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## THE INFLUENCE OF SUPPLY CHAIN COLLABORATION ON SUPPLY CHAIN PERFORMANCE FOR MALAYSIAN MANUFACTURING INDUSTRY

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### ABSTRACT

*Although Malaysian manufacturing has the second-highest growth rate, still its growth rate is far away from developed countries. There are numerous approaches and strategies to improve the performance but collaboration is on the top. There are many studies that verify supply chain collaboration has positive effects, but all are for a specific industry or sector. There is no study available for overall manufacturing. The purpose of this research is to empirically verify the relationship between supply chain collaboration and supply chain performance for the manufacturing of Malaysia. A questionnaire was distributed by convenience sampling in all listed manufacturing in the federation of manufacturers Malaysia. The retrieved data were purified from mission values and outliers, validity, and reliability. Finally, data were analyzed through Smart PLS 3. The finding revealed that all the approaches have a positive influence on supply chain performance. Information sharing, agreeing vision and mission, supplier relationship, customer relationship, and information quality are significantly effecting, while postponement and risk and reward sharing have positive effects but this effect is not significant. This study will help managers to understand the importance of collaboration while making a strategic decision. Meanwhile, this study will also help the organization in reducing risks. This study presents a framework that can be implemented in other industries and demographics. The first limitation of this study is to cover only manufacturing. Secondly, this study covers direct suppliers and customers for collaboration; the next study can include suppliers of suppliers and customers of customers.*

**Keywords:** Supply chain management; supply chain collaboration; supply chain performance; Manufacturing.

### INTRODUCTION

The main focus of our research is on the manufacturing sector of Malaysia because according to “High-value manufacturing - Malaysia’s next frontier” Malaysia is a top location for manufacturing (Shahbaz et al., 2018). The department of statistics disclosed that the Malaysian manufacturing sector share in the economy is 24.9% (Jinn and Shuhaimen, 2017). Likewise, Malaysia Productivity Corporation reported that the manufacturing sector, with productivity growth of 7.1, has the highest growth rate in productivity (Malaysia Productivity Corporation,

2016). This situation creates enough pressure on Malaysia's manufacturing sector to be more efficient and effective in its production and supply chain in order to be globally competitive. The rapid growth in the global supply chain requires interconnectedness among stakeholders.

To achieve collaboration, all members must share information with suppliers, distributors, retailers, wholesalers, end-users, so that all members can make quicker decisions, should have less inventory, and high flexibility, with more satisfied clients (Effendi, 2015). Trust is a necessity for intra-organizational information sharing. So, it is essential to form long term connections for trust-building (Abdallah et al., 2014). However, it is recognized that competition is no more among organizations but among networks. Conclusively, if an organization wants to contest worldwide, it should include all followers of the network. Additionally, the organization measures the performance collectively rather than individually. Therefore, supply chain collaboration must be executed in the whole sector or industry to be globally competitive. This study has empirically verified seven supply chain collaboration approaches namely, information sharing agreed on vision and goals, supplier relationship and customer relationship, information quality, postponement, and risk and reward sharing on supply chain performance.

## LITERATURE REVIEW

According to Shukla, Garg, & Agarwal (2011) "Supply Chain Management is the management of material, money, men, and information within and across the supply chain to maximize customer satisfaction and to get an edge over competitors". Supply chain comprises distributors, retailers, and end-users so first not only upstream but downstream as well, and secondly, it is not a simple chain but has developed as a complex network (Shahbaz et al., 2017). Consequently, after the above discussion, we can conclude that the supply chain is not a simple chain. Most of the researchers replace the word chain into the network because of its complexity (Christopher, 2011; Zsidisin and Ritchie, 2009). Therefore, the prior terminology "supply chain" will prevail because of its commonness and simplicity (Singh and Abdul Wahid, 2014).

### *Supply chain performance*

Various researches have offered several frameworks and vast literature is also available on performance. However, still, a commonly accepted metric is not available (Ravindran and Warsing, 2013). Formerly, the performance was measured by cost, and only later on other financial measures were included, like return on equity and sale (Anand and Grover, 2015). In this study collaboration with external partners will be discussed. Kauppi, Longoni, Caniato, & Kuula, (2016) revealed from numerous studies that in the current scenario organizations firmly need to employ collaboration with external partners to meet the global challenges. Certainty, the organization desires competing, then the organization must emphasize both inside and outside of traditional boundaries. (Basu et al., 2017). Various approaches were suggested for performance enhancement, but supply chain collaboration is considered among the highest effective approaches (Singh et al., 2018).

### *Supply chain collaboration*

As Daud (2010) illustrated in his thesis, from the findings of many articles, the relationship with stakeholders has become a burning issue in Malaysian organizations. Various supply chain management approaches have been reported under the collaboration, few are being mentioned



ahead. SCM approaches have been defined in various ways. 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.

Another research explored that customer integration has a significant positive influence on performance. Accordingly, several types of research showed that SCM approaches had a positive influence on performance. According to Ataseven & Nair (2017), information sharing and agreed vision and goals (AV&G) are the main parts. By review of the literature, it can be concluded that information sharing, agreed on vision and goals and risk/reward sharing, electronic data interchange, supplier relationship, and customer relationship are utmost significant approaches and moreover, these approaches were empirically confirmed in various sectors (Ataseven and Nair, 2017; Kilubi, 2016; Wiengarten et al., 2016). Detail about each supply chain collaboration is mention below.

- ***Information sharing***

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, 2013). Information sharing includes quality, customer, time, market changes, design or uncertainty (Singh, 2013). IS has been investigated in multiple industries and is discovered that it has a foremost influence in improving SCP (Abdallah et al., 2014; Effendi, 2015).

Nowadays, SC is at risk Cao et al. (2010) conducted a literature review and proved that information sharing is positively influencing performance and is a good tool for reducing uncertainty as well. Thus, the below hypothesis is being proposed.

**H1:** Information sharing has a positive influence on supply chain performance.

- ***Agreed vision and goals***

AV&G defined as the process where supply chain partners make their strategic decisions collectively, especially they make their vision and goals jointly (Cao and Zhang, 2013). It includes plans, combines information, resolves problems, and develops rules, regulations, and procedures. In the meantime, all members have their own aims and objectives, thus it is sometimes difficult to generate a common theme that can source uncertainty (Kauppi et al., 2016). To reduce this uncertainty, AV&G has become an important strategy for today's business. Moreover, it was verified empirically as well. AV&G is positively influencing SCP (Effendi, 2015; Ha et al., 2011; Shahbaz et al., 2018; Shukla et al., 2013). Wiengarten, Humphreys, Cao, Fynes, & McKittrick (2010) stated that AV&G has a positive relationship with operational performance when the quality of information is high. In the meantime, (Effendi, 2015) proved that AV&G with suppliers and customers improves logistic efficiency (Chen et al., 2018; Jüttner and Maklan, 2011). Hence, based on the literature review the following hypothesis has been drawn.

**H2:** Agreed vision and goal has a positive effect on supply chain performance.

- ***Risk and reward sharing (RRS)***

RRS is considered essential for the organization to be sustained (Matopoulos et al., 2007). RRS has become more necessary as an effect of a growing international market and the evolving



convolution of the supply chain (Udbye, 2014). “RRS is a particular degree of relationship among chain members that results in higher business performance than would be achieved by the firms individually” Thus, RRS is proved to have a significant positive influence on SCP and this relationship is verified empirically (Shukla, 2016; Sundram et al., 2011). Finally, based on empirical verification, the following hypothesis has been developed.

**H3:** Risk and reward sharing has a positive effect on supply chain performance.

- **Information quality (IQ)**

It has been stated above that information sharing has been essential for any organization. It not only reduces the risks, but also enhance the performance, only if when shared information is accurate, timely shared, complete, and safe (Chopra and Sodhi, 2004; Gandhi et al., 2017). Otherwise, if it is unsafe and incomplete, it can enhance the cost (Chopra and Meindl, 2006; Low, Baharudin, & Lim, 2016) and even it can create more uncertainty or even disrupt operations. Information qualities are defined as “the extent to which information exchange is accurate, timely, complete, adequate, and credible” (Li et al., 2005; Qrunfleh, 2010). It has been proved that information quality creates confidence, which ultimately enhances the relationships among partners of the supply chain (Sundram et al., 2016; Tsai et al., 2008; Wiengarten et al., 2010). Based on previous literature, it is recommended to verify this relationship for Malaysian organizations, thus below-mentioned hypothesis has been proposed.

**H4:** Information quality has a positive effect on supply chain performance.

- **Supplier relationship**

Supplier collaboration is a long-term relationship between the organization and its suppliers, in which the company is involved directly with the processes and activities of its suppliers to ensure their performance and capabilities (Chen, 2012). Supplier relationship means to build a good relationship with the supplier by mutual tanning, having an attractive reward system, or setting common goals (Chen et al., 2013). Supplier relationships can create numerous advantages like reducing cost, new product development, reducing cycle timing, or reducing uncertainty. Due to the lack of training and eagerly available tools, most global supplier relationships tended to be transactional, adversarial, and penalty-oriented (Manuj, 2013). In numerous studies, it has been revealed that supplier relationship has positive effects on performance, and now there is a need to assess these effects in the current scenario. Based on the literature review, the below-mention hypothesis has been developed.

**H5:** The supplier relationship has a positive effect on supply chain performance.

- **Customer relationship**

Customer relationship is defined as “the entire array of practices that are employed for the purpose of managing customer complaints, building long-term relationships with customers, and improving customer satisfaction” (Li et al., 2005). Customer relationship empowers organizations to better understand the customers’ demands and improve estimating. Besides the customer’s valuable requirements, these relationships are also good to reduce demand-side uncertainty (Chen, 2012). Meanwhile, close and continuous contact with customers is crucial for organizations to develop highly customized products (Sukati et al., 2012). Moreover, numerous surveys propose that organizations that have strong customer relationships are



confident in their ability to evaluate customer complaints and provide support to their customers (Qrunfleh, 2010). After a comprehensive literature review, it has been revealed that customer relationship has a positive effect on performance. Now there is a need to verify the below-mentioned hypothesis in Malaysian industries.

**H6:** The customer relationship has a positive effect on supply chain performance.

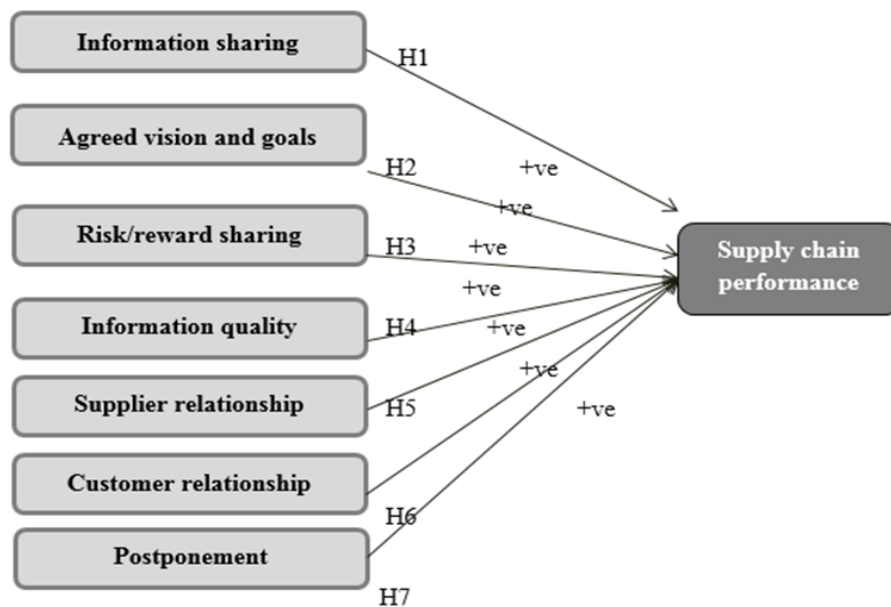
- **Postponement**

The postponement is defined as “situations in which a generic product is produced based on the total aggregate demand of all products, and the generic product is customized later on when there is a better estimation of customer requirements” (Christopher and Ryals, 1999; Tsiakkouri, 2010). Due to global completion and technology, rapid development demand has become fluctuated. This fluctuation can cause an increase in cost and a reduction in performance (Singh, 2013). It has been proved that by applying postponement strategy time, capital and cost can be saved. Postponement creates a high level of flexibility and standardizations at the same time (Musa, 2012; Qrunfleh, 2010). Standard designed products are produced in advance, while are completed when customers make their final demand (Afzal, 2011; Sundram *et al.*, 2016). It can be argued that postponement has a positive effect on performance.

**H7:** Postponement has a positive effect on supply chain performance.

### **Research Framework**

Supply chain collaboration approaches have become an essential tool not only for development but also for their sustainability as these protect from uncertainty and risks. After a comprehensive literature review, it has been revealed that supply chain collaboration approaches have positive effects on performance. Figure 1 illustrates the research framework that consists of seven independent variables (information sharing, agreed vision and goals, risk/reward sharing, information quality, supplier relationship, customer relationship, and postponement) and a dependent variable (supply chain performance).



**Figure 1:** The research model





## METHODOLOGY

The aim of this study was to evaluate the effects of SCC approaches on SCP. The research philosophy for this study was positivism as it was empirical verification. The primary and large-scale data were collected and the hypotheses were tested. Meanwhile, this study adopted a deductive approach as the theory already existed and this study made findings based on existing theory. Furthermore, the research strategy was a quantity as the aim is to evaluate the effect of an independent variable on the dependent variable. Additionally, the time horizon for this study was cross-sectional as the questionnaire was distributed one time to one respondent. The unit of analysis for this study was the organizational level as the aim was to measure supply chain performance and risks that affected organizations. As this was a quantitative study; the survey method was used for data collection. 7 point Likert scale was used and questionnaires were distributed through the internet to all respondents.

The population of this study consisted of large manufacturing organizations in Malaysia. A questionnaire was developed. The items for measuring SCC were adapted from Sundram et al. (2016), as it has already been tested and verified for Malaysian Electric and electronic industry; so this is a validated and reliable instrument. Meanwhile, SCP measurements were adopted from Kauppi et al., (2016). Data were collected from the Federation of Malaysian Manufacturers (2017) by convenience sampling. The total number of Manufacturing was 2250 while large manufacturing was 585. By applying the sampling technique of Krejcie & Morgan (Krejcie and Morgan, 1970), the sample size should be 234 for 600 population. This study sent a questionnaire to all 585 listed organizations and total 258 responses have been received. Retrieved responses were screened manually. Missing values, incomplete and filled with the same answer were excluded. Finally, 243 responses were considered for data analysis.

### *Data analysis*

This study hypothesized the relationship between SCC and SCP and empirically verified this relation. This study comprises on three segments descriptive analysis, validity and reliability and at the last structural model tested by using Smart PLS 3.

### *Descriptive analysis*

This study claims that organizations with SCC have better SCP. Descriptive study for this study consists of business incorporations that are based on FMM 2017 criteria. Most of the respondents (94%) belonged to private organizations, followed by public-limited, partnership, and sole proprietorship.

**Table 1: Descriptive analysis.**

Business incorporation	Number of respondents	Percentage (%)
Private Limited	229	94
Public Limited	9	3
Partnership	3	1
Sole Proprietorship	2	0.8
<b>Employee experience</b>		
1-5	31	12
6-10	24	10

11-15	41	17
16-20	134	55
21 and more	13	6

### *Measurement model*

The measurement model is the model that explains the relationship between constructs and items/dimensions. Special codes were assigned to every item for identification (Table 2). The measurement model was tested by two stages; the first stage was data purification by SPSS. This stage included missing values, outliers, and collinearity treatment. Histogram, skewness, kurtosis, 5% trimmed mean, scatterplot, and collinearity statistics were calculated and data were purified. The second stage was the validity and reliability testing. Factor analysis and Cronbach's  $\alpha$  were calculated. Reliability can be verified by Cronbach's  $\alpha$ , and the value of Cronbach's  $\alpha$  should be more than 0.7 to be considered reliable. Table 3 shows that all constructs had Cronbach's value more than the threshold, so it can be said that this scale was reliable. To verify the internal consistency composite reliability (Table 3), the value should be 0.7. All values were more than the threshold limit, thus this scale was internally consistent as well. The average variance extracted (AVE) is the degree to which a latent construct explains the variance of its indicators. An AVE of less than 0.50 indicates that more error remains in the items than the variance explained by the construct (Hair et al., 2014). Table 3 presents the value of AVE that is more than 0.5. Factor loading should be more than 0.5 and less than 0.7 (Hair et al., 2014). Table 2 shows that all values of the factors were between the threshold limit, so it can be concluded that validity has been attained.



**Table 2: Coding and factor loading**

Constructs	Code	Items	Factor loading
Information Sharing	IS1	"The organization informs its trading partners in advance of changing needs"	0.730
	IS2	"Organization's trading partners share proprietary information"	0.725
	IS3	"Organization's trading partners keep your organization fully informed about issues that affect its business"	0.760
	IS4	"Organization's trading partners share business knowledge of core business processes with your organization"	0.783
	IS5	"Organization and its trading partners exchange information that helps the establishment of business planning"	0.817
	IS6	"Organization and its trading partners keep each other informed about events or changes that may affect the other partners"	0.741
Average vision and goals	AGV1	"Supply chain members have common, agreed goals"	0.876
	AGV2	"Supply chain members are actively involved in standardizing supply chain management practices and operations"	0.920

	AGV3	“Supply chain members clearly define roles and responsibilities of each other’s cooperatively”	0.874
	AGV4	“Know which supply chain members are responsible for what activity”	0.870
Supplier relationship	SI1	“Organization considers quality as the number one criterion in selecting suppliers”	0.867
	SI2	“Organization regularly solve problems jointly with its suppliers”	0.907
	SI3	“Organization helps its suppliers to improve their product quality”	0.918
	SI4	“Organization has continuous improvement programs”	0.884
	SI5	“Organization include its key suppliers in its planning and goal setting”	0.876
	SI6	“Organization actively involves its key suppliers in new product development”	0.871
Customer relationship	CI1	“Organization frequently interacts with customers to set its reliability, responsiveness and other standards”	0.877
	CI2	“Organization frequently measures and evaluates customer satisfaction”	0.910
	CI3	“Organization frequently determine future customer expectations”	0.707
	CI4	“Organization facilitates customers’ ability to seek assistance from it”	0.824
	CI5	“Organization periodically evaluates the importance of the relationship with customers”	0.564
Information Quality	IQ1	“Information exchange between the organization and its trading partners is timely”	0.873
	IQ2	“Information exchange between organization and its trading partners is accurate”	0.850
	IQ3	“Information exchange between organization and its trading partners is complete”	0.866
	IQ 4	“Information exchange between organization and its trading partners is adequate”	0.859
	IQ5	“Information exchange between organization and its trading partners is reliable”	0.583

Postponement	POS1	“Organization’s products are designed for modular assembly”	0.791
	POS2	“Organization delays final product assembly activities until customer orders have actually been received”	0.913
	POS3	“Organization delays final product assembly activities until the last possible position (or nearest to the customer) in the supply chain”	0.918
Risk and reward sharing	RR1	“Supply chain members share risks and rewards”	0.891
	RR2	“Supply chain members share research and development costs and results”	0.707





	RR3	“Supply chain members help each other financial capital investment”	0.909
Supply chain performance	SCP1	“Quality performance”	0.865
	SCP2	“Flexibility performance”	0.858
	SCP3	“Customer service”	0.894
	SCP4	“Delivery speed”	0.913
	SCP5	“Cost performance”	0.805

**Table 3: Cronbach’s  $\alpha$ , composite reliability, and average variance extracted**

Constructs	Number of items	Cronbach’s $\alpha$	Composite reliability	Average variance extracted
Information sharing	6	0.853	0.891	0.578
Join goals	4	0.910	0.935	0.784
Supplier relationship	6	0.946	0.957	0.788
Customer relationship	5	0.838	0.888	0.619
Information quality	5	0.867	0.906	0.662
Postponement	3	0.850	0.908	0.767
Risk and reward sharing	3	0.789	0.877	0.706
Supply chain performance	5	0.917	0.938	0.753

### *Structural model*

As the preliminary analysis, bivariate correlation analysis was calculated by Smart PLS. Various interpretations can be generated from this analysis. It can be seen from Table 4 that all the SCP approaches had a significant relationship with SCP; all the values were greater than 0.6. Meanwhile, information quality had the highest correlation with SCP; it can be concluded that if the information is shared with quality, only then it will enhance the performance. Furthermore, all approaches were correlated with each other.

**Table 4: Bivariate correlation.**

	IS	JD	SI	CI	IQ	POD	RR	SCP
IS	1.000							
JD	0.599	1.000						
SI	0.604	0.529	1.000					
CI	0.603	0.631	0.645	1.000				
IQ	0.558	0.592	0.615	0.647	1.000			
POD	0.584	0.711	0.491	0.516	0.528	1.000		
RR	0.589	0.611	0.703	0.712	0.723	0.541	1.000	
SCP	0.668	0.685	0.656	0.673	0.693	0.603	0.667	1.000

Additionally, all these SCC approaches had also the collective effects of SCP. Based on the Smart PLS algorithm shown in figure 2, the coefficient of determination  $R^2$  is 0.675 total variance explained by dependent variable, mean all seven SCC approaches are explaining 6.75% the SCP. According to Hair et al. (2017), the  $R^2$  more than 0.5 is considered a moderator, thus SCC approaches have moderation effects on SCP.



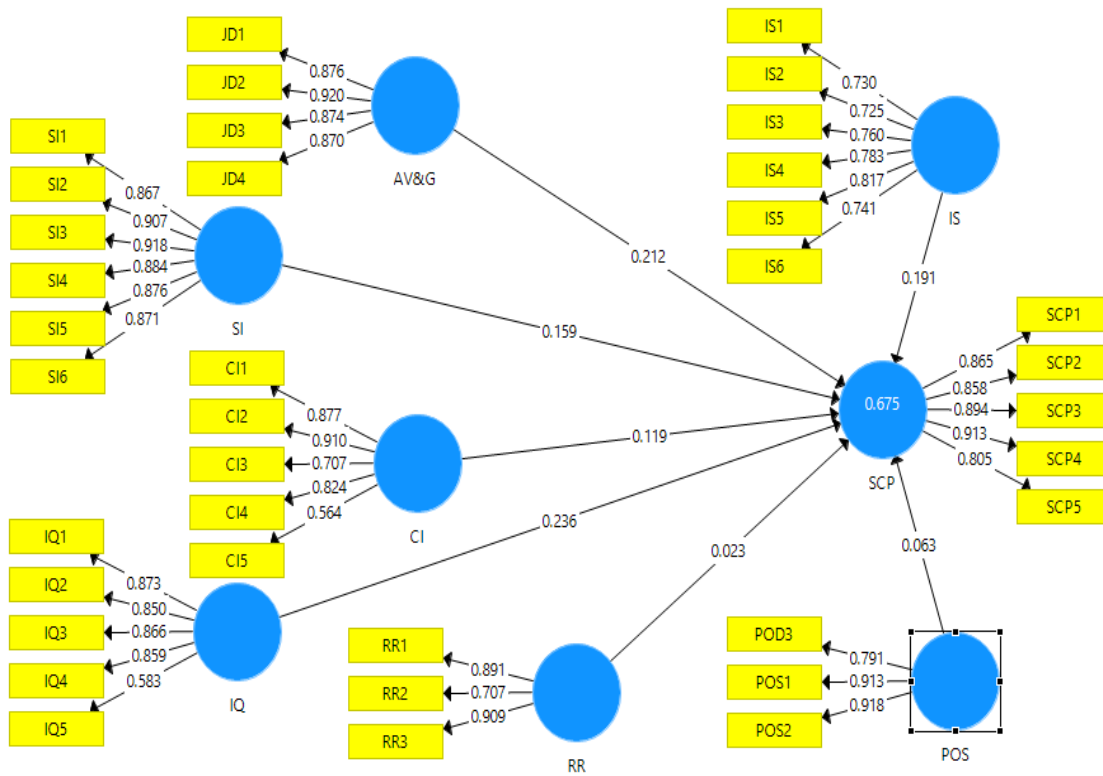


Figure 2: PLS algorithm results

Furthermore, there is a need to check the significance of these results for the acceptance/rejection of the hypothesis. Table 5 shows the results of Smart PLS bootstrapping. The provided results support some proposed hypotheses. After an extensive literature review, it has been revealed that SCC approaches have positive effects on SCP. In this study, the measurement was done according to one-tailed tests with a 90% confidence interval. The current study is line with Sundram et al. (2016, 2011) as IS, AV&G, SI, CI, IQ had positive and significant effects on SCP, and all t-values were higher than 1.645 and P-value was higher than 0.1. Meanwhile, POS and RR did not have significant effects but still, it was positive. This revealed that POS had positive effects on the overall manufacturing of Malaysia, but the previous studies revealed that the relationship was positive for individual industries. Meanwhile, RR is also not having significant effects of SCP in this study are also negative in the previous study (Sundram et al., 2016, 2011).

Table 5: Path coefficient and t values

Constructs	Path Coefficient (P-Value)	t-value	Result
Information sharing	0.191	2.784	Supported
Join goals	0.212	2.708	Supported
Supplier relationship	0.159	2.148	Supported
Customer relationship	0.119	1.749	Supported
Information quality	0.236	4.065	Supported
Postponement	0.063	1.034	Not-Supported
Risk and reward sharing	0.023	0.302	Not-Supported

## DISCUSSION AND CONTRIBUTION

The findings of this study revealed that supply chain approaches have positive and significant effects on supply chain performance. It has been found that all seven supply chain collaboration approaches have positive effects on supply chain performance but not all are significantly affecting. Information sharing, agreeing vision and mission, the supplier relationship, customer relationship, and information quality are significantly affecting while postponement and risk and reward sharing have positive effects but this effect is not significant. It has been established that supply chain collaboration has positive and significant effects on performance but for the specific industries. Therefore, this study revealed that all supply chain collaboration approaches are not important for the manufacturing sector in Malaysia. One approach might be significant for one industry, while is irrelevant for the other. The current study found that most influencing approaches are agreeing with vision and goal, which means manufacturing industries that have common goals and vision are getting more benefits than those having variation in their vision. Meanwhile, information quality has more positive effects on performance than information sharing. Shared information should be of good quality, only then it will have benefits; otherwise, leak, vague, and wrong information can create disruptions. Furthermore, the supplier's relationship is more important than the customer's relationship. Although customer relationship is positively and significantly affecting the performance, a good relationship with suppliers can reduce cost, bring innovation, and especially can reduce disruption and risks. Previous literature found that risk and reward sharing significantly affects the supply chain performance for electric and electronic industries. However, this study found that although risk and reward sharing is acceptable, organizations hesitate to share their rewards. Lastly, postponement is also significant in literature, but manufacturing in Malaysia do not significantly accept this.

This study theoretically suggests that not all supply chain collaboration approaches are substantial. Some supply chain collaboration approaches are most important while few are not. Collaboration approaches are noteworthy in Malaysia for electric and electronic sectors. These findings are comparable with previous literature (Wiengarten *et al.*, 2010). The managerial contribution was of two types. First, this study confirmed that supply chain performance not only improves performance but also reduces risks for Malaysian manufacturing. During decision-making, now managers should invest more in collaboration, especially agreeing on vision and goals, information quality, supplier's relationship, and customer's relationship. Now managers know that only sharing information with considering the quality is not a good decision. Second, managers can now understand which approach is more beneficial than others. They can reconsider risk and reward sharing and postponement. Lastly, this study developed a novel framework for Malaysian manufacturing that will guide organizations and researches to adopt supply chain collaboration approaches.

## CONCLUSION

It can be concluded that all SCC approaches have positive effects on SCP for Malaysian manufacturing. SCC approaches (IS AV&G, SI, CI, and IQ) have positive and significant effects on SCP. RR and POS have also positive but non-significant effects on SCP. POS is significant but only for the specific industries not as by postponing customers will not satisfy and it will also increase the cost. While the effect of RR is not significant as suppliers and customers are hesitant



to share risky information. The aim of this study was to empirically verify the relationship between SCC and SCP for manufacturing in Malaysia. A questionnaire was developed and distributed by convincing sampling in all listed manufacturing in the federation of manufacturers of Malaysia by emails. The retrieved data were purified from mission values and outliers, validity and reliability. Finally, data were analyzed through Smart PLS. The finding of this study revealed that all the approaches to supply chain collaboration have positive effects on supply chain performance. This study will help managers to understand the importance of collaboration while making strategic decisions. This study presents a framework that can be implemented in other industries and demographics. The first limitation of this study is to cover only manufacturing; the next study can include the service sector. Secondly, this study covers direct suppliers and customers for collaboration; the next study can include suppliers of suppliers and customers of customers (tier 2 partners).

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