Contents lists available at Science-Gate

International Journal of Advanced and Applied Sciences

Journal homepage: http://www.science-gate.com/IJAAS.html

The impact of supply chain risks on supply chain performance: Empirical evidence from the manufacturing of Malaysia

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ARTICLE INFO

Article history:
Received 21 January 2019
Received in revised form
20 May 2019
Accepted 22 June 2019

Keywords:
Supply chain risks
Logistic side risks
Collaboration side risks
Finance side risks
Supply chain performance

ABSTRACT

Nowadays, competition has shifted from organization to industry level so any disruption can not only disturb organization but also affect the whole industry. Although Malaysia is known from palm oil and rubber manufacturing sector has the highest growth rate (7.1%) and the second contributor to GDP and employer. After extensive literature view, it has found that various disruptions have been reported that not only disrupt Malaysian manufacturing but also a global business but there is no study available the empirically assess these risks. This is an empirical investigation and data was collected through a questionnaire distributed by systemic probability sampling to listed Manufacturing organizations listed in the Federation of Manufacturing Malaysia by emails. Final and purified data was analyzed through Structural Equational Modeling through Smart PLS. Total three types of risks were assessed namely logistic side risks, collaboration side risks, and finance side risks. It has been found that although all three types have a negative impact on supply chain performance only logistic side risks is effecting significantly. This study will help managers to understand how supply chain risks are affecting and what type of risks they should be more aware. Furthermore, various approaches can be proposed for mitigation but there is also a need to verify these approaches for Malaysia.

1. Introduction

The objective of supply chain management is to the mountain the sale either form goods or services while keeping the expenditures and expenses minimum. Previous logistics 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 (Hassan et al., 2015). The rapid growth in the global supply chain requires interconnectedness among stakeholders. As a result, a high level of interdependency and complexity develop in supply chain (Christopher et al., 2011; Elkins et al., 2005; Kamalahmadi and Parast, 2016).

Every single company is a crucial chip of complex Supply Chain system. Now it is above board that if any fragment of the Supply Chain disturbs, it will directly disturb the entire structure. According to Chopra and Sodhi (2004), SCRs' are interconnected, any problem can disrupt the whole. It can be observed from Tsunami and earthquake in Japan when a single disruption disturbed many elements of the global supply chain and harmed many businesses in other countries, overall economic loss was 210 million dollars (SCRL, 2011), while the highest ever global loss was reported 144 billion dollar due to natural disaster. Malaysia has faced many supply chain issues that not only have affected the organizations but also to the overall economy like due to Typhoon Damrey Thunderstorms in 2011 Malaysia, Vietnam and Philippine faced 1.008 billion dollar loss. Airport closure in Thailand caused raw material to be transferred the Malaysian and Singapore airports by trucks, this triggered long lead time and high transportation cost occurred (Kungwalsong, 2013). Among other risks involved in SC are maritime piracy in the Straits of Malacca, currency fluctuating, import/export regulations

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https://doi.org/10.21833/ijaas.2019.09.001
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(Singh and Wahid, 2014). Delays in physical distribution in electronic and electric industry (Hassan et al., 2015), rapid technological changes (Yaakub and Mustafa, 2015), increase outsourcing, product variation and suppliers defaults (Salleh Hudin and Abdul Hamid, 2015), oil prices, China economic slowdown and foreign capital outflow, natural hazards like loss of Malaysia Airlines 370, crash of Flight 8501 of AirAsia, devastation of Malaysia Airline over Ukraine and floods (Solutions, 2015) and additionally Malaysian palm oil company IOI, World's largest palm oil producers and traders, has been blocked for their operations by Greenpeace because of forest demolition and child labor (Shahbaz et al., 2019). From the supply chain viewpoint, these disruptions not only affect the organizational performance but also disturb the other elements of the supply chain.

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 measured 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., 20017). 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 manufacturing sector has highest growth rate (7.1%) and second contributor to GDP (23%) and employer (2.3 million) (MPC, 2016). Manufacturing sector is facing very high risk locally as well as globally (Ali et al., 2008). It has been reported that the biggest challenge for Malaysian manufacturing during or after a disaster is its management (Azmani et al., 2017).

Conclusively, after realizing Malaysian economic situation and present development in manufacturing industry it can be concluded that effective supply chain is essential. However, to make the supply chain effective, efficient and achieve best operational performance there is a need to assess the supply chain risks. This study has empirically verified three supply chain risks namely, logistic side risks, collaboration side risks, and finance side risks. Next segment is a literature review that briefly explains these risks and previous studies.

2. Literature review

Supply chain risk management (SCRM) is a new field that came from the juncture of the supply chain (SC) and risk management and it has gain historical importance in research (Zubair and Mufti, 2015). Being a relatively new area SCRM is being assumed as a confused and orderless field (Trkman and McCormack, 2009). According to Manuj and Mentzer (2008), there is still no clear definition that describes SCRM completely. Even though this area has attracted many researcher's attention still it does not have a clear definition (Ponomarov and Holcomb, 2009). A comprehensive review from 1995 to 2009 shows that study on SCRM is still limited (Tang and Musa, 2011). Some definitions have been mention below to get common and better understanding of the area according to the current study.

From the above-stated definitions, it is clear that SCRM is vast in its objectives and have become more complex (Basole et al., 2016). Consensus has been developed that there is no clear definition of SCRM (Musa, 2012; Sodhi et al., 2012; Tang and Musa, 2011). After thorough investigations of definitions, some limitations have been identified. (i) there is no definition that explain the flow of information, material and finance, (ii) no definition is available that express the whole supply chain risk management process like identification, assessment, and mitigation of supply chain risks, (iii) there is no definition that aims to reduce vulnerability as whole that means the focus is on whole supply chain and all members, not an only organization. To cover above mentioned limitations this study proposes a new definition and perceives the supply chain risk management as "the management of supply chain risks through supply chain risk management process that makes the smooth flow of the information, material and financial from supplier to end-users".

2.1. Supply chain 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 added (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 (Shahbaz et al., 2018b).

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).

Supply chain risks have been assessed in various ways in the literature review. It is concluded in the performance section in the literature review that it is almost impossible to find out a unique and commonly acceptable way to measure the performance. Performance measures should have some characteristics like sustainability, relevance, effectiveness, coherence, efficiency, and robustness (Chardine-Baumann and Botta-Genoulaz, 2014). The study of (Wagner and Bode, 2008) considered a good attempt, performance metric investigate overall supply chain performance for risk management on four indicators delivery dependability, delivery speed, order fill capacity, and customer satisfaction. Since quality is critical factors, many risk direct effect on quality (Chen, 2012). Additionally, Chen et al. (2013) add quality and measure overall supply chain performance on five indicators Items Product quality, Order fill capacity, Delivery dependability, Delivery speed, and Customer satisfaction. This study is closet and updated that is current study adopted the items of supply chain performance from (Chen et al., 2013).

2.2. Supply chain risks

Most of the researchers categories overall supply chain risks into three internal to organization also called organizational factors, external to organization but internal to network also known as industry factors and lastly external risk sources also called environmental factors (Basole et al., 2016; Ellis et al., 2011; Faisal et al., 2006; Jüttner et al., 2003; Lockamy III and McCormack, 2010; Ritchie and Brindley, 2007). Industrial factors are a relationship among supply chain partners and these partners are linked through flow, according to the adopted definition; supply chain has three kinds of flow information flow, material flow, and financial flow. Hence, material flow creates logistic side risks (Tse et al., 2016) whereas finance flow cause financial side risks and meanwhile information flow originate information side risks (Tang and Musa, 2011). Moreover, most of the researchers use information risk to cover information flow risks but this study argues that information side cover information related risks and miss the relational risk like coordination or etc. to cover all these issues, current study use collaboration side risk and this argument is supported by Basole et al. (2016). The aim of this study is to cover supply chain risks that comprise external to organization and internal to supply chain risks. Meanwhile, this is based on the definition of the supply chain that is based on the flow. There are three types of flow namely logistic flow, information flow, and finance flow. Thus, this study categories supply chain risks into logistic side risks, collaboration side risks, and finance side risks.

2.2.1. Logistic side risks

Logistics uncertainty is viewed as an uncertainty factor that causes a delay or an interruption originating from own or partners logistics system or natural disasters throughout the logistic process (Tse et al., 2016). Logistic side risks are considered, material flow of goods from the supply side and to demand side, usually, little attention has been paid for the logistic side. Although, it has been noted that logistic disruption is ‘‘quickly cripple the entire supply chain’’ (Punniyamoorthy et al., 2013; Shahbaz et al., 2018a). Normally, logistic side risks originate from cargo damage, supply side or warehouse problem (Wilson, 2007), delay in delivery (Wang et al., 2014), improper packaging (Zubair and Mufti, 2015), labor disputes, natural disasters, terrorist activities, and transportation infrastructure failures (Thun and Hoenig, 2011), wrong choice of mode of transportation (Punniyamoorthy et al., 2013), transportation complexity (Wagner and Neshat, 2012).

2.2.2. Collaboration side risks

Research revealed that collaboration can produce more effectual and considerable results, but also carry numerous glitches. Collaboration risk is “the apprehensive with cooperative relationships or the probability that the partner does not comply with the spirit of cooperation” (Faisal, 2009). Or it may be defined as “risks refer to uncertainty in coordination and information (Kouvelis et al., 2011). Thus, it would be a serious issue if one member of supply chain does not obligate itself to cooperation as anticipated by the other members (Basole et al., 2016; Das and Teng, 1998; Shahbaz et al., 2018c). Information risks are associated with the systems and flows of information and include data capture and transfer, integrity, information processing, market intelligence, system failure, etc. These risks appear as missing data, errors in information, and breaches of data security, systems failure, and incorrect transactions and so on (Waters, 2011). This study covers the risks generated from information flow among partners of the supply chain but partners do not only share information, but there are also many other this among them like trust, lack of coordination, lack of competencies and high dependencies. Thus this study enhanced the scope of information side risks and considers it as collaboration side risks. New challenges such as collaboration risks would arise when partners are

involved in the supply chain such as the decision making becomes complex when more partners involved with various interests, culture, and preferences (Zeng, 2017).

It has been learned from a validated sample of 162 responses that the complexity of partnerships executes the most significant effect on supply chain risks and the collaboration risks are considered the top risks that can impact supply chain performance to the most extent. It has been found that collaboration side risk gains less attention in the literature (Tang and Musa, 2011). Mostly, there are two types of flows information flow and relationship flow, some studies measured information flow risks only (Faisal et al., 2007; Punniyamoorthy et al., 2013; Tsai et al., 2008), while some cover both (Chen, 2012), thus this study change the name from information side risks to collaboration side risks to cover both types of risks.

2.2.3. Finance side risks

Financial side risks defined as "risk that members of supply chain encounters financial challenges that could impact its ability to produce and supply a particular goods/services (Mody, 2012). The financial crisis was highlighted by both the public (16%) and private organizations (17%) as one of the most recurrent disruptive occasions challenged (Abidin and Afroze, 2018). The financial side risks occur due to the flows of cash among organizations, the incurrence of expenses and the use of investments for the entire network, Accounts Payables, settlements and Accounts Receivables (Faisal, 2009). Financial side risks can also be defined as "The risk that a potential event will have a financial impact. For example, if the company is in the retail software business, then a potential patent infringement claim can occur that may result in legal costs, loss of business and etc. (Handfield and McCormack, 2007). It is empirically verified that for Garment manufacturing supply chain financial risks has 46.3% of probability of loss, which is the highest risks (Braud and Gong, 2016).

2.3. Hypothesis development

Logistics can be defined as "the science of an effective flow of materials; the goal is to ensure that all materials and products can at the right time, at the right place" (Feng et al., 2017). It includes the risk related to transportation, materials handling, supply planning, and the third-party logistics service provider. Normally, logistic side risks originates from cargo damage, supply side constrictions or warehouse problem (Wilson, 2007), Delay in delivery (Wang et al., 2014), improper packaging (Zubair and Mufti, 2015), labor disputes, natural disasters, terrorist activities, and transportation infrastructure failures (Thun and Hoenig, 2011), Wrong Choice of mode of transportation (Punniyamoorthy et al., 2013), transportation complexity (Wagner and Neshat, 2012). Therefore, ensuring that members of the supply chain are able to provide products/services consistently and on time is one of the keys to evaluating the existence of risks in the supply chain, for instance transport times (daily, weekly, etc.) and mode of transportation (air, land or sea) in order to ensure that transportation will not be interrupted by some emergencies (Feng et al., 2017). Chopra and Sodhi, (2004) stated that logistics disruption is considered a subset of the drivers of disruption risk. Wilson (2007) claimed that an interruption caused by transportation only stops the flow of goods, so it is less severe than other types of risk drivers, such as supplier plant shutdowns.

An interruption in transportation can be caused by labor disputes, terrorist activities, natural disasters, and transportation infrastructure failures. According to Chopra and Sodhi, (2004) expressed that logistics disruption is considered a subset of the drivers of disruption risk. While, it is also claimed that an interruption caused by transportation only stops the flow of goods, so it is less severe than other types of risk drivers, such as supplier plant shutdowns (Wilson, 2007). An interruption in transportation can be caused by labor disputes, terrorist activities, natural disasters, and transportation infrastructure failures (Tse et al., 2016). Based on the previous studies H1 has been developed.

H_1: Logistic side risks negatively affect the supply chain performance.

Globalization and emerging economies are raising the collaboration risk (Musa, 2012). It is considered the top risk type that can influence supply chain performance to the most extent (Zeng, 2017). Collaboration side risks associated with the systems and the flow of information, and arising from the links between the members of the supply chain (Vilko, 2012). Collaboration risks arise from issues such as lack of ability to support the operations, lack of trust, level of information accuracy, information system security and disruption, intellectual property, and information outsourcing (Basole et al., 2016). Meanwhile, leakages of core competencies by suppliers to competitors (Sharma and Bhat, 2012), Delay or unavailability of the information and communication infrastructure (Punniyamoorthy et al., 2013) or Breakdown of external/internal IT infrastructure (Wang et al., 2014). It has been stated that collaboration side risks have a strong impact on the cost of products, and delivery time (Feng et al., 2017). Upon the above reference, this study proposes that:

H_2: Collaboration side risks negatively affect supply chain performance.

There are various types of financial side risks, initially risk was associated with embedded costs, differing costs of capital and rates of expense incurrence, and cash movements and settlements

from one firm to the next (Cavinato, 2004) and financial side risks also include interest rate fluctuations, credit rating for company's bonds, changes in currency exchange rates and changes in accounting and tax laws (Karia and Soliman, 2017; Ravindran and Warsing, 2016).

In many studies, it has been revealed that financial side risks negatively affect the not only the financial performance but also overall supply chain performance (Mody, 2012; Musa, 2012; Ravindran and Warsing, 2016; Singh and Wahid, 2014). Financial side risks include exchange rate risk, price and cost risk, the financial strength of supply chain partners, delay payments and financial handling (Abidin and Afroze, 2018; Musa, 2012). Thus, there is a need to verify that:

H_3: Financial side risks negatively affect the supply chain performance.

2.4. Research framework

Fig. 1 shows the proposed conceptual framework that consists of three independent variables, logistic side risks, collaboration side risks, and finance side risks and a dependent variable supply chain performance.

3. Methodologies

The focus of this study is to know the effects of supply chain risks on supply chain performance and the aim of this study is to empirically verify the hypothesis. This study gathers the experiences from humans in numbers thus this is empirical quantitative study. The research philosophy is positivism, the research approach is cross sectional and research strategy is quantitative as it is an empirical study, the aim is to test the hypothesis and generalize the findings based on existing theory.

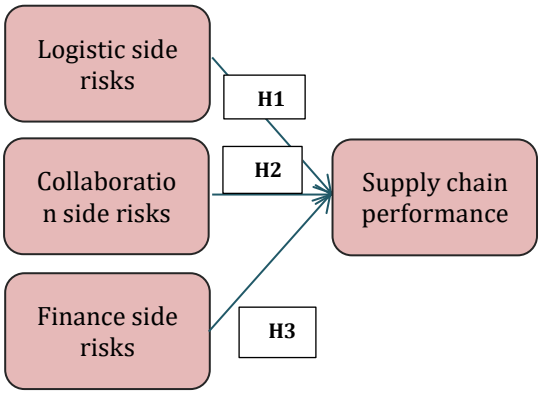

Fig. 1: Research framework

A survey method has been used for data collection. Likert scale 7 has been used and questionnaires have been distributed through the internet by systematic probability sampling. The questionnaire has been adopted from various reputed studies based on extensive literature review; the detail of the adopted items is mentioned in Table 1.

Table 1: Questionnaire items with references (Chen et al., 2013)

Variable	Items
Logistic side risks	Poor logistics performance of logistics providers Poor design of transportation network Wrong choice of mode of transportation Improper packaging and marking details Breakdown of equipment, trucks and/or delivery van Delay in delivery time Supply chain complexity Lack of professionalism in logistics sector Processes errors Corruptions at port and toll gates
Collaboration side risks	Distorted information from members Inadequate security of information system Wrong choice of communication Lack of coordination among members Disruption due to high dependency Insufficient information from members Leakages of core competencies from any member Poor information sharing within members Supplier network misalignment
Finance side risks	Fluctuation in prices Fail to reduce cost Receivable risk Customer refusing the freight charges Increase custom or taxes Economic shift Fluctuation in exchange rates
Supply chain performance	Product quality Order fill capacity Delivery dependability Delivery speed Customer satisfaction

3.1. Sampling and data collection

The target population in this study consist listed manufacturing organizations in the Federation of Manufacturing Malaysia 2017. This includes all members of the organizations including distributor, retailers, and suppliers and customer. The questionnaires were distributed by systematic probability sampling with K value 5 to the members by the email. Sample framework consists of 2300 organizations so total 480 questionnaires were sent and 354 people responses.

3.2. Descriptive statistics

Selecting the right respondents in essential for generalizing the survey. These respondents suppose to have the best knowledge in the areas of the study. This study has received a wide range of respondents from various departments. Table 2 shows the distribution of respondents based on the departmental position. Respondents have been provided six (6) options based on literature (Chen, 2012) and to cover all risk sources. It can be seen in Table 2 that the highest number of respondents are from Sales and distribution (22%). While second highest is Finance/HR/IT (20%). Meanwhile, production and operation and general management have also a reasonable number of respondents 19% and 17% respectively. Lastly, the lowest number of respondents are from and purchase and logistic/supply chain 12% and 10%. Thus, it can be concluded that all the risks sources have been coved with a reasonable number of respondents. The respondents of this study are diverse in experience. Table 3 illustrates those respondents from 10 to 14, 15 19 or 20 to 24 have almost the same number and highest percentage. So it can be concluded that the highest number of respondents have more than 10 years of experience. Whereas, respondents with less than 5 years of experience 13%. Meanwhile, respondents with more than 25 of the year of experience are also small this is due to their busy schedule and also there are fewer numbers of people with very high experience in jobs.

Table 2: Respondents distribution based on their departmental position

	Frequency	Percent	Valid Percent	Cumulative Percent
Purchase	34	9.9	9.9	9.9
Logistic/supply chain	40	11.7	11.7	21.6
Production and operation	64	18.7	18.7	40.2
Sales and distribution	75	21.9	21.9	62.1
Finance/HR/IT	70	20.4	20.4	82.5
General Managers (Director, CEO and etc.)	60	17.5	17.5	100
Total	343	100	100	

Table 3: Respondents distribution based on their experience

	Frequency	Percent	Valid Percent	Cumulative Percent
Less than 5 years	45	13.1	13.1	13.1
5 - 9 years	53	15.5	15.5	28.6
10 - 14 years	81	23.6	23.6	52.2
15 - 19 years	71	20.7	20.7	72.9
20 - 24 years	63	18.4	18.4	91.3
More than 25 years	30	8.7	8.7	100.0
Total	343	100.0	100.0	

4. Data analysis

The aim of this study is to evaluate the effects of supply chain risks on supply chain performance for the Malaysian manufacturing. Data has been analyzed through SPSS and Smart PLS. First special codes have been assigned to all items and data has been put in SPSS file. The second step was a manual screening of data, responses with high mission values and same responses have been deleted. Furthermore, by histogram and skewness and kurtosis data has been clean from missing values and outliers. The validity and reliability of the questionnaire have been assessed and lastly, the structural model has been evaluated by multiple regressions through Smart PLS. Data analysis has divided into a measurement model and structural model.

4.1. Measurement model

Reliability and validity are crucial for the quality of research in the quantitative approach of the social sciences research (Saunders et al., 2011). This study calculated composite reliability, convergent validity, and discriminant validity to verify the measurement model. Smart PLS 3 has been used for reliability and validity. Fig. 2 shows the PLS Algorithm results. The range of composite reliability is between 0 and 1, higher the values higher levels of reliability. Its threshold value is considered good at more than 0. 70. The composite reliability below 0.60 indicates a deficiency of internal consistency and above 0.90 is not required as it means that all the items are measuring the same phenomenon (Hair et al., 2016; Shahbaz et al., 2017). Table 4 shows that all values of composite reliability between thresholds limit. An AVE value of 0.50 or higher indicates that the construct explains more than half of the variance of its indicators. While an AVE of less than 0.50 indicates that more error remains in the items than the variance explained by the construct (Fradinata et al., 2017; Hair et al., 2014). It can be seen in Table 4 that all AVE are following the criteria. Generally, convergent validity is assessed by the values of factor loading (Hair et al., 2014). High factor loadings

indicate convergence for a latent construct. Average of all factor loadings should be statistically significant, a good rule of thumb is that standardized loading estimations should be at least 0.5 or higher and 0.7 or higher is considered ideal (Hair et al., 2014). Fig. 2 revealed that all loadings are more than 0.5. Discriminant validity is assessed by Fornell and Larcker (1981), it means to compare the AVEs for each construct with the square of the estimated correlation between these constructs (Hair et al., 2014). It has been revealed that most of the researches prefer Fornell-Larcker criteria and look it as a conservative approach (Henseler et al., 2015). It compares the square root of the AVE values with the latent variable correlations. Specifically, the square root of each construct's AVE should be greater than its highest correlation with any other construct. Table 5 explained that all square root values are higher than its proceeding values. Thus, it can be concluded all measurement items meet all the criteria of validity and reliability.

4.2. Structural model

This study has applied Smart PLS to the examined coefficient of determination R2, standardized path (Beta coefficient) and t-statistics.

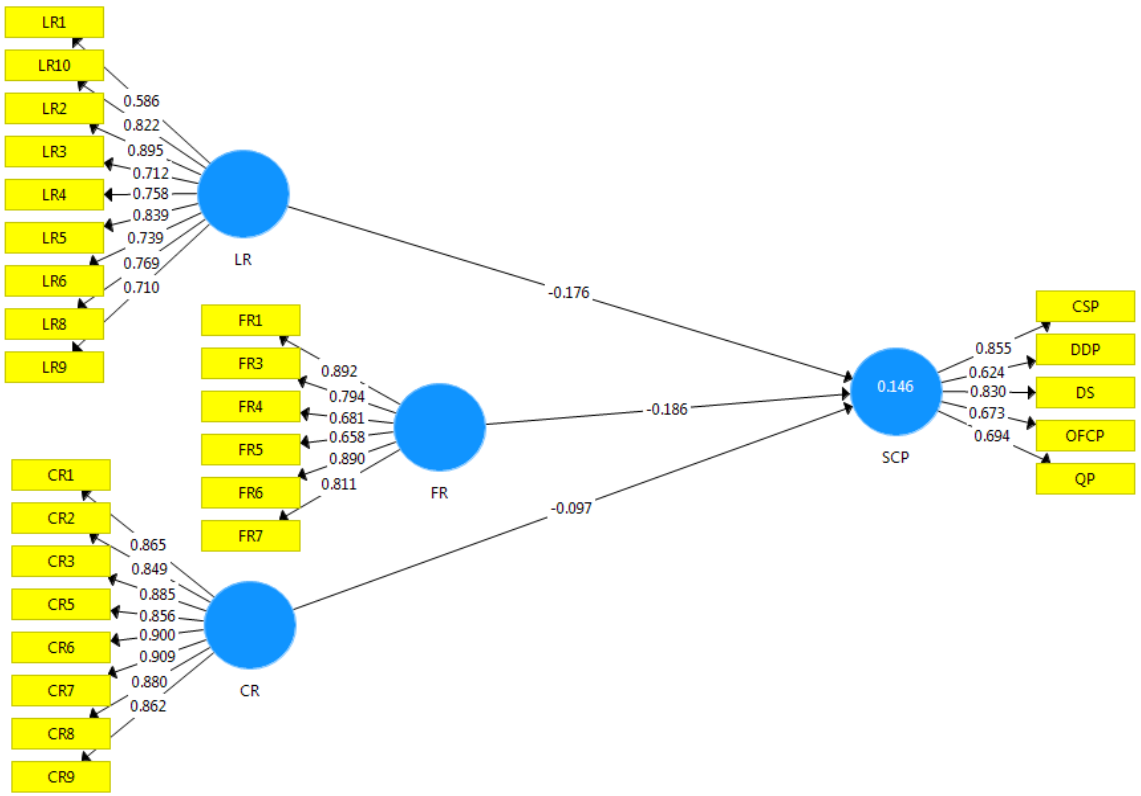

Fig. 2: Measurement model

Table 4: Validity and reliability

Constructs	Number of items	Cronbach's α	Composite reliability	Average variance extracted
Logistic side risks	9	0.910	0.925	0.583
Collaboration side risks	8	0.958	0.963	0.767
Financial side risks	6	0.882	0.909	0.629
Supply chain performance	5	0.829	0.857	0.549

Table 5: Discriminant validity

	LR	CR	FR	SCP
LR	0.763			
CR	0.563	0.876		
FR	0.479	0.555	0.793	
SCP	-0.320	-0.300	-0.324	0.741

A standardized path value shows the strength of the relationship if the value is negative that shows the negative relationship between the variables and vice versa. Statistical level of t-value shows the significant level of a relationship. This study chose 5% level of significance as this is predictive study so chances of error are high. Lastly, R2 examines the effect of independent variables on dependent variables. Meanwhile, both independent and moderator variables are continuous variable so interaction terms were calculated from standardized values to avoid collinearity problem.

The aim of this study is to evaluate the effects of SR, PR, and DR on SCP. This effect is calculated by the coefficient of determination R2. "R2 is a measure of the proportion of an endogenous construct's variance that is explained by its predictor constructs". Fig. 3 this study applies PLS and found that R2 is 0.146 or 14.6 %. The low value of R2 is not surprising as it is consistent with previous studies and it has been learned in the literature review that supply chain performance is dependent on

numerous factors besides supply chain risks (Ng and Ghobakhloo, 2017; Wagner and Bode, 2008; Zsidisin et al., 2015).

Meanwhile, standardized path coefficients and their t-statistics obtained from PLS analysis for making a decision regarding hypothesis. The path coefficient was generated by using the algorithm, while, the standard errors were computed by using the bootstrap resampling method with 500 resamples. Table 6 shows that all three industrial risks have negative effects on supply chain performance but only two risk sources namely logistic side risks (β= -0.176, t= 2.796, p< 0.05), and finance side risks (β= -0.186, t= 3.096, p< 0.05) are significantly affecting. On the other hand, collaboration side risk (β= -0.097, t= 1.476, p< 0.05) is not significantly affecting supply chain performance. Thus, it can be concluded that two hypothesis H1, H3 is accepted, while H2 is rejected at 5% level of significance. It can be determined that Malaysian construction has major risks from its supply side and more specifically from supplier and customer sides.

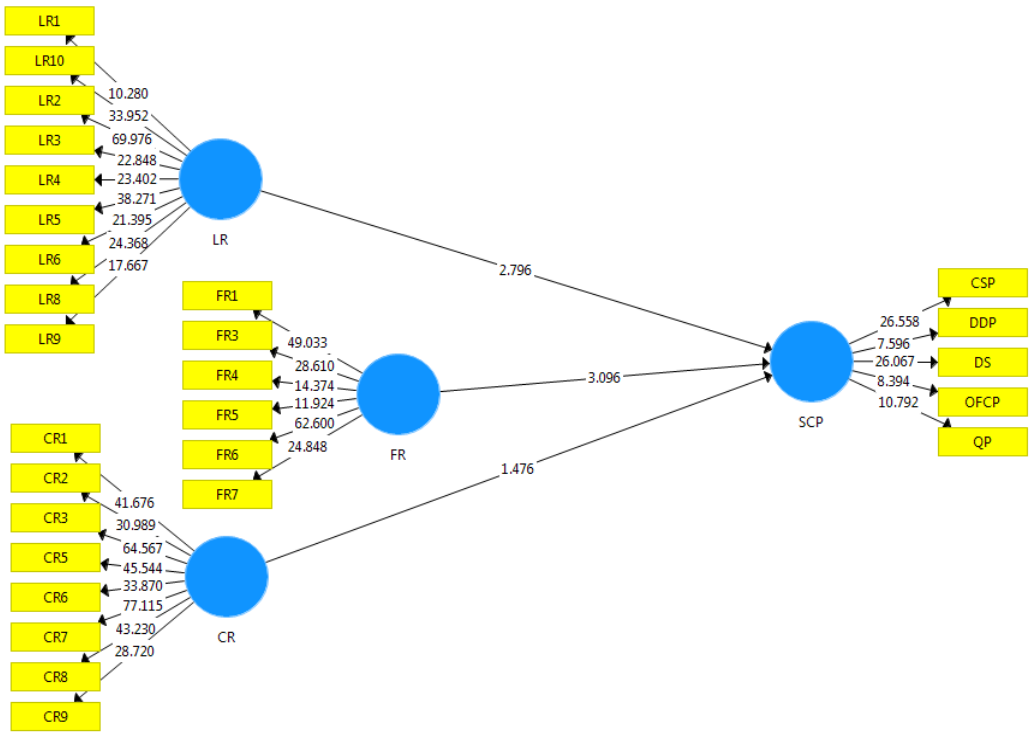

Fig. 3: Results of PLS bootstrapping (t-value)

Table 6: Structural model for the independent variable

Hypothesis	Paths	(β-Values)	t-values	Decision
H1	LR → SCP	-0.176	2.796	Accepted
H2	CR → SCP	-0.097	1.476	Rejected
H3	FR → SCP	-0.186	3.096	Accepted

5. Discussions

The current study found that logistic side risks have significant negative effects on supply chain performance as path coefficient is -0.176 and t-value are 2.796. This study is in line with the previous empirical findings like in a study on heavy industry in India also measure supply chain performance with same measures and reveal same findings (Feng et al., 2017; Manikandan et al., 2011; Punniyamoorthy et al., 2013; Sharma and Bhat, 2012; Zubair and Mufti, 2015). Wilson (2007) applied dynamic theory and simulation and conclude that "The greatest impact occurs when transportation is disrupted between the tier 1 supplier and warehouse". While, Tse et al. (2016) revealed that logistic uncertainty has a high probability of assurance. The reason for this contradiction is this study only includes the aspects that can create a delay in the system while missed the other aspects like a poor design of transportation, wrong choice or breakdown of the system. Thus, it can be concluded that logistic side risks have a negative and significant impact on performance that cannot only delay but also can halt the whole system.

Collaboration side risks have a strong impact on the cost of products, and delivery time (Feng et al., 2017). Meanwhile, it has been found that leak of critical information and distorted information have high probability and high impact on performance (Zubair and Mufti, 2015). Current study hypothesized that collaboration side risks have negative effects on performance but empirical results are different. It can be seen that the beta value is -0.097 and t-value is 1.476. So, although collaboration side risks have negative effects on performance these effects are not significant. These findings are also in line with empirical findings of the literature like Punniyamoorthy et al. (2013) empirically verified with same measurements of supply chain performance and conclude that

information side risks have a negative impact on supply chain performance but relatively lower than other supply chain risks. On the other hands Zeng (2017) unveil that collaboration risks, relationship risks and partner's operational risks all impose a significant negative impact on company stock. First, this study measured effects on stock price not supply chain performance, second current study measure collaboration risks among direct members of the supply chain only.

Current study proposed that financial side risks have a negative impact on supply chain performance as path coefficient is -0.186 and t-value are 3.096. So it can be said that financial side risks have a negative impact on supply chain performance thus H3 is rejected. There is inadequate research available in this area and researchers have a tendency to evade this area due to highly integrated knowledge base required (Musa, 2012) like it is empirically verified that for Garment manufacturing supply chain financial risks has 46.3% of probability of loss, that is highest risks but low impact (Alhosani and Zabri, 2018; Braud and Gong, 2016).

Furthermore, Hendricks and Singhal (2003) expose that financial risk announcement negatively effects on stock price. Moreover, Berling and Rosling (2005) explained that purchase price risk is the major financial risk for the supply chain. Additionally, Ravindran and Warsing, (2016) verified after qualitative and quantitative studies that only 20% organization have concerned with finance side risks. Thus, it can conclude that although empirical finding is scared for finance side risks through other methodologies, it can be verified that finance side risks have a negative impact on supply chain performance.

6. Conclusion

Finally, it can be concluded that the Malaysian construction industry is risky in terms of logistic side risks and finance side risks while collaboration side risks need less attention. The finding revealed that Malaysian manufacturing needs more consideration on finance side risks like fluctuation in prices, fail to reduce cost, increase custom or taxes, economic shift and fluctuation in exchange rates can be disruptive. Additionally, second attention should be given to logistic side risks like poor logistics performance of logistics providers, poor design of transportation network, wrong choice of mode of transportation, improper packaging and marking details, breakdown of equipment, trucks and/or delivery van, delay in delivery time, supply chain complexity, lack of professionalism in logistics sector and processes errors. Now managers will be more able to understand that Malaysian manufacturing is in a dangerous situation and which risk is more dangerous than other. Future research can explore other dimensions of risks. Research gap for further study is to propose a mitigation strategy to deal with risks.

Compliance with ethical standards

Conflict of interest

The authors declare that they have no conflict of interest.

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