THE ROLE OF RISKS, COLLABORATION AND PERFORMANCE IN THE SUPPLY CHAIN OF MANUFACTURING FIRMS OF MALAYSIA

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I dedicate my work to my family and many friends. A special feeling of gratitude to my loving parents, whose prayer and affection are the source of strength and sign of success for my bright future. They always encourage me to get the highest goal of my life. Their everlasting love, guidance and encouraging passion will remain with me Insha'Allah till my last breath.

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ABSTRACT

Malaysian manufacturing is contributing around 80 percent in the exports and consider the highest sector for employability but its growth is decreasing for a few years. After plentiful literature, it has been found that various supply chain issues not only disrupt core organization but a whole network and ultimately the economy. Previous studies show that there are limited studies available for supply chain risks. Likewise, the effects of supply chain risks on supply chain performance for Malaysian manufacturers are scarce, primarily, only few studies exists that covers overall risks. Meanwhile, there are ample strategies to deal with risks but collaboration needs to verify as a mitigation approach for all kind of risks. Thus, the aim of this study is to identify the potential supply chain risks, assess their effects of performance and verify the role of supply chain collaboration as a risk mitigation approach. To cover all three aspects of supply chain (internal to organizational, external to organizational but internal to supply chain and external to supply chain), seven risk sources were identified namely supply side risks, process side risks, demand side risks, logistic side risks, collaboration side risks, financial side risks and environment side risks. To assess the effects of these risks on performance a questionnaire was developed through a systematic process. The population of this study is 2300 manufacturing organizations listed in the Federation of Manufacturing Malaysia. The questionnaires were sent to every 5th organization by systemetic sampling. So, total 480 questionnaires were sent but received 354 responses. Data was analyzed through structural equation modeling using smart PLS. The findings revealed that all types of risks have a negative impact on supply chain performance but only supply, demand, logistic and environment side risks have a significant negative impact. Although, logistic and collaboration side risks can be mitigated through supply chain collaboration but supply, finance and environment side risks can be mitigated significantly. Moreover, process and demand side risks cannot be mitigated through collaboration. The theoretical contribution is empirically verifications of the theory of swift, even flow and relational view for all kind of risks.

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ABSTRAK

Industri pembuatan Malaysia menyumbang kira-kira 80 peratus dalam eksport negara dan merupakan sektor tertinggi menyumbang kepada kebolehkerjaan. Namun pertumbuhan sektor ini dilihat semakin menurun sejak beberapa tahun. Kajian literatur mendapati isu-isu rantaian bekalan bukan sahaja mengganggu misi utama organisasi bahkan seluruh rangkaian dan akhirnya menggganggu seluruh sektor pembuatan. Kajian terdahulu menunjukkan bahawa risiko-risiko rantaian bekalan sukar untuk dikenalpasti secara tepat. Begitu juga, kesan risiko ini terhadap rantaian bekalan yang masih belum dikaji secara menyeluruh, terutamanya, kajian yang melibatkan keseluruhan risiko dalam rantaian bekalan. Sementara itu, terdapat pelbagai strategi untuk menangani risiko. Kolaborasi antara rangkaian dilihat sebagai strategi menangani risiko, namun ianya perlu disahkan sebagai pendekatan mitigasi untuk semua jenis risiko. Tujuan kajian ini adalah untuk mengenal pasti risiko rantaian bekalan, menilai kesan risiko terhadap prestasi dan peranan kolaborasi rantaian bekalan sebagai pendekatan mitigasi risiko. Untuk merangkumi ketiga-tiga aspek rantaian bekalan (aspek dalaman organisasi, aspek luaran organisasi tetapi dalaman untuk rantaian bekalan dan aspek luaran rantaian bekalan), tujuh sumber risiko telah dikenalpasti iaitu risiko bekalan, risiko proses, risiko permintaan, risiko logistik, risiko kerjasama, risiko kewangan dan risiko alam sekitar. Untuk menilai risiko ini, borang soal selidik telah dibangunkan menggunakan proses yang sistematik. Populasi kajian ini adalah 2300 organisasi pembuatan yang disenaraikan di Federation of Malaysian Manufacturers (FMM). Borang soal selidik telah diedarkan kepada ke setiap organisasi ke-5 dengan menggunakan pensampelan sistematik. Sejumlah 480 soal selidik telah dihantar dan menerima 354 jawapan. Data dianalisis melalui structural equational modeling - Smart PLS. Penemuan kajian menunjukkan bahawa semua jenis risiko mempunyai kesan negatif terhadap prestasi rantaian bekalan tetapi risiko bekalan, permintaan, logistik dan alam sekitar mempunyai kesan negatif yang besar. Risiko logistik dan kolaborasi dapat dikurangkan melalui kolaborasi rantaian bekalan, namun risiko bekalan, kewangan

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dan alam sekitar dapat dikurangkan dengan lebih ketara. Selain itu, risiko proses dan permintaan tidak dapat dikurangkan melalui kerjasama. Sumbangan teoritikal adalah menguji secara empirikal theory of swift, even flow dan relational view untuk semua jenis risiko.

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LIST OF ABBREVIATIONS

EFA	:	Exploratory Factor Analysis
FMM	:	Federation of manufacturing Malaysia
KMO	:	Kaiser-Meyer-Olkin
UTHM	:	Universiti Tun Hussein Onn Malaysia

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CHAPTER 1

INTRODUCTION

This chapter briefly explains the overall study. First is the introduction of the study that explains the basic concepts of supply chain risks, performance and collaboration. Second is the backgroud that elaborates the previous conditions of the supply chain of Malaysian manufacturing. Then, there is problem statement that explores the main issues of this study. Research questions and research objectives are mentioned after problem statement. There is scope of the study that is expressed before operational definitions of the study. Lastly, outline of the studey is explained.

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1.1 Introduction of study

Supply chain is a flow of material, finance, and information (Chen, Sohal, & Prajogo, 2013). Currently, supply chain is involved in every part of the business either directly or indirectly. The old term logistic was only responsible for the transfer of goods from supplier to manufacturer and then to customers but now it is not a simple chain, it has become a complex network i.e. it includes suppliers, 2nd tier suppliers, retailers, distributors, marketing, finance and even new product development (Kouvelis, Dong, Boyabatli, *et al.*, 2012). Nowadays, supply chain risk management gained the interest of many researchers and practitioners (Zubair & Mufti, 2015). Supply chain risk management is juncture of two concepts namely supply chain and risk management

Risk management is not a new field, it can be found in far past (Manuj & Mentzer, 2008a). In Management the first and inspiring work about risk was by Markowitz in 1952 (Rao & Goldsby, 2009). In a global survey, it has noted that political uncertainties, natural disasters, and economic issues would be among the top risks. In the same survey, it is exposed that loss of income has been increased from

28% to 42% in just two years (Kungwalsong, 2013). It has also been reported that in a few decades supply chains have gained notable attention due to globalization (Kamalahmadi & Parast, 2016). There are many examples in the history that add the value of supply chain risk management i.e. fire in New Mexico electronic chip manufacturing plant stop supply to Ericsson, as a result, company has to bear a loss of $2.34 billion (Yang & Yang, 2010). In the last five decades, among the operation management fields, production inventory and supply chain are considered record studied research areas (Paul, Sarker, & Essam, 2016).

According to Ali, Jaafar, & Mohamad, (2008) in Malaysia supply chain has gained the status of the strategic industry from the supportive industry. Additionally, by managing supply chain well, Malaysian companies can get not only a competitive advantage but also can serve their customers proactively (Khalid, 2009). Moreover, in Malaysia, a major concern is supply chain issues after manufacturing (Othman, Pandiyan, Sundram, *et al.*, 2016). Furthermore, Jüttner & Maklan, (2011) indicated that disruptions or risk of disruption in the supply chain have an instant effect on performance and affect capability that fulfills customer requirements. Many steps have been taken by authorities of Malaysia i.e. the initiative of Integrated Logistics Services incentives. The aim of this program was to improve the logistics sector. Numerous other measures have been taken in the third industrial plan to boost up supply chain (Ali *et al.*, 2008).

Rao & Goldsby, (2009) stated that most studied area in research, in the last fifty years, is the production inventory and supply chain system. Huge literature is available on the effects of risks on performance, it has been proved in different countries and sectors that risk sources negatively affect the performance (Chen, 2012; Duhamel, Carbone, & Moatti, 2016; Kauppi *et al.*, 2016; Lim, 2010; Lockamy III & McCormack, 2010; Wagner & Bode, 2008). Additionally, many researchers have tested the positive effects of supply chain collaboration approaches influence by multiple ways, some direct or indirect relationship with performance while influence on other strategies (Ahmad & Saifudin, 2014; Cook, Heiser, & Sengupta, 2011; Effendi, 2015; Shukla, 2016; Sundram, Chandran, & Bhatti, 2016). Although the above mention studies are quite a detail and comprehensive still there are many limitations that are being discussed in the next section.

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1.2 Background

Manufacturing can be defined as "the production of goods or items by using machines, equipment and labor force" manufacturing activities differ from basic items to technologies but the term is used for the process of industrial production that starts from raw materials and transformed into finished goods (Low, Baharudin, & Lim, 2016). Manufacturing sector is called the engine for the economy of any country especially for developing countries i.e. Malaysia. Currently, Malaysia, the manufacturing sector is contributing around 80 % of the overall country's export. Beside this, it is also known as the 21st largest exporting nation in the world (Low *et al.*, 2016). Even due to the recession and economic shift, manufacturing maintains its growth and contribute highest after service sector for the economic growth of the country (Bank Negara Malaysia, 2018). According to the index position of Business Circule, (2014) Malaysia is a the top location for manufacturing business as it can increase export, revenue and most important for the growth of country the employability. Despite all these Malaysian manufacturing is facing hardships.

Malaysia is considered an agricultural country but since independence government realized the importance of manufacturing industry. The first incentive was introduced in 1958 called "Pioneer Industrial Ordinance" for industrial investment, a decade later "Investment Incentives Act" was introduced. Besides these incentives, various institutions were established as "Malaysia Industrial Development Finance (MIDF)" and "Malaysia Industrial Development Authority (MIDA)" to accelerate the growth of manufacturing. However, due to the diversifying the agriculture-based economy to promote the manufacturing industries did not begin until the 1970s. In 1975, an "Industrial Coordination Act" was introduced to enhance the industrialization and established new objectives namely "New Economic Policy". During the 1960s and 1970s, the average growth rate of the sector was 12% per anum of the GDP growth that was relatively higher than in other sectors. This achievement was due to sustained political condition, price stability, the balance of payments, favorable investment climate, abundant natural resources, and well-educated labor forced (Mohammad, 2016).

Additionally, the various industrial plan was initiated. The first ten year Industrial Master Plan (IMP1) was introduced in 1985. This Plan offered a wider range of incentives and promoted through many parameters that included

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investments and reinvestment, capital expenditure, industrial location, and equity requirement. This plan almost achieves growth targets and enhance the export growth rate to 28.6 percent from 9.4 as was targeted. In 1996, due to high technological changes and to maintain the sustainability several factors were identified i.e. the "Malaysian infant technology base, secondly inadequate supply of skilled labor and finally a commitment to new markets opening under regional trading arrangements and multilateral trading system commitments" (Abidin, 2018). To respond to these challenges "Second Industrial Master Plan (IMP2)" was launched. This plan was formulated for 1996 to 2005 that improve industrial linkages, enhance value-added activities and develop industrial clusters. Eight industry clusters were formulated these were "electrical and electronics, textiles and apparel, chemical, agro-based products, transportation, machinery, materials products and resources-based such as wood, rubber and palm oil industries". During this era annual growth was 6.2% although less than the target set of 9.5% but during this plan some special measures were taken at global, regional and bilateral levels i.e. "World Trade Organization (WTO), Malaysia has participated in negotiations of free trade agreements in the areas of trade in goods, rules of origin, and investment at both regional and bilateral levels" while at regional level "Malaysia"s involvement is through ASEAN" and at bilateral level "Malaysia has concluded a bilateral free trade agreement with Japan under the Japan-Malaysia Economic Partnership Agreement, and regional agreements under the ASEAN- Republic of Korea FTA, and the ASEAN-China FTA, besides the Trade and Investment Framework Agreement (TIFA) with the USA" (Wan, 2016).

Meanwhile, during 1996 to 2005 due to some global issues i.e. terrorism, oil prices and economics shift various challenges affect the Malaysian economy, to cope up the situation Third Industrial Master Plan (IMP3) was initiated for 2006 to 2020 to achieve the greatest industrial development and achieve the status the developed country. During the 3rd plan, the target was to grow at 6.3% annually and to get this target RM1.3 trillion of overall investment that is RM84.6 billion/year was estimated (Amirah, Asma, Muda, *et al.,* 2018). All these figures are estimated at constant 2005 prices. Meanwhile, the manufacturing sector was targeted to be the second sector in driving growth after the service sector. Initially, everything was going smoothly but it was reported that since 2013 growth rate is dramatically decreasing continuously from 6.1% per anum to 4.3% per anum (Mohammad, 2016).

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Table 1.1: Growth in Manufacturing Production

2010=100	Index				Annual change (%)		
Years	**2013**	**2014**	**2015**	**2016**	**2014**	**2015**	**2016**
Export-oriented industries	114.5	120.8	126.7	132.6	5.6	4.8	4.7
Domestic-oriented industries	121.2	130.6	136.7	140.9	7.7	4.7	3.0
Total	**116.0**	**123.0**	**128.9**	**134.4**	**6.1**	**4.8**	**4.3**

Moreover, the department of statistics in December 2017 revealed that the Malaysian manufacturing sector is growing at a rate of 3.7%, although the second growing sector but below than expected 4%. Yaakub & Mustafa, (2015) conducted a study on the effects of supply chain risks and supply chain management approaches for Malaysian SME's and concluded that there is need to extend this study for overall Malaysian manufacturing and further need to classify the risks. According to Othman *et al.*, (2016) most of the research related to supply chain resulted that logistical issues are top factors behind the manufacturing industry success and it has been revealed that in Malaysia major concern is supply chain issues for the manufacturing. Additionally, the same study also found that "there is no detailed study available that focusing on the identification of logistics cost performance in Malaysia environment. Most importantly, table 1.1 shows that growth in manufacturing production is dramatically decreasing from 6.1% change to only 4.3%. Figure 1.1 shows that the highest number of incidents (1303 out of 2660) that created permanent disability or nonpermanent disability for employees belong to manufacturing only (Department of occupational safety and health, 2018). 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.

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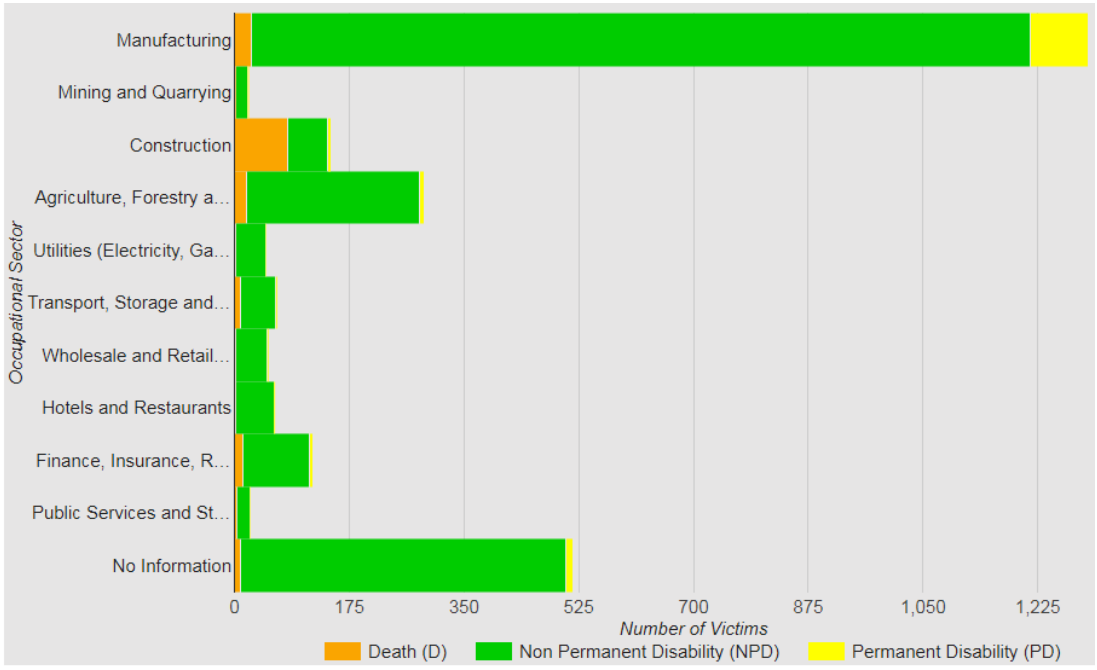

Figure 1.1: Occupational accidents statistics by sectors (Department of occupational safety and health, 2018)

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 & Sodhi (2004), Supply chain risks 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 (Supply Chain Risk Leadership Council, 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 i.e. 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 supply chain are maritime piracy in Straits of Malacca, currency fluctuating, import/export regulations (Singh & Abdul Wahid, 2014). Delays in physical distribution in electronic and electric industry (Hassan, Zaharudin, & Yunus, 2015), rapid technological changes (Yaakub & Mustafa, 2015), increase outsourcing,

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product variation and suppliers defaults (Hudin & Abdul Hamid, 2015), oil prices, China economic slowdown and foreign capital outflow (Saleem, 2015), natural hazards i.e. loss of Malaysia Airlines 370, crash of Flight 8501 of AirAsia, devastation of Malaysia Airline over Ukraine and floods 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. From the supply chain viewpoint, these disruptions not only affect the organizational performance but also disturb the other elements of the supply chain.

Effective mitigation strategy can only be operationalizing when risks are appropriately identified. Numerous studies have been done to categorize the risk source (Duhamel *et al.*, 2016; Kauppi *et al.*, 2016; Lockamy III & McCormack, 2010; Wagner & Bode, 2008) and many more but not a single study available that cover all types of risks. There are many factors that can reduce uncertainty and enhance the performance of the organization. Researchers recommend multi approached to deal with supply chain risks i.e. proactive, accommodation, defensive and reactive strategies (Yaakub & Mustafa, 2015). Based on the previous issue the aim of this study is to identify potential risks, assess their impact on performance and propose a mitigation approach through supply chain risk management process.

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1.3 Problem Statement

Malaysian Manufacturing sector is contributing around 80 % in the overall country's export (Low *et al.*, 2016). Department of statistics in December 2017 revealed that the Malaysian manufacturing sector is growing at the rate of 3.7% below than expected 4%. Most importantly, growth in manufacturing production is dramatically decreasing from 6.1% change to only 4.3% per anum. According to Othman *et al.*, (2016) most of the research related to supply chain resulted that logistical issues are top factors behind the manufacturing industry success. 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 have globally competitive manufacturing.

Every single company is a crucial chip of complex Supply Chain system (Fang, Jiang, Yang, *et al.*, 2018). Now it is above board that if any fragment of the Supply Chain disturbs, it will directly disturb the entire structure (Chen *et al.*, 2018).

Malaysia has faced many supply chain issues that not only have affected the organizations but also to the overall economy such as due to Typhoon Damrey Thunderstorms of 2011 in Malaysia, Vietnam and Philippines faced 1.008 billion dollar loss and 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 supply chain are maritime piracy in Straits of Malacca, currency fluctuating, import/export regulations (Singh & Abdul Wahid, 2014). Delays in physical distribution in electronic and electric industry (Hassan *et al.*, 2015), rapid technological changes (Yaakub & Mustafa, 2015), increase outsourcing, product variation and suppliers defaults (Hudin & Abdul Hamid, 2015), oil prices, China economic slowdown and foreign capital outflow (Saleem, 2015), natural hazards i.e. loss of Malaysia Airlines 370, crash of Flight 8501 of AirAsia, devastation of Malaysia Airline over Ukraine and floods. These disruptions demand comprehensive investagions on the effects of these risks on performance.

Effective mitigation strategy can only be operationalizing when risks are appropriately identified. Numerous studies have been done to categorize the risk source (Duhamel *et al.*, 2016; Kauppi *et al.*, 2016; Lockamy III & McCormack, 2010; Wagner & Bode, 2008) but studies that cover all types of risks are limited. Broadly supply chain risks also known as supply chain risk sources (Wagner & Bode, 2008) can be divided into three categories (i) internal to the organization (operational risks), (ii) external to the organization but internal to supply chain network and (iii) external to supply chain network (Olson & Wu, 2011). This study conducted an extensive literature review and found that most of the studies use either operational risks, external/environmental risks or risks as general. Chen (2012) have studied 90 articles on supply chain risk sources and conclude that 25% articles have used only operational risks, very few studies have applied external risks and the study that covers all dimensions of risks were very limited. Although, massive literature is available in supply chain risk management but still impact of supply chain risks on supply chain performance in Malaysian manufacturing is pitchy.

There are many factors that can reduce uncertainty and enhance the performance of the organization. Researchers recommend multi approached to deal with supply chain risks i.e. proactive, accommodation, defensive and reactive strategies (Yaakub & Mustafa, 2015). Hence, in proactive approaches, high

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collaboration is necessary for the transformation of information, funds, goods and services (Mentzer, DeWitt, Keebler, *et al.*, 2001). All members have a strong interest in the performance of the organization. There is a positive relationship between supply chain collaboration and the performance of the organizations (Cantor, Blackhurst, Pan, *et al.*, 2014). As, Daud, (2010) illustrated that relationship with the members of the supply chain has become a burning issue in Malaysian organizations. Additionally, according to Othman, (2016), most of the research related to supply chain resulted that logistical issues are top factors behind the manufacturing industry success.

It can be concluded that decreasing in manufacturing production and disruptive incidents of the last few years (that badly affects the performance of Malaysian manufacturing) strongly demand a comprehensive investigation of supply chain risks. Effective mitigation strategy can only be operationalized when risk is appropriately identified and assessed. Although, massive literature is available still impact of all kinds of supply chain risks on supply chain performance is patchy. Meanwhile, Supply chain collaboration needs to verify for Malaysian manufacturing. There are only rare studies that investigate supply chain collaboration as a risk mitigation tool. There is a lack of empirical investigation with theoretical underpinnings.

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1.4 Research Questions

After reviewing extensive literature and problem identification following research questions have been formulated.

i. Do supply chain risks (supply side risks, process side risks, demand side risks, logistic side risks, collaboration side risks, finance side risks, and environment side risks) affect the supply chain performance in Malaysia?
ii. Does supply chain collaboration affect supply chain performance?
iii. Does supply chain collaboration moderate the relationship between supply chain risk sources and supply chain performance?

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