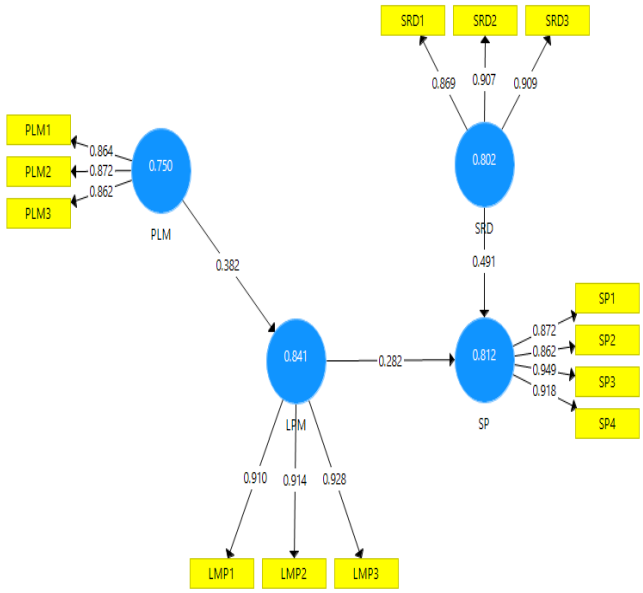


Fig. 2: Measurement model with Smart PLS 3.0

The researcher evaluates the PLS model based on the prediction orientation that has non-parametric properties. The researcher considers that the PLS evaluation model is performed for a "measurement model" or outer model to assess the validity and reliability of the model. The outer model in this study uses reflexive indicators by evaluating through convergent and discriminant validation of latent construct and composite reliability formers and Cronbach alpha for its indicator block [33]. We investigate the impact of PLM variables on Sustainability Performance (SP) and Lean Management Practices (LMP) as a mediating pathway.

Table 1: Cronbach Alpha, composite reliability and average variance extracted

	Cronbach's Alpha	CR	AVE
LPM	0.906	0.941	0.841
PLM	0.836	0.900	0.750
SP	0.922	0.945	0.812

The analysis reveals that in Indonesian pulp and paper industry, lean management practices enhance sustainability performance on product lifecycle management has an effect interaction in the structural model.
The discriminant validity test conducted by comparing the square root of AVE for each construct with the correlation value between constructs in the model. Good discriminant validity shown on the square root of AVE for each construct is greater than the correlation between the constructs in the model. The rule of thumb reliability value that the use of Cronbach Alpha to test the reliability of the constructs will give lower value (under estimate), so it is preferable to use composite reliability should be greater than 0.60 - 0.70 is still acceptable for exploratory research adopted from [33]. Discriminant validity test resulted from model structure examined that composite reliability LPM (0.941); PLM (0.900); SRD (0.924) and SP (0.945) which means that all constructs in the model structure can be considered to have good reliability because they are > 0.70 as shown in Table 2.
The next step in analysing the structure of the model Rule of thumb for the recommended AVE value must be greater than 0.50, and each cross loading for each variable in the measurement model (> 0.70) means that 50% or more variance of the indicator could explained.

Table 2: Loading factor with SmartPLS 3

Factor Loading	LPM	PLM	SP
LMP1	0.910		
LMP2	0.914		
LMP3	0.928		
PLM1		0.864	
PLM2		0.872	
PLM3		0.862	
SP1			0.873
SP2			0.864
SP3			0.948
SP4			0.916

Convergent validity test reflexive indicators with Smart PLS 3.0 program conducted by the researchers to be able to see the value of the loading factor for each indicator constructs. Rule of Thumb is usually used to assess the validity of convergent i.e., the loading factor value (> 0.60 - 0.70) for exploratory research is still acceptable when the Average Variance Extracted (AVE) (> 0.50) [33]. The entire value of factor loading in this study > 0.70. We analyse that LMP3; PLM2; SRD3 (Provide knowledge about the tools (tools) required to implement Lean Manufacturing and adequate training to employees-worker in the company (Support Worker Principles); The emergence of provider-oriented architecture for information sharing and clarity and reliability reports have important impact on Sustainability Performance as shown in Table 3. The Researchers tried to analyse the results of the model when the exogenous variables have an effect on the dependent variable with other exogenous variables, it is to be an indirect effect. Therefore, the researchers tried specifically indicators to analyse the total effects of exogenous variables specifically by adding direct and indirect effects. One variable may have no direct effect, but it may have an indirect effect as well. Researchers analysed for T Statistics PLM→LPM→SRD→SP (3.484) > 1.96 gave significant effect on SP. In this study, measurements and modelling made by making multiplication between exogenous and moderator variable indicators to form interaction constructs.

The researcher found that in Indonesian pulp and paper industry has a positive significant relationship between product life cycle

management practices and sustainability performance (SP) mediated by lean management practices in the structural model.

The researcher examined and evaluated the measurement model or outer model for this case by examining valid and reliable. To test the significance to determine the influence between variables based on the literature [33] recommend using 5000 resampling numbers in the bootstrapping process.

6. Conclusion

This study aims to look at the effects of lean management practices seen from the economic, environmental dimension, and social dimensions of corporate performance. Based on the results of hypothesis testing of the three independent variables (economic dimension, the dimension of environmental and social dimensions) stakeholders in this research, the investors need transparent information related to the economic performance of the company as a consideration before making investment decisions. Thus, with good sustainability performance, it will be profitable for investor accomplish profitable investments. The investment decisions made can be a request for the purchase of shares of the company. As an example, when the demand is high, then the stock would have resulted in the number of shares outstanding in the market will be more. Hence, the researchers have concluded that Pulp and Paper Industry in Indonesia has provided knowledge about the tools required to implement Lean Manufacturing and adequate training to employees-worker in pulp and paper industry namely the Support Worker Principles.

The emergence of provider-oriented architecture for information sharing and clarity and reliability reports have an important impact on Sustainability Performance in this research. Finding reveals a phenomenon with role of lean management practices adoption have significant effects on Product Lifecycle Management practices towards enhancing sustainability performance. Future researchers could extend the period of observation and manage the samples more efficiently to reflect better research results. The use of lean management in this research has been found to enhance the performance of the organization, and thus would increase the level of productivity of the industry in Indonesia. The performance enhancement would benefit the workers in the long run because the sustainability in performance and growth would lead to job stability and affects the Indonesian economy tremendously that would increase the GDP level.

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