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The impact of supply chain collaboration on operational performance: Empirical evidence from manufacturing of Malaysia

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ABSTRACT

Indeed due to global advancement, rapid technological innovation, and enhancing regional influence, supply chain (SC) has become an essential element. Now, competition has shifted from organization to industry level; any disruption can not only disturb organization but also effect whole industry. Although Malaysia is known from palm oil and rubber but manufacturing sector has highest growth rate (7.1%) and second contributor to GDP and employer. Due to regional and economic shift toward China and India this sector is facing numerous problems. Supply chain collaboration has dogged the performance in various industries and in various regions. The aim of this study is to explore the potential benefits of supply chain collaboration toward achieving operational performance. This is an empirical investigation conducting among manufacturing industries in Malaysia. Factor analysis and multiple regressions through SPSS have been used for data analysis. The finding of this study reveals that two supply chain management approaches information sharing (IS), joint decision making (JDM) significantly effect, while Electronic Data Interchange (EDI) does not have a significant effect on operational performance.

1. Introduction

The objective of supply chain management is to maintain the sale either form goods or services while keeping the expenditures and expenses minimum. Previous logistic focused only on procurement, maintenance, inventory management, and distribution. Supply chain adds values like new product development, marketing, customer services and finance. Now supply chain has its own objectives like customer satisfaction and sustainable organizational performance. The rapid growth in the global supply chain requires interconnectedness among stakeholders. And a result will be a high level of interdependency and complexity development in supply chain (Christopher et al., 2011; Elkins et al., 2005; Kamalahmadi and Parast, 2016). Empirical studies have been proved that supply chain collaboration increased performance (Sheu et al., 2006). Likewise, another example will add the importance of collaboration, Dow (2011) the policy of dove chemical company proposed a plane with the partners like with their logistic providers in North America, who deal 90% of Dow's shipment, develop a highway security network that shares intelligence information, discuss best approaches and generate a mutual security plane for safe shipment.

Performance measure is an indicator that establishes how well an organization accomplishes its goals; it may include market orientation, customer satisfaction, financial performance or etc. previous performance has been measure in numerous methods like firm performance, operational performance, and financial performance. However, it has been established that competition is no more among organizations but among supply chain. Thus to compete globally, it is essential to include all members and performance should be measured on supply chain level. An organization with better supply chain can keep the business smooth, efficient and effective (Basu et al., 2017). In order to achieve efficiency and effectiveness managers must establish a completive supply chain approaches, there are various approaches to that positively affect the performance, the most effective is considered is supply chain collaboration (Seo et al., 2015).

Although Malaysia is known from palm oil and rubber but manufacturing sector has highest growth rate (7.1%) and second contributor to GDP (23%)

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and employer (2.3 million) (MPC, 2016). Manufacturing sector is facing very high risk locally as well as globally (Ali et al., 2008; Saleem, 2015). It has been reported that biggest challenge for Malaysian manufacturing during or after disaster is communication (Azmani et al., 2017).

Conclusively, after realizing Malaysian economic situation and present development in manufacturing industry it can be conclude that effective supply chain is essential. However to make the supply chain effective, efficient and achieve best operational performance supply chain collaboration need to be more improved. This study has empirically verified three supply chain collaboration approaches namely, information sharing, joint decision making and Electronic Data Interchange and revealed that all three approaches have positive and significant effect of operational performance.

2. Literature review

Supply chain is very new field; it has its roots in every aspect of the organizations. Previous it was regarded as logistic and its functions were only flow of goods. With the passage of time researchers and academicians add value like, marketing, inventory management, finance, promotions, or even new product development. According to Shukla et al. (2011) "Supply Chain Management is management of material, money, men, and information within and across the supply chain to maximize customer satisfaction and to get an edge over competitors". It also includes suppliers, logistic provider, customers and other members so first this it deals not only supply but also demand and other sides and secondly it is not a simple chain but has become a complex network (Shahbaz et al., 2017). Thus for better understanding it is essential to understand all member of supply chain that have either indirect or indirect effects of performance.

2.1. Operational performance

The performance is "A set of metrics used to quantify the efficiency and effectiveness of supply chain processes and relationships, spanning multiple organizational functions and multiple firms and enabling supply chain orchestration" (Maestrini et al., 2017). The aim of every organization is to enhance the performance but for improvement they must need to measure it accurately first (Gunasekaran and Kobu, 2007). Previously performance was measured by cost with the passage of time more financial indicator were added like return on asset, return on investment, sale and etc., (Anand and Grover, 2015). Only financial indicators are not enough for measure overall and accurate performance, consequently, with invent of balance scorecard approach some operational indicators were add (Gunasekaran et al., 2004). Other approaches also added values in measuring supply chain like quantitative or qualitative measures, strategic, tactical and operational measures and etc., (Arzu Akyuz and Erman Erkan, 2010). A comprehensive review and revealed that for the good performance measure all the members should be considered, performance measure should consider both financial and non-financial items, all the levels of supply chain must be considered and all process of supply chain should be included so the performance should be measured by operational performance.

Meanwhile, researchers had used many ways to measure the effects of risk sources and supply chain practices with different means like firm or organizational performance (Cook et al., 2011; Shukla et al., 2013), product performance, operational performance (Kauppi et al., 2016; Sukati et al., 2013), logistic performance (Effendi, 2015), financial performance (Li et al., 2015) or operational performance (Ahmad and Saifudin, 2014; Chen, 2012; Sukati et al., 2012; Sundram et al., 2016). Nevertheless, indicators to measure above mention performance are alike. SCM had been measured by operational performance and its indicators were quality performance, flexibility performance, customer service, delivery performance and cost performance (Kauppi et al., 2016). Effendi (2015) has use logistic effect for SCM and its metric consisted on order fill rate, order fulfilment lead time, operations flexibility, inventory turnover and total logistics cost. SCM has been measured SCM with organizational performance and its dimension was profit, cost, ROI and sale (Florian and Constangioara, 2013). It can be conclude that SCM performance had been measured by various ways like operational, organizational, firm, financial measures. A model has been developed for measuring performance and revealed that for measuring overall performance, these items should be considered cost, quality, flexibility, customer satisfaction, capacity, time, consistency. Thus, this study will consider all the requirement of better operational performance.

2.2. Supply chain management approaches

SCM approaches has been defined in various ways like according to (Basu et al., 2017) "SCM approaches are used to achieve organizations short term and long term goals such as to enhance productivity, control inventory, reduce waste, increase market share and sustain growth". After measuring the performance now there is a question; how to improve it? Literature on SCM has proposed and verified number of approaches and strategies that have positive effect on performance like just in time, lean/agile/hybrid, integration, flexibility and supply chain collaboration. However, due to globalization it is hard for an organization to sustain alone, supply chain collaboration has become an essential part of business practices nowadays (Chopra and Sodhi, 2004). If an organization wants to competition it must focus on internally and externally (Basu et al., 2017).

Several dimensions had been proposed for SCM approaches in literature. Sezen (2008) has explored

SC integration, SC design and IS and revealed that none of the approach affected flexibility performance and only SC design affected resource performance and output performance. Cook et al. (2011) had develop and verified five dimensions that are long range relationships, information sharing, leveraging the internet, advanced planning techniques and supply and distribution network structures and found a positive relationship with organizational performance. In addition Sundram et al. (2011) has investigated SCM approaches by customer and supplier and relationships, postponement, agreed goals and vision, level and quality of IS and reward/risk sharing. This study found that all has positive relationship except customer relationship. Another study investigates internal integration, customer integration and supplier integration and found that customer integration did not significant positive impact of performance. Thus many studies have been conducted on SCM approaches that have revealed positive effect of performance.

The rapid growth in global supply chain requires interconnectedness among stakeholders. As a result high level of interdependency and complexity develop in supply chain (Christopher, 2016; Elkins, 2005; Kamalahmadi and Parast, 2016). Empirical studies have proved that supply chain collaboration increased performance (Sheu et al., 2006). Likewise another example will add the importance of collaboration, Dow (2011) the policy of dove chemical company is propose a plane with the partners. Like Dow with their logistic providers in North America, who deal 90% of Dow's shipment, develop a highway security network that share intelligence information, discuss best approaches and generate a mutual security plane for safe shipment. According to Ataseven and Nair (2017) information sharing, joint decision making (JDM) and teamwork are the major dimensions of SCM approaches. By review the literature it can be conclude that information sharing, joint decision makes and Electronic Data Interchange are most important approaches and additionally these approaches have also empirically verified in many countries and many industry.

2.3. Information sharing (IS)

IS defined as "the willingness to make strategic and tactical data such as inventory levels, forecasts, sales promotion, strategies, and marketing strategies available to firms forming supply chain nodes" (Cao and Zhang, 2012). The ability to see from one side of the channel to last is crucial, information is assumed as blood for SC collaboration (Christopher, 2016). The aim of IS is to improve the efficiency and effectiveness in the whole network of organizations and finally enhance not only the firm performance but also the operational performance (Qrunfleh, 2010). IS may also include logistic, customer, quality, time, market changes, design or uncertainty (Singh, 2013).

IS has been investigates in multiple industries and regions and revealed that it has a major contribution in enhancing operational performance (Abdallah et al., 2014; Effendi, 2015). IS positively affects performance in many ways like enhanced service levels, customer responsiveness, decreased costs, and reduced levels of complexity (Flynn et al., 2010).

Huo et al. (2014) has studies IS with supplies, customers and internal in Chines manufacturing and revealed that all have positive effect on operational performance and internal IS also has a positive relationship with external IS. IS has a positive effect on operational performance but not significantly in manufacturing sector of Turkey (Sezen, 2008). Today supply chain has become more fragile and risks have become a serious concern. Cao et al. (2010) did a comprehensive literature review and found that IS has not only positive effect on performance but also a good tool for reducing uncertainty. Based on the literature review below hypothesis has been developed.

H1: Information sharing has a positive effect on operational performance.

2.4. Joint decision making (JDM)

JDM defined as the "process by which supply chain partners coordinate activities in supply chain planning and operations for optimizing the supply chain benefits (Cao and Zhang, 2012) it include plans, combine information, resolve problems and develop rules and regulation and procedures. An effective strategic coalition and worthy relationship with customers and suppliers is required and It should consists on trust, loyalty and positive relationship (Basu et al., 2017). The aim of JDM is to align partners and to synchronize decisions on order placement, inventory replenishment and order delivery (Cao et al., 2010). Meanwhile, every partner has its own objectives and goals, so it is sometime very hard to come on mutual points that may cause uncertainty (Kauppi et al., 2016); to reduce this uncertainty JDM has become an important strategy for today business.

Furthermore it has also empirically verified that JDM has positive effect on operational performance (Effendi, 2015; Ha et al., 2011; Shukla et al., 2013). JDM had a positive relationship with operational performance when quality of information is high (Wiengarten et al., 2010). Meanwhile, Effendi (2015) revealed that JDM with suppliers and customers improves logistic efficiency. JDM at strategic, tactical and operational level improves magnitude of relationship quality, strength and closeness that ultimately enhance operational performance (Jüttner and Maklan, 2011). Hence, based on literature review following hypothesis has been drawn.

H1: Joint decision making has a positive effect on operational performance.

2.5. Electronic data interchange (EDI)

Electronic Data Interchange (EDI) and now the Internet have enabled partners in the supply chain to act upon the same data, at same time with minimum resources (Christopher, 2016). It is defined as a set of specifications for exchanging standard business documents such as purchase orders, invoices and bills of lading over computer networks. EDI is defined as the direct computer-to-computer transfer of information (possibly through a third party) between independent organizations (Kanda and Deshmukh, 2006). Electronic data interchange provides visibility to data across supply networks, finally, process management applications and server-to-server links that enable true and real time channel information and transaction harmonization. From this level the degree of collaboration strengthens with increasing communication to facilitate joint operations and coordination, where companies in the supply chain use the competencies of network partners, to cooperation where channel partners (Ross, 2016). EDI has numerous advantages like faster information flow, quick payments, receive standardized data, easy tracing of orders, visibility of information to all members and easy updating of received data (Arshinder, 2006). In various studies it has been revealed that EDI has positive and significant effects on performance (Cook et al., 2011; Shukla, 2016; Shukla et al., 2013). On the basis of above literature below hypothesis has been developed.

H1: Electronic Data Interchange has a positive effect on operational performance.

2.6. Research framework

After exhaustive literature review Fig. 1 framework has been developed. Fig. 1 shows the proposed conceptual framework that consists of three independent variables, information sharing, joint decision making and electronic data interchange, and a dependent variable operational performance.

3. Methodologies

The aim of this study is to find how much supply chain collaboration approaches have effects on operational performance. This is quantitative study; survey method has been used for data collection. Supply chain collaboration is has been applied in numerous countries and in various industries, extensive work has been done in recent years. After comprehensive literature review this study adapt questionnaire from different previous studies according to best match with industry and demographic position. Likert scale 5 has been used and questionnaires have been distributed through internet to all respondents. Below Table 1 is describing four variables information sharing, joint decision making, electronic data interchange and operational performance according to their sub-dimensions and references.

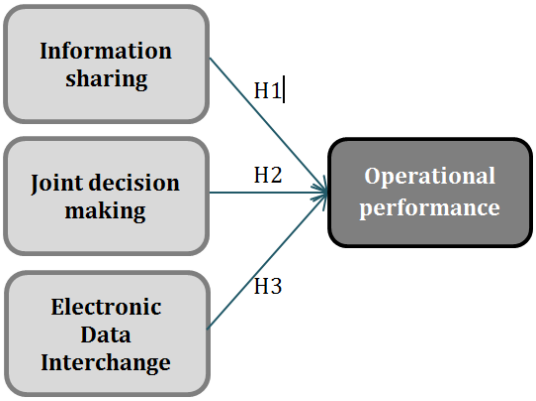

Fig. 1: Research framework

3.1. Sampling and data collection

The target of population in this study consists of manufacturing sector of Malaysia. Information sharing, joint decision making and electronic data interchange are independent variables and operational performance is a dependent variable. The samples of this study are members of manufacturing companies including manufacturing, assembling, distributer, retailers, and suppliers. Data were collected through questionnaires. The questionnaires were distributed to the members through self-administered surveys and the email. The sample size was 284 due to limited time and economic restraints. The state of Selangor has been consider as only state has highest number of manufacturing industries (42%) (FMM, 2017). This study considered the target respondents having experience more than 10 year. Manufacturing sector is being categories into three according to size of employees by FMM (2017), Fig. 2 shows number of respondents according to size of organization. Whereas, Fig. 3 explain distribution of respondents accords to their working experience and size of organization.

3.2. Data analysis and discussion

Data has been analyzed through SPSS 23 version. First special codes have been assigns to analysis then manual screen of data has been performed and responses with high mission values and same responses have been deleted. Furthermore, by histogram, Q-Q plot and skewness and kurtosis data has been clean from missing values and outliers. Additionally data reliability has been checked through Cronbach's α. Table 2 presents the value of Cronbach's α, mean and standard deviations. For the independent variables, information sharing yield the highest mean is 3.868, joint decision making mean is 3.906, EDI mean is 4.162 and at the last, Operational performance mean is 4.643.

Table 1: Questionnaire items with references

Variable/Construct	Items	References
Information sharing	Organization informs its trading partners in advance of changing needs Organization's trading partners share proprietary information with your organization Organization's trading partners keep your organization fully informed about issues that affect its business Organization and its trading partners exchange information that helps establishment of business planning Organization's trading partners share business knowledge of core business processes Organization and its trading partners keep each other informed about events or changes that may affect the other partners	(Sundram et al., 2016)
Joint decision making	Participating in the sourcing decisions of your suppliers Participating in the marketing efforts of your customers Involving all members of your firm's supply chain in your product/service/marketing plans Contacting the end users of your products to get feedback on performance/customer service	(Jayaram et al., 2010)
Electronic data interchange	Shared operational decision making Willingness of collaborative problem solution Willingness of collaboration in strategic decision making Creating linkage with suppliers through information technology Creating linkage with customers through information technology Enterprise application integration among internal functions Integrative inventory management Data integration among internal functions	(Effendi, 2015) (Qi et al., 2017)
Operational performance	Quality performance Flexibility performance Customer service Delivery speed Cost performance	(Kauppi et al., 2016)

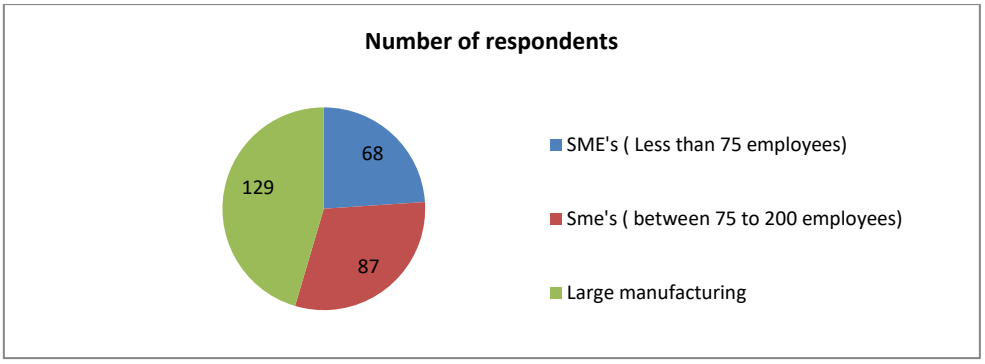

Fig. 2: Number of respondents according to vehicle manufacturing

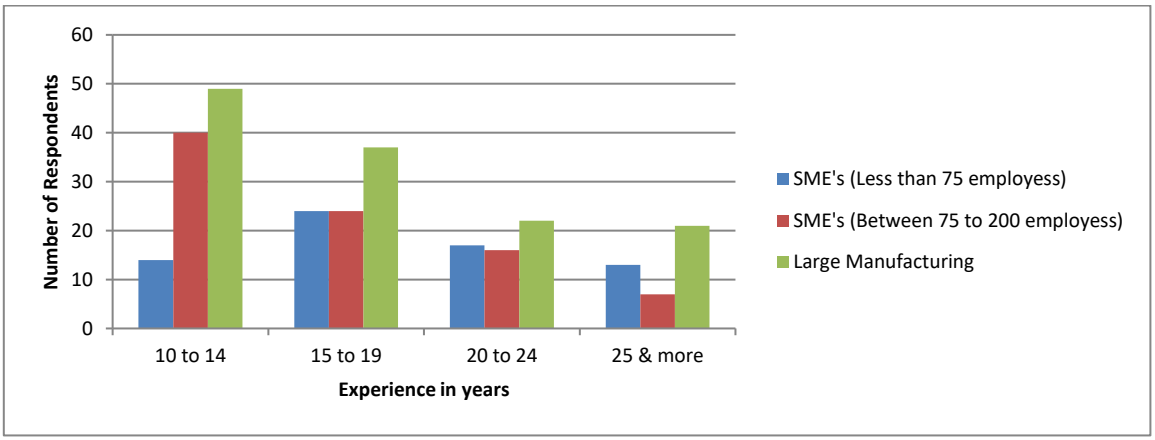

Fig. 3: Number of respondents according to their experience and vehicle manufacturing

Table 2: Cronbach's α coefficient, means and standard deviations

Variable	Cronbach's α	Mean	SD
Information Sharing	.886	4.2444	.51143
Joint Decision Making	.783	4.0586	.54648
Electronic data interchange	.785	3.0189	.90359
Operational performance	.692	3.9617	.59285

Correlation is relationship among variables; one tail Pearson correlation has been calculated to determine the relationship between supply chain collaboration approaches and operational performance. Analysis of correlation shows that all three relationships are significant it can be seen in Table 3. The correlations between information sharing and operational performance is 0.726**, that mean there is significant relationship between two. Correlation of joint stock making is 0.446** indicates positive relationship among members but this relationship is not strong. The value of correlation of

EDI is 0.590** that also explain the strong relation between Edi and operational performance.

Table 3: Correlation analysis

Variable	IS	JDM	P/RS	SCP
Information Sharing	1			
Joint Decision Making	.119	1		
Electronic data interchange	.458**	.510**	1	
Operational performance	.726**	.446**	.590**	1

*Correlation is significant at the 0.05 level (1-tailed); **Correlation is significant at the 0.01 level (1-tailed)

Furthermore, multiple regression analyses are first confirmed by testing the assumptions of normality, linearity, homoscedasticity, and independence of residuals, revealing that the residuals are normally distributed. Multiple regression analysis allows for determining the degree of strength and the direction of the linear relationship among research variables (Shukla, 2016). Regression analysis in Table 4 indicates the relationship among independent and dependent variable. Information sharing, joint decision making and EDI regressed against operational performance and the variance accounted for, R^2(.580), R^2(.516), R^2(.397), respectively and these figures show that (58 %) of sharing information, (51.6%) of joint decision making and (39.7%) of EDI can be increased performance of Manufacturing sector of Malaysia.

Table 4: Regression analysis

Model	Unstandardized Coefficients		Standardized Coefficients	R^2	t	Sig.	Results
	B	Std. Error	Beta				
a (Constant)	1.451	.338			4.290	.000	
Information sharing	.678	.076	.163	.580	2.485	.000	Supported
Joint decision making	.559	.075	.390	.516	5.672	.000	Supported
Electronic data interchange	.623	.041	-.004	.397	-.059	.000	Not Supported

a: Dependent Variable: Operational performance

Multiple linear regression analyses are employed to develop models relating the three independent variables and one dependent variable. In the first model, the dependent variable is operational performance, the model seem to be reliable (p-value for F<0.01 and adjusted R-square of 0.130. The significant of all the independent variable was found P<0.05, which is 0.000. The result shows the variables of information sharing, joint decision making and electronic data interchange jointly explain of the variance (r^2) of supply chain management. Beta coefficient values indicate about the contribution of individual predictor in the model. The beta for information sharing is 0.678. This mean when one unit increase in information sharing, the overall performance of supply chain will increases by 0.678. The significant was found between joint decision making and operational performance, and indicates about beta value .559 which shows the relationship between them. The beta of electronic data interchange is .623 which mean when one unit increase due to EDI with members, then overall performance of supply chain will increases by 0.623. There is a significant relationship between these three variables of information sharing, joint decision making and but not with electronic data interchange with supply chain management hence proved that H1, H2 are accepted while H3is not accepted.

4. Discussions and conclusion

This study focuses on the relationship between information sharing, joint decision making, Electronic Data Interchange and operational performance in the context of the Malaysian manufacturing. The findings of the study indicate that the independent variable like information sharing, joint decision making and EDI positively influences on operational performance. These outcomes are reliable with extant supply chain management literature (Cao and Zhang, 2011; Effendi, 2015). This study suggests that implementation of supply chain collaboration approaches among manufacturing industries is also an important predictor, similar to other developed countries. It will give some benefit to individual, both suppliers and buyers organization and other researchers. This paper makes a number of significance and discussion of study. Firstly, all the three factors improve operational performance.

Researchers can use finding of this study to produce idea for further studies, and supply chain managers are able to identify specific operational performance that have the higher prospective to increase performance of manufacturing industries. Next, making collaboration with supply chain partners can help to boost operational performance. Managers of the supplier firm need to collaborate with the managers from the buyer firm in terms on making several supply chain decision. Moreover, connecting managers across functional and organizational boundaries and providing them with relevant, accurate, and timely information reduces temporal and spatial distance enabling them to make better, more collaborative decisions. Recent technological advancements have dramatically increased companies' ability to connect. Connectivity creates the capability to share information. However, In this study, we propose that information sharing; joint decision making and EDI are the relevant factors and suggest that operational performance is the most important one. The measurement instrument provided as a result of this study is useful for researchers who are interested in conducting survey-based research associated to operational performance measures in any sector. This study also provides empirical explanation that identifies positive and important relationship among supply chain management and operational performance within the context of Malaysian manufacturing. Thus,

managers looking for proficiency and efficiency improvements should consider a set of supply chain management that could help them to expand their supply chain abilities and in turn their performance.

Supply chains consist of all associated activities, from raw material flows to good transformations. Management of the performance of supply chain activities in order to increase supply chain associations and good advantage is important. The supply chain management provided in this study can be suitable for managers to evaluate to their current performance of Malaysian manufacturing. Industry strongly interested in developing good performance and should develop innovative strategies. There is scope to enhance this study by taking different industries and increasing the number of respondents into consideration.

Manager's perspective, this study demonstrates why careful consideration should be applied when deciding which supply chain strategy should be developed. Firms that manage to achieve this relationship benefit greatly by improving their operating margins, cost efficiencies, waste reduction, agility and time-to-market, and overall gain sustainable competitive advantages. This study also demonstrates that such a relationship cannot be achieved in isolation at a firm-level alone.

This study was conducted to understand how supply chain management approaches contribute to operational performance. The current study find out the approaches to enhances the operational performance literature through the information sharing, joint decision making and EDI. This study has empirically proved that information sharing, joint decision making and Electronic Data Interchange have key role toward performance of supply chain members of Malaysian manufacturing. This study shows the impact of three supply chain management approaches, information sharing, joint decision making and EDI with operational performance is positive and significant except EDI. In doing so it introduces a theoretical perspective of potential deployment of supply chain management as a means to achieve operational performance. Overall, this study provides further awareness into the developing field of the relationships among supply chain management and performance measures.

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