

SUPPLY CHAIN AND FIRM PERFORMANCE: EXAMINING THE MODERATING ROLE OF SUPPLY CHAIN INFORMATION STRATEGY

Saengchai S., Jermstiparsert K.*

Abstract: This study aims to investigate the association between the performance of supply chain and firm as working in the regional context of Indonesia under the title of manufacturing concern. For contributing in the existing literature, we have tested the moderating effect of information strategy between the relationship of supply chain performance and business performance accordingly. A sample of manufacturing firms working in the region of Indonesia were selected as core sample of the study while employing a survey approach for SEM-PLS estimation technique. It is observed that there is a significant relationship between supply chain performance and firm performance where the moderating role of information strategy is a key source to understand. Based on the stated findings, our study is providing a helpful outline for the decision makers in the field of business and management. However, it is suggested that researchers should understand the risk factors as associated between the supply chain management performance and business performance accordingly.

Keywords: Supply chain and performance, firm performance, information strategy

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Introduction

There are two major factors ensuring that a supply chain (SC) is working to its best abilities. These factors include proper and complete evaluation and observation of the data collected regarding operational and performance parameters. This data could be in the form of inventories or delivery schedules etc (Prajogo & Olhager, 2012; Tilabi, Tasmin, Takala, Palaniappan, Abd Hamid & Ngadiman, 2019). Considering the above information, it can be assumed that any SC trying to achieve successful management needs to adopt information systems (IS). Moreover, these are must be affiliated with the SC itself. In this way, the SC will have the ability to gather all the necessary information related to the factors responsible for the measurement of the objective in place for specific SC strategy. Organizations are recommended to adopt practice-based commentary to ensure the alignment of this caliber can be attained. As an example, the successful IS implementation by Wal-

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Mart to reduce cost and support its low-cost strategy can be considered. Wal-Mart implemented an IS regarding the management of the material, frequency, and a number of orders placed along with RFID-based inventory tracking. Due to these measures, Wal-Mart has been able to produce a forecast of demands and inventory management on a real-time basis. Because of this data, the company experienced an increased turnover in inventory and a decrease in the cost that went into it. However, if not applied properly such measures can lead to a disastrous outcome as well. Mismanagement of alignment among the application and objections of the SC, in the Nike case, leads to the failure of investment of about \$100 million. Despite such a large amount invested in a software for SC shortages in inventory and excesses in SC could not be averted (Chen, Sousa, & He, 2016). The evaluation of aforementioned examples only reinforce and emphasize of the significance of alignment amongst any IS deployed and the aims of a SC (Tarafdar & Qrunfleh, 2017).

It is interesting to see businesses adopting the same strategies but having to deal with completely different outcomes. It can only mean that a lack of information before deployment of IS in play (Grundey & Varnas, 2006). A question derived from the above-mentioned scenarios arises regarding the kind of applications to be implemented by an SC member business if it rains to reduce inventory and accomplish leanness (Shrimali & Soni, 2018). Alternatively, more importantly, the processing of required information in the best way possible to avoid the failure of a system implemented is another concern. With reference to the discussion above it can be concluded that the most important step to achieving alignment between ISs and SCs is a proper analysis of the support an IS application can provide for the fulfillment of the required needs of an SC. This research study will be focusing on examining the moderating relationships between the following factors:

- SC strategies including specific kinds of strategic objectives and goals that SCs can devise and SC IS strategies, for example, specific IS applications as well as portfolio outlines for the SCs
- The related impact of the above on the SC performance including SC flexibility, integration, and consumer approachability and the progress of a business for example to what extent is an organization able to successfully attain the goals it has set weather market or economics-oriented

A hypothesis can be formulated concerning the literature available for the ISs and SCs. According to this hypothesis, the factor influencing the progress of a principle firm and its SC is a constructive and moderating affiliation amongst two SC strategies and two IS strategies (Ebrahimi, Koh, Genovese, & Kumar, 2018). These strategies include Lean and Agile and Efficiency and Flexibility, respectively. The senior executives belonging to over 200 manufacturing organizations holding positions in SC and supply materials management as well as procurement have endorsed this hypothesis. Based on the theoretical proposition IS for Efficiency and IS for Flexibility are responsible for the fortification of the SC welfares from Lean SC strategy and Agile SC strategy, respectively. Moreover, these strategies are also

accountable for the provision of ample support required to enhance an organization's progress (Horvat, Antic, & Jeremic, 2015; Vilamova, Besta, Kozel, Janovska, Piecha, Levit, Straka, & Sanda, 2016).

Literature review

The literature has advanced the categorizations of SC strategies without an explanation of the supplementary inferences for the implementation of supportive IS. Moreover, previous studies are unable to answer to the reasons related to the necessity of alignment between IS systems and SCs. Research gap exists in explaining the way in which IS can support the processing requirements of information linked with particular supply chain types. Moreover, there is lack of information in literature about the alignment of SC strategies with relevant IS strategies (Green, Inman, Birou, & Whitten, 2014). This research gap has been addressed through this study. Therefore, in this research study, the lack of this theoretical understanding has been addressed. It provides an analysis of the advantages an SC can gain because of the implementation of an IS and its integration with SC strategies including boosting the SC and organizational progress. Furthermore, a limited analysis regarding the impact of IT in on SC integration procurement-related activities and supplier relationships (Popovic, Kraslawski, Barbosa-Póvoa, & Carvalho, 2017) is available. This research study has attempted to develop the existing information by taking a wider feature of the nature of the SC into consideration. This includes SC strategy. It also points out the group of applications, as IS strategy, which is not only applicable but also helps augment the development of an SC. After considering the above observations, it is safe to assume that this research study has contributed to the literature related to SC in multiple ways. It has proved not only theoretically but also with evidence that SC performance can be improved and significantly enhanced by the integration of aligned SC strategy and IS strategy. In addition, this research study has been successful in providing the tools capable of measuring the aforementioned factors in the case of not only SC performance but also that of an organization (Dobrzykowski, McFadden, & Vonderembse, 2016). The study has clearly demonstrated the significance of the application of ISs to help operation managers allowing them to understand that the implementation of an appropriate and properly investigated as well as measured IS into the SC strategy is essential for the progress of an SC. Furthermore, guidance has been provided regarding methods that managers can acquire to verify investments especially in the area of IT.

This research study starts with giving a theoretical contextual introduction extracted diligently from the literature available on IS and SCs (Thanki & Thakkar, 2018). It is then followed by the development of the research methodology and formulation of hypothesis. The study concludes by providing a description of used procedures and outcomes, interpretations, contributions, and limitations of research. The following hypothesis has been formulated based on the above research observations and analysis:

The hypothesized relation developed between the IS strategy, SC strategy, Supply Chain Performance and the performance of firm has been presented in the Figure 1. It has been proposed that IS strategy act as a mediating factor to positively influence the relation between supply chain performance and SC strategy.

In explanation,

1. The association between supply chain performance and a Lean SC strategy is strengthened by the IS for Efficiency
2. The relation between Supply chain performance and Agile SC strategy is strengthened by IS for Flexibility.

The research suggests that the performance of a firm is improved through effective supply chain performance. The study describes the foundations or key concepts underlying the hypothesized relationships.

H1. Information sharing for efficiency (ISE) moderates the relationship between lean supply chain strategy and supply chain performance.

A suitable and timely communication within and across the organizations is required for sharing of information regarding delivery of products, inventories, exceptions with reference to the Just in Time approach is required by the Lean SC strategy. Inter organizational and internal operations are improved through IS for Efficiency strategy, which support the organization in effectively managing the routine coordination across its departments and with the suppliers as well as customers (Chienwattanasook & Jermstittiparsert, 2018; Prajogo & Olhager, 2012). The ordering of materials and its flow between the manufacturing and purchasing sector is coordinated through ERP. It results in reduced level of inventories for raw materials. The integrated workflows are implemented across the supply chain functions including production planning and procurement.

It has been revealed through research that processes become error-free and productive because of the ERP implementation. The system results in better availability of information for controlling routine operations. The cost of procurement for MRO (maintenance-repair-order) is reduced for the standardized products (Qrunfleh & Tarafdar, 2014). Moreover, organizations become able to implement suitable and efficient practices to manage the workflow and reduce the wastage of resources in the manufacturing processes (Dawabsheh, Hussein, & Jermstittiparsert, 2019). With EDI or transaction-oriented B2B system, co-ordination of inventories and product deliveries is enhanced through improved connections among the production planning systems of the firm with the suppliers entry system. This reduces the level of inventories and time for completing new product orders.

As mentioned earlier Wal-Mart has demonstrated how IS for Efficiency and IS strategy can assist a Lean SC strategy. With the usage of inter-organizational applications, Wal-Mart has been able to provide real-time point-of-sale data to major suppliers such as Proctor and Gamble. It has done so by integrated satellite-based communication systems. As a result, inventory renewal needs to stay updated as required. This is helpful in a way that suppliers are able to keep track of

the data related to orders and inventories to ensure stock safety in the long-run. Similarly, by implementing RFID-based inventory tagging and tracking inventory records experience a higher accuracy. Because of this application, the organization has to face a lesser inventory-on-hand, reduced safety stock levels, and inventory loss, ultimately having a positive impact on the advantages of leanness in an SC (Dubey et al., 2017).

Another example to support the above assumption would be a multinational renowned clothing line Zara. Zara is known to not only design and produce but also deliver new collections to its outlets around the globe. This is possible due to three kinds of IS:

- As the first step, Zara gathers market and consumer data from all its outlets and uploads it to its central design office for its product managers. It does so by using a mixture of wireless handheld tools and networks.
- Next, assigned designers collaborate with product managers to define new designs and order quantities. They do so by utilizing decision-making systems that analyze the data gathered through step 1.
- Lastly, Zara uses certain applications to simplify communication with its suppliers. This communication covers the details of the distribution and delivery of supplies. These supplies include raw cloth and completed designs.

Therefore, it can be concluded that Zara's capability to implement the Agile SC strategy and sustain a flexible SC is based on its IS for Flexibility strategy. The following research hypothesis has been developed based on the above information sourced through literature.

H2: Information sharing flexibility (ISF) moderates the relationship between supply chain agility and the supply chain performance

The key consideration in Lean SC strategy is the management of supply chain through reduction of wastage of resources. It further requires effective supply chain management through employing better approaches resulting in improved product quality, lower time of deliver and low level of inventories. In Lean SC strategy, the focal firm works in coordination with the suppliers to implement innovative approaches including just in time and mass production (Thanki & Thakkar, 2018). It is necessary to reduce the level of inventory and focus on improved quality of products for managing supply chain effectively. By reducing the time and improving product quality, the performance of the firm is enhanced. Resultantly, the performance of supply chain is improved (Arabzad, Ghorbani, & Zolfani, 2015). When the supply chain is agile, it has high capability of responding to the demand and preferences of customers in an effective way. For instance, market uncertainties can be managed through implementation of buffers that will result in better responsiveness to the changes. Supply chain agility results in quick response to the demand of customers and market uncertainties and improved level of product customization (Radosevic, Pasula, Berber, Nešković, & Nerandžić, 2013). Based on these facts, the following research hypotheses have been developed

H3: Agile supply chain strategy (AGSCS) has significant impact on the supply chain performance.

H4: Lean supply chain strategy (LSCS) has significant impact on the supply chain performance.

Supply chain performance has been defined with respect to its effectiveness and efficiency. According to (Fawcett, Magnan, & McCarter, 2008) there are three aspects for determining the performance of supply chain. These measures include resource measurement, flexibility and output measurement of the firm. The output is generally measured in terms of customer satisfaction. Flexibility reflects the responsiveness of system to the market uncertainties.

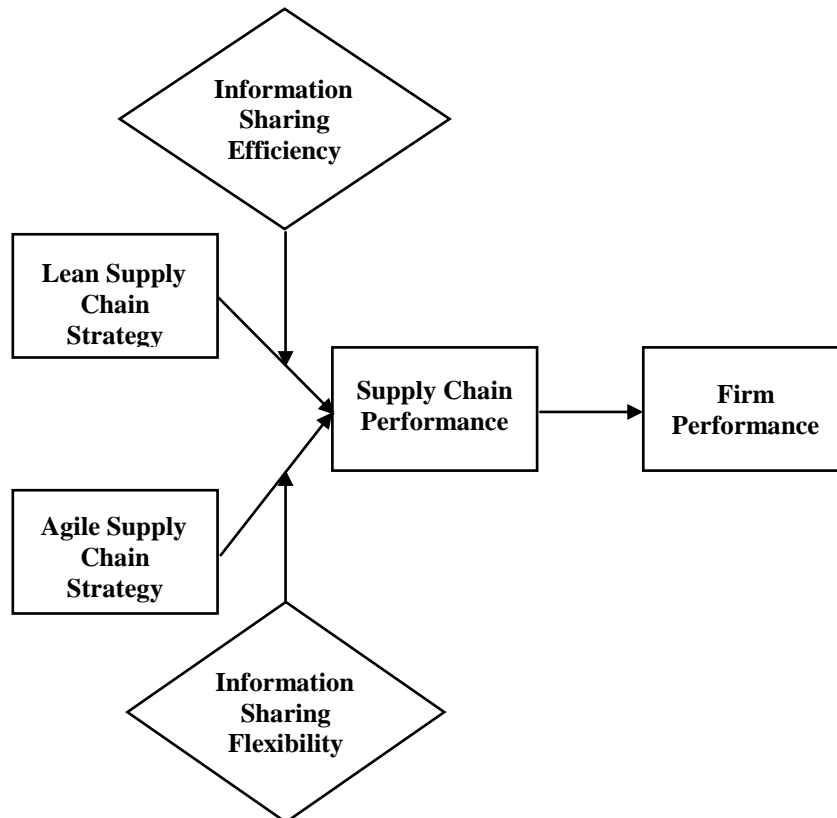


Figure 1: Conceptual framework

Generally, literature supports a positive relation between firm performance and supply chain performance. The efficiency of sharing information is improved through supply chain integration. By increasing timely delivery of products and lowering the level of inventory, the performance of firm can be improved (Agarwal, Shankar, & Tiwari, 2006). The degree of association between firm performance and supply chain flexibility is high. The ability of the firm to innovate

products responding to customer needs is positively influenced by its flexibility. Several studies have suggested that better response by the firm in meeting customer needs makes them superior. Based on the literature, the following research hypothesis has been developed:

H5: The supply chain performance (SCPR) is in significant relationship with firm performance (FP).

Methodology

The research employed method of questionnaire survey for data collection. For this, total 331 questionnaires were distributed in various construction organizations. For achieving high response rate, several reminders were given through phone calls and SMS. These efforts results in 195 questionnaires. Almost 17 out of 195 were not complete or useable. These questionnaires lack important responses and information by the participants. Almost 178 questionnaires were processed for further analysis. The total valid response rate was about 53.7 percent. This response rate is considered somehow sufficient for this research study. According to Qamar, Hall, and Collinson (2018) the sufficient level of response rate for surveys is considered about 30 percent.

Results

For testing the association among the constructs, the Smart PLS Structural Equation Modeling (SEM) has been used in this research. The technique is also known as second-generation approach. SEM is considered very effective approach and can be used as a good alternative for multiple regressions (Qamar et al., 2018). The advantage of SEM over multiple regressions is its ability to handle multiple regressions with multiple dependent variables in contrast to multiple regressions, where one dependent variable can be used at a time. SEM approach can handle several dependent variables simultaneously. The researchers working in the field of behavioral science use SEM approach. Researchers are able to include latent variables in the research analysis using SEM to run path-analytic modeling. The variables, which cannot be observed and measured directly, are called latent variables. These variables are estimated through other measures this research, all the constructs are unobserved variables, which need to be estimated through their indicators. An inner model (structural) and outer model (measurement) are used in SEM analysis. A two-step process was applied for model validity based on the advancement of PLS path modeling. This research study has used the two-step process in which, an outer model is assessed and the inner model is assessed. More precisely, the assessment of the measurement model is done in first step, and in the second step, the structural model is assessed. The measures allocated to the unobserved or latent constructs are identified in the measurement model. On the other hand, the association between the dependent and independent unobserved constructs is incorporated in the structural model. The research can estimate, define

and forecast the extent of association among the latent constructs through this approach (Bulgurcu, Cavusoglu, & Benbasat, 2010). When the assessment of measurement model is done, the reliability of internal consistency, content validity, convergent and discriminant validity are required (Hair, Ringle, & Sarstedt, 2013). The estimation of the outer loadings of the measure of each construct was assessed through the reliability of individual item. According to the researchers, items with values of 0.4 to 0.70 should be considered. In this research, 2 out of 61 items were eliminated because of the values below 0.40 (standard value). Considering the suggestions of Hair et al. (2013) based on the issue of multi-collinearity, about 38 items have been eliminated. When the items are similar, they are less likely to measure a construct. When most of the items become similar in the research, to represent the item set, only one or two sample items are accepted. It has been recommended by Hayduk and Littvay (2012) that one or two best indicators are sufficient. There must be a minimum of two estimated indicators in every latent for a model to be estimated (with latent variables). While estimating a complicated model, the degrees of freedom are increased. According to Bulgurcu et al. (2010) the validity of single and multiple items are equal. The empirical and theoretical findings of the measures will be same when single-item measures are used only. According to Hair, Sarstedt, Hopkins, and Kuppelwieser (2014) single-item indicators can be used in the research. The researcher proposed some constructs which can be measured through single item indicators.

The extent to which the intended latent constructs are represented by the items associated with similar latent constructs is referred as convergent. As per the suggestion of (Hayduk & Littvay, 2012), the AVE approach has been used for estimating the Convergent validity of latent construct. It has been recommended by Hair et al. (2014) that AVE of each latent construct must be greater or equal to 0.50 for achieving a sufficient level of convergent validity. According to Bulgurcu et al. (2010) the AVE values estimated in this research came out to be in the range of 0.567 and 0.8771 as represented in table 1, reflecting high loadings.

Table 1: Reliability

	CR	AVE	Cronbach Alpha
FP	0.975	0.872	0.885
AGSCS	0.934	0.843	0.874
LSCS	0.702	0.737	0.924
SCP	0.960	0.871	0.893
ISE	0.802	0.832	0.916
ISF	0.840	0.873	0.943

The next stage is the assessment of the structural model after ascertaining the measurement model in the present study. The procedure for the bootstrapping through a number of 5000 bootstrap samples and 331 cases to assess the significance of the path coefficients was applied. Structural model, according to

(Hair et al., 2014), illustrates about the reliance and dependence of relationships in the hypothesized model. In partial least squares (PLS), structural model takes before the directional relationships between the variables, their t-values and the path co-efficient. The PLS approach is similar to the standardized beta coefficient estimated in the regression analysis (Qamar et al., 2018). This research study has highlighted the model of evaluation. After this, the hypotheses have been tested for finding the correlation among the variables.

Table 2: Direct Effect

	(β)	SD	T-value	P-Values
H3	0.321	0.178	3.321	0.000
H4	0.342	0.165	3.234	0.000
H5	0.453	0.187	3.768	0.000

Parsimonious models are supported in PLS-SEM approach in the structuring of hypothesis. For maintaining the model estimation quality, the parameters are kept to be lowest as possible. Different layers of constructs are involved in the HCM (Hierarchical component model), which is usually a second order structure and has high abstraction level. According to Hair et al. (2014) HOC contains a high order component concerning two or more lower-order components (LOCs) in a formative way. Various reasons are there for the addition of Hierarchical component model in PLS-SEM. This supports in reduction the number of structural model relationships. In this way, the PLS path model becomes economical. When the constructs have high correlation, the HCMs come out to be impressive. However, relationship estimates may become biased because of multi-collinearity issues. These issues can be eliminated through a second order construct.

Table 3: Indirect results

	(β)	SD	T-value	P-Values
H1	0.211	0.135	3.211	0.000
H2	0.357	0.152	3.678	0.000

The total variations in the dependent variable caused by the explanatory variables are demonstrated by the value of For the estimation of structural models in PLS-SEM, the value of R-squared is an important as well. It is referred to be the goodness of fit or coefficient of determination. According (Hayduk & Littvay, 2012) and (Hair et al., 2014), the total changes in the dependent variable caused by the independent variable are represented through R-squared value. The minimum acceptance level of R-squared value is set to be 0.10. In PLS-SEM, the value of R-squared to be 0.19 is considered weak, 0.33 as moderate and 0.67 to be substantial.

The R-squared value of the endogenous latent variables has been presented in Table 4. The variance explained by independent variables is 62 percent.

Table 4: Expected Variance

	R ²
Firm Performance	67.0%

Conclusion

With reference to the discussion above it can be concluded that the most important step to achieving alignment between ISs and SCs is a proper analysis of the support an IS application can provide for the fulfillment of the required needs of an SC. This research study will be focusing on examining the moderating relationships between the following factors a) SC strategies including specific kinds of strategic objectives and goals that SCs can devise and SC IS strategies, for example, specific IS applications as well as portfolio outlines for the SCs b) The related impact of the above on the SC performance including SC flexibility, integration, and consumer approachability and the progress of a business for example to what extent is an organization able to successfully attain the goals it has set whether market or economics-oriented. The prime objective of the current study is to investigate the relationship between supply chain performance and firm performance of firms operating in Indonesian manufacturing industry. In addition to that the moderating role of information strategy in the relationship between supply chain performance and the firm performance is also examined. The firms operating in the manufacturing industry of Indonesia are chosen as the sample of the study. Employing the survey-based methodology, the SEM-PLS technique is used to test the hypothesized relationships. So, current study has used SEM-PLS as statistical tool to answer the research questions raised in this study and research objectives envisaged in the current study. The findings of the study have provided support to the theoretical foundation and proposed hypothesis of the current study. Current study will be helpful for policymakers and practitioners in understanding the issues related to supply chain risk, supply chain integration and supply chain performance. In author knowledge this is among very few pioneering studies on this issue.

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ŁAŃCUCH DOSTAW I WYDAJNOŚĆ FIRMY: BADANIE MODERUJĄCEJ ROLI STRATEGII INFORMACJI W ŁAŃCUCHACH DOSTAW

Streszczenie: Niniejsze badanie ma na celu zbadanie związku między wydajnością łańcucha dostaw a firmą działającą w kontekście regionalnym Indonezji pod tytułem koncern produkcyjny. Wnosząc wkład w istniejącą literaturę, przetestowaliśmy odpowiednio moderujący efekt strategii informacyjnej między stosunkiem wydajności łańcucha dostaw a wydajnością biznesową. Próba firm produkcyjnych działających w regionie Indonezji została wybrana jako podstawowa próba badania, stosując podejście ankietowe do techniki szacowania SEM-PLS. Zauważono, że istnieje znaczący związek między wydajnością łańcucha dostaw a wydajnością firmy, w której moderującą rolę strategii informacyjnej jest kluczowym źródłem do zrozumienia. W oparciu o stwierdzone ustalenia nasze badanie stanowi pomocny zarys dla decydentów w dziedzinie biznesu i zarządzania. Sugeruje się jednak, aby badacze rozumieli odpowiednio czynniki ryzyka związane między wydajnością zarządzania łańcuchem dostaw a wydajnością biznesową

Słowa kluczowe: łańcuch dostaw i wydajność, wydajność firmy, strategia informacyjna

供应链和企业绩效: 检查供应链信息策略的建模作用

摘要: 本研究旨在调查供应链绩效与企业印尼区域性背景下以制造关注为题的工作之间的关联。为了对现有文献做出贡献, 我们测试了信息策略对供应链绩效与业务绩效之间的关系的调节作用。在采用调查方法进行SEM-PLS估算技术的同时, 选择了在印度尼西亚地区工作的制造公司样本作为研究的核心样本。可以看出, 供应链绩效与企业绩效之间存在显著关系, 其中信息策略的调节作用是理解的关键来源。基于陈述的发现, 我们的研究为业务和管理领域的决策者提供了有用的概述。但是, 建议研究人员应了解与供应链管理绩效和业务绩效相关的风险因素

关键字: 供应链与绩效, 企业绩效, 信息策略