

## INFLUENCE OF LEAN PRACTICES ON SUPPLY CHAIN PERFORMANCE

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**Abstract:** Malaysian electronic industry has lower performance due to various supply chain issues. Decreases in electronic industry performance decreases the overall contribution in gross-domestic product (GDP). This study investigated various lean supply chain practices to boost supply chain performance. Therefore, this study is one of the attempts to examine the effect of lean practices on supply chain performance. Lean practices include; cellular layout, 5S and visual management. A survey was conducted, and questionnaire was distributed among the employees of electronic companies in Malaysia. In the current study structural equation modeling (SEM) technique is used with the help of partial least square (PLS) version 3. It is found that lean practices have significant positive relationship with supply chain performance. More importantly, organization structure has key importance to adopt lean practices in supply chain. Lean practices implementation requires supportive organization structure.

**Key words:** supply chain, lean practices, cellular layout, 5S, visual management, organization structure

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### Introduction

Apart from the fact that supply chains have sufficient capability to gain competitive advantage based on cost reduction or quick responsiveness (Li et al., 2006), the actual world is much far from absolute certainty. It is clear from the previous studies that companies are focusing to adopt initiatives like low-cost sourcing (Wagner and Bode, 2006, 2008), reduction in inventory and total quality management (Kleindorfer and Saad, 2005), and trying to focus on “Vendor Managed Inventory” (Yao et al., 2007) which has significant influence on performance.

As the recent environment is full of growing rate of uncertainty among markets (Christopher and Holweg, 2011) which requires enterprise risk management (Hameed et al., 2017). This uncertain environment lead towards the lower performance and lead to the failure (Zhao et al., 2013). It can be management through better supply chain practices, particularly in Malaysian electronic industry which has low performance.

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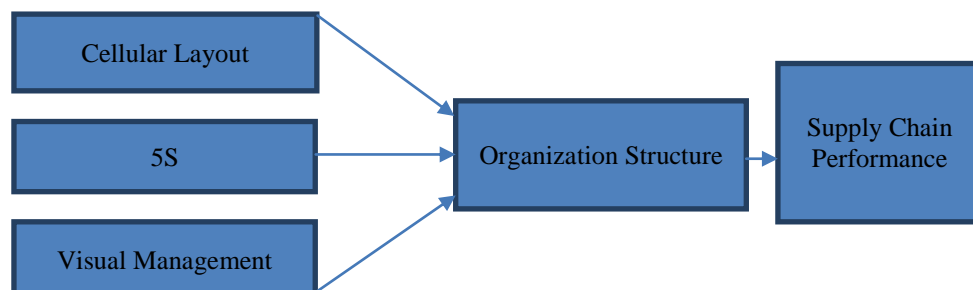
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Malaysian electronic industry has lower performance as compared to the other countries such as Australia, Brazil, Canada, Hong Kong, Indonesia, India, Israel and Japan which is evident from world report on electronic industry. Malaysian electronic industry needs to focus on various supply chain activities to boost overall performance. Decreases in electronic industry performance decreases the overall contribution in gross-domestic product (GDP). As the supply chain activities always have significant contribution in organization performance (Boonjing et al., 2015).

Therefore, this study is one of the attempts to examine the effect of lean practices on supply chain performance. The study filled the gap by providing various insights to boost electronic industry performance through lean practices. Lean practices include; cellular layout, 5S and visual management. Cellular layout is a concept in which various processes are brought together in a cell rather than isolated process. Moreover, 5S is the set of guidelines to keep activities in order, clean and well managed. Normally it is based on general instructions. Furthermore, visual management refers to the deliberate effort in creating a situation clear to all interested parties in the transection or any process. Here, the organization structural is most crucial. A firm having supportive organizational structure can lead through lean activities (Soon, 2013), however, an organization having less supportive organizational structure will not be able to take benefit from lean practices.

Therefore, the purpose of this study is to examine the role of lean practices on supply chain performance of Malaysian electronic companies. Additionally, the sub-objectives are listed below:

- 1) To investigate the effect of cellular layout, 5S and visual management on supply chain performance,
- 2) To investigate the mediating role of organization structure between lean practices and supply chain performance.



**Figure 1. Theoretical framework of the current study showing the lean practices and supply chain performance**

### Literature Review

There are many lean practices are available in prior literature (Shah and Ward, 2003), however, this study is limited to cellular layout, 5S and visual management.

Many studies are available on supply chain activities (Boonjing et al., 2015; Ul-Hameed et al., 2019), however, most of the studies are missing with the relationship of lean supply chain activities and supply chain performance. Therefore, this study is going to fill this research gap.

A wide range of approaches exist to device performance of SCM, for example, integration (Devaraj et al., 2007), cost viability (Hitt et al., 1998) and inventory level (Holmberg, 2000). One model is examined by Beamon (1999), where he described that estimating SCM performance requires to incorporate a few rules. The rules specify three estimation which are: a) assets estimation (Efficiency), b) Output estimation (Consumer loyalty), and c) Flexibility (how well the framework responds to vulnerability). Studies have attempted to survey SCM performance in various ways, however, most measures are from the financial prospective instead of non-financial as cited by Harland (1996). Lean production is one of the processes which eliminate the waste, more flexibility, maintain smoothness in flow and continuously improves the quality. However, a few studies attempted to work on lean supply chain practices. These studies include, but many studies on lean supply chain are missing with supply chain performance and organizational structure to support lean supply chain practices. Lean supply chain activities have significant difference as compared to the conventional supply chain. Therefore, this study examined lean supply chain activities in the presence of organizational structure and focused on three major lean practices, namely; cellular layout, 5S and visual management.

A typical practice in lean usage is the utilization of cellular layout changes to progress correspondence and to decreases non-value-added exercises. In a look into on office layout, it was discovered that geometry of workspace has in reality an effect on correspondence designs (Boutellier et al., 2008). In any case, it is not generally the path as a few investigations demonstrates positive outcome in lean usage without having to altering the layout. It was discovered that by moving forward the routing adaptability it could make up for the more costly and tedious alternative of layout change while accomplishing reduced stocks, work-in-process and dock-to-dock time (Domingo et al., 2007). Therefore, cellular layout and effective changes in cellular layout has significant effect on supply chain.

Moreover, 5S is a vital starting point inside lean management philosophies particularly in Japanese organizations (Gapp et al., 2008). It is characterized as the five measurements of workplace organization. The 5S are characterized as sort, rectify, shine (clean the place and keep up equipment day by day), standardize (build up rules and principles for the territory), and manage (set up the benchmarks). It became clear that by contributing in 5S, the workplace would become not only clean but also effectively, orderly and well-organized. 5S participation would lead to less need to verbally communicate as the visual feature will lend to clear simple communication (Soon, 2013). Thus, 5S is one of the important elements of lean supply chain which supports to the effective and efficient practices and lead towards higher supply chain performance among

electronic industry of Malaysia. As according to the Bullington (2005), 5S has significant contribution in supply chain performance. In line with cellular layout and 5S, another lean practice, namely; visual management is equally important. Visual management refers to the deliberate effort in creation of scenario much clear to all involved parties. It encompasses various items such as developing a pure presentation to show the production status or any other process in production of service like supply chain activities. Transparency in supply chain operation increases the supply chain.

The difference between an effect firm and ineffective one is that the environment in well managed companies encourages the idea of identifying as well as acting on issues without any delay. This is accomplished by visual controls by the utilization of different activities such as 5S described earlier by Hirano (1995). Visual presentations are utilized for different reasons from monitoring quality and production levels classifications (Kocakülâh et al., 2011; Zainudin et al., 2017a). Management visibility through visual management investigates the waste when it appears, therefore, it can be removed (Lynch, 2005) which enhances the supply chain performance by saving the time as well as resources. Moreover, visual management supports visually communicate by utilizing different simple signals which give immediate understating which aids the workers to work rapidly by mitigating the error rate. No doubt with the help of cellular layout changes, 5S and visual management, supply chain performance become increase, however, it requires an effective organizational structure. The structure which help to promote lean practices. The structure which accept various changes in layout and help to adopt 5S and visual management activities. Without the organization support, the implementation of lean practices cannot be fruitful.

A study carried out by Kim (2007) on the effect of organizational structure and supply chain performance found that organizational structure have signifincat relationship with supply chain performance. Organizational structure with supportive managemet has important contribution in supply chain management and increases the stuply chain performance activities. Thus, it is important to mold organization structure towards supply chian activities.

Change is required in organizational structure for better performance. The author argued that organization requires to adopt latest procedure that cannot be realized in the out-dated firm structure where autonomous functional areas like production as well as marketing shift to integrated practices of supply chain handling. It indicates that an autonomous section can be essential to control as well as adjust efficiently in supply chain practices (Kim, 2007). In other words, a firm which considers the job and status of free division in charge of inventory network management (SCM) exercises ought to be plainly settled. In this regard, it is exceptionally careful that numerous organizations perceiving the significance of inventory network management have started receiving new organizational structure.

In conclusion, above discussion revealed the fact that lean practices have significant contribution towards supply chain performance. Lean practices such as cellular layout, 5S and visual management are positively associated with supply chain performance. However, these lean practices are not beneficial in case if the organization structure is not supportive. Therefore, to take benefit from lean practices, a supportive organization structure is required. Hence, below hypotheses are proposed:

*H1: There is a significant positive relationship between cellular layout and organization structure.*

*H2: There is a significant positive relationship between 5S and organization structure.*

*H3: There is a significant positive relationship between visual management and organization structure.*

*H4: There is a significant positive relationship between organization structure and supply chain performance.*

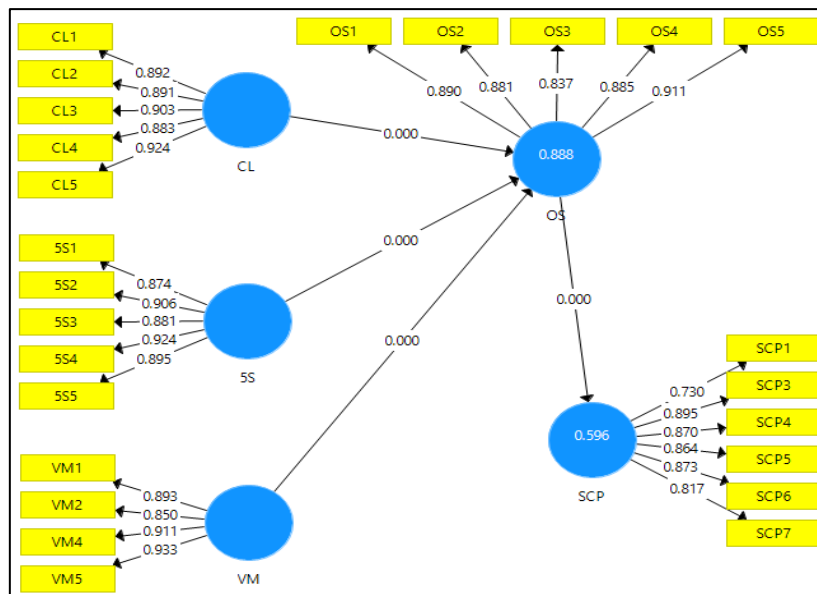
### **Research Method**

The present study is aimed to examine the effect of lean practices on supply chain performance within the electronic companies of Malaysia. Thus, by examine the nature, and purpose of the study, a survey was conducted. Questionnaires were responded from the employees of electronic companies of Malaysia. A mail survey was used to collect the data. Five hundred (500) questionnaires were distributed with the help of mail among the electronic companies. Sample is selected by following the inferential statistics of Comrey and Lee (1992). According to him, 200 sample size is satisfactory, 300 is good and 500 is excellent. Moreover, a 5-point Likert scale was used to collect the data. Questionnaire was based on two major sections, first section was based on the demographic variables including, age, education, income and marital status. Second section was based on the items related to key variables of the study, namely; cellular layout, 5S, visual management, organization structure and supply chain performance. From five hundred (500) questionnaires, only two hundred and seven (207) were returned. Two remainders were sent to respondents after one-week gap. Therefore, two hundred and seven (207) responses were used to analyse the data. Response rate was 41.4% which is acceptable. As Sekaran (2003) demonstrated that 30% response rate is adequate if the data is gathered by mail survey. Moreover, the PLS-SEM is used in this study which is most suitable while analysing the data with small sample size (Reinartz et al., 2009; Zainudin et al., 2017b).

### **Analysis and Results**

Figure 2 shows confirmatory factor analysis through partial least square-structural equation modeling. The steps of PLS-SEM are compiled by Hameed et al. (2018) which are based on measurement model and structural model assessment. In Figure

2, CL represents cellular layout; VM represents visual management; OS represents organization structure and SCP represents supply chain performance. Factor loading is shown in Figure 2. Results shows that all the factor loading is above 0.7 as recommended by Hair et al. (2014). Reliability and convergent validity are shown in Table 1 where all the values are above the satisfactory level. Moreover, average variance extracted (AVE) is shown in Table 2 which shows that all values are above 0.5 which attained the convergent validity.



CL = Cellular Layout; SS = 5S; VM = Visual Management;  
OS = Organization Structure; SCP = Supply Chain Performance  
**Figure 2. Confirmatory Factor Analysis**

**Table 1. Reliability and Convergent Validity**

	$\alpha$	rho_A	CR	(AVE)
5S	0.939	0.940	0.953	0.803
CL	0.940	0.941	0.955	0.808
OS	0.928	0.929	0.945	0.776
SCP	0.918	0.924	0.936	0.711
VM	0.919	0.926	0.943	0.805

Table 2 depicts the discriminant validity through square root of AVE. It is clear that the square root of AVE is more than other values which is the indication of discriminant validity achievement. Moreover, hypotheses testing results are shown in Figure 3 and Table 3. It is clear that all the hypotheses are accepted because the t-value for all the hypotheses is above 1.96. It is also clear from the p-value because p-value is below 0.05.

**Table 2. Descriminenet Validity**

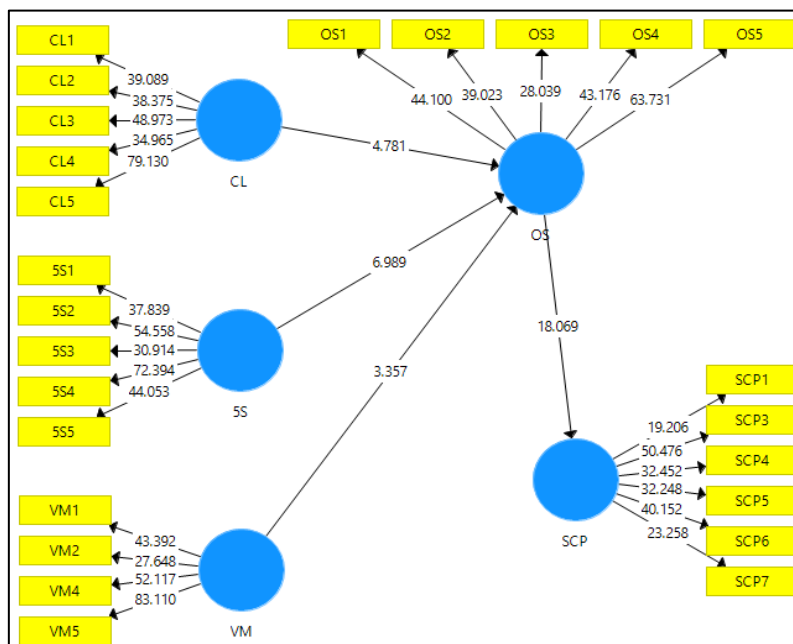
	5S	CL	OS	SCP	VM
5S	<b>0.896</b>				
CL	0.827	<b>0.899</b>			
OS	0.815	0.800	<b>0.881</b>		
SCP	0.741	0.761	0.772	<b>0.843</b>	
VM	0.650	0.652	0.722	0.804	<b>0.897</b>

Additionally, beta value for all the hypotheses is positive which shows a direct relationship between the variables. Therefore, all the indepndet variables have significnat positive relationship with supply chain performance.

**Table 3. Hypotheses Testing Results**

	(O)	(M)	(STDEV)	((O/STDEV))	P Values	Decision
5S -> OS	0.492	0.492	0.070	6.989	0.000	Supported
CL -> OS	0.343	0.338	0.072	4.781	0.000	Supported
OS -> SCP	0.772	0.776	0.043	18.069	0.000	Supported
VM -> OS	0.178	0.183	0.053	3.357	0.001	Supported

Moreover, r-square indicates that all the variables, namely: cellular layout, 5S, visual management and organizational structure has the ability to bring 59.6% change in dependent variable, namely: supply chain performance.



**Figure 3. Structural Model Assessment**

### Findings of the Study

Results of the study shows that lean practices have significant positive influence on supply chain performance. Better implementation of lean supply chain increases the overall performance of supply chain among Malaysian electronic companies. These results are consistent with previous studies (Daud and Zailani, 2011; Dunay and Shaban, 2017; Farah, 2015; Muchiri, 2017; Nimeh et al., 2018; Wachuma and Shalle, 2016). As the results found that cellular layout has significant relationship with organization structure with t-value 4.781 and beta value 0.343. Beta value shows a direct relationship and t-value shows significant relationship. Therefore, both have direct relationship with each other's. To take benefit from cellular layout a company should have better organization structure which supports the system. Similarly, lean practices, namely; 5S found significant relationship with organization structure. It shows t-value 6.989 and p-value 0.000 with beta value 0.492. Therefore, there is a positive relationship between 5S and organizational structure. In line with cellular layout, 5S also requires a supportive organization structure. In case of visual management, it has significant contribution in supply chain performance. Increase in visual management increases the supply chain performance through better organization structure. Visual management increases the organization performance (Liff and Posey, 2004) which automatically increases supply chain performance. As the relationship between visual management and organization structure found significant with t-value 3.357 and positive beta value 0.178. Finally, it is found that better organization structure enhances the supply chain performance. The relationship between organization structure and supply chain performance found t-value 18.069 and beta value 0.772.

### Conclusion

The current study examined the role of lean practices on supply chain performance. Three lean practices were selected, namely; cellular layout, 5S and visual management to check the effect on supply chain performance. Moreover, the role of organization structure was also examined. Data were collected from the employees of Malaysian electronic companies and analysed through PLS-SEM. It is found that lean practices have vital role to boost supply chain performance. Lean practices increase the efficiency and effectiveness in supply chain which effect positively on overall supply chain performance. Therefore, implementation of lean supply chain practices can influence the electronic company operations and performance. More importantly, organization structure has key importance to adopt lean practices in supply chain. Lean practices implementation requires supportive organization structure. Malaysian electronic companies must insure the lean supply chain practices and supportive organization structure to enhance overall supply chain performance. These companies should focus on various lean practices such as cellular layout, 5S and visual management.



### Limitations and Future Research

The current study is limited to the Malaysian electronic companies. Results cannot be implemented to other countries. Further research must be included with other companies. Moreover, in the current study, only three lean practices are involved. The further research should also include other lean practices which may affect the results. Moreover, open innovation strategies are important in any business. External and internal knowledge incorporate can be more beneficial in lean practices. Thus, future research is required to introduce open-innovation strategies to boost supply chain activities through lean practices.

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### WPLYW PRAKTYK LEAN MANAGEMENT NA PRODUKTYWNOŚĆ ŁAŃCUCHA DOSTAW

**Streszczenie:** Malezyjski przemysł elektroniczny ma niższą wydajność z powodu różnego rodzaju problemów związanych z łańcuchem dostaw. Spadek wydajności przemysłu elektronicznego zmniejsza ogólny wkład w produkt krajowy brutto (PKB). W badaniu przeanalizowano różne praktyki lean management w łańcuchu dostaw w celu zwiększenia produktywności łańcucha dostaw. Dlatego niniejsze studium jest jedną z prób zbadania wpływu praktyk Lean na produktywność łańcucha dostaw. Na potrzeby badania przeprowadzono ankietę, którą rozprowadzono wśród pracowników firm elektronicznych w Malezji. W obecnym badaniu wykorzystano technikę modelowania równań strukturalnych (SEM) za pomocą trzeciej wersji metody częściowych najmniejszych kwadratów (PLS). Stwierdzono, że praktyki lean mają znaczący pozytywny wpływ na produktywność łańcucha dostaw. Co ważniejsze, struktura organizacyjna ma kluczowe znaczenie dla przyjęcia praktyk lean management w łańcuchu dostaw. Wdrożenie praktyk wyszczuplających wymaga wspierającej struktury organizacyjnej.

**Słowa kluczowe:** łańcuch dostaw, praktyki lean, 5S, zarządzanie wizualne, struktura organizacyjna

### 精益实践对供应链绩效的影响

**摘要:** 由于各种供应链问题, 马来西亚电子行业的业绩较低。电子行业表现的下降降低了国内生产总值 (GDP) 的总体贡献。该研究调查了各种精益供应链实践, 以提高供应链绩效。因此, 本研究是检验精益实践对供应链绩效影响的尝试之一。精益实践包括: 蜂窝布局, 5S和视觉管理。进行了一项调查, 并在马来西亚的电子公司员工之间分发了问卷。在当前的研究中, 结构方程建模 (SEM) 技术在偏最小二乘 (PLS) 第3版的帮助下使用。发现精益实践与供应链绩效具有显著的正相关关系。更重要的是, 组织结构对于采用供应链中的精益实践至关重要。精益实践的实施需要支持性的组织结构。

**关键词:** 供应链, 精益实践, 蜂窝布局, 5S, 可视化管理, 组织结构