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SUPPLY CHAIN RESILIENCE AMONG SMES MANUFACTURER IN MALAYSIA- A SURVEY

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Abstract

According to the 2018 report from Business Continuity Institute, supply chain disruption was listed as one of the top ten threats. There was a tremendous growth in academic research papers on harnessing resilience to face this growing business threat. The number of insolvent companies in Malaysia had increased 1,203% year-on-year from 2754 in the year of 2016 to 38093 in 2017 which is extremely worrying. This paper presents the familiarity of supply chain resilience among SMEs manufacturers in Malaysia including their recovery speed in their past experience in facing financial crisis and potential barriers they might face when creating supply chain resilience and lastly a list of performance measures for their "financial survival bag" was suggested. 800 questionnaires were distributed to SMEs manufacturers in Malaysia and 280 respondents' responded to the survey. Majority of the respondents are directors/CEOs/owners/ financial decision makers. More than half of the SMEs manufacturers in Malaysia are familiar with resilient supply chain management. However, more than half of them have only a limited understanding and are unclear about the action to be taken to respond to disruption. In a nut shell, majority of the SMEs manufacturers in Malaysia have not implemented resilient supply chain management. Furthermore, there is a need to research on their business longevity and ensure their long term survivability in Malaysia.

Keywords: Resilience, resilient, financial supply chain, SMEs manufacturing, resilient supply chain, organization resilience.

1. Introduction

Business management involves to cope up with many hazards that might crop up due to weather situations, calamities, natural disasters or terrorism. Business Resilience stands for the ability of business owners to regrow their business after a financial setback hits the company. Commonly, the term resilience is increasingly popular in research literature for its ability to reduce risks in a disruptive system. The word resilience originated from the Latin word "resiliere", which means to "bounce back" (Hosseini et al., 2016). What is the nature of resilience? The cells in a human body have the ability to regenerate and / or to heal naturally (Tang & Marshall, 2017), a built-in design by God. Resilience is an essential element/ characteristic; everyone has resilience. Resilience is revealed in our daily living/ routine processes for instance, in a simple process of toddler learning to walk. No one can claim to have learnt to walk (objective to achieve) without a fall (disruption/ failure). The process of falling, standing up again and walking is a very good example of natural resilience. This involves risk management where one starts to study/ investigate why fall happens, how to prevent falling during walking process. Taking precautions to prevent a fall is the right strategy to be adopted. However, it does not automatically guarantee no more falling. And yet, for one to stand up once again and get stable, what is needed is a "resilience" strategy. Similarly, resilience has to be built in to businesses, systems, materials and everything else to ensure their survivability. According to the 2018 report from Business Continuity Institute, 446 respondents in the survey were concerned about supply chain disruption as a threat to their organization and the current trend has increased the complexity of the supply chain. Regardless of the sector and size, supply chain disruptions vary from natural disasters to man-made disruptions (cyber-attacks, terrorism, etc.). The wide range of uncertainty and unavoidable risk has been fertilizing the growth of organization resilience.

Organization resilience is the ability of an organization to recover/bounce back from disruption to a better state of the organization (Lee et al., 2013). Organization resilience requires 3 basic pillars; operational resilience, information resilience and supply chain resilience (Kerr, 2016). Operational resilience is the adaptiveness of the process towards disruption. Information resilience is the robustness of the product against disruption. Supply chain resilience is the agility of the people in the chain when facing disruption.

1.1. Supply chain resilience

There were two main incidents in 2001 that triggered the growth of resilience study, one was the foot and mouth disease in UK and another one was the 9/11 terrorist attack in US. In 2001, only risk management and vulnerability concept are in practice form the initial concept of resilience. Later on, resilience study has diversified into other disciplines such as ecology, psychology and even engineering (Pettit, 2008; Ponomarov & Holcomb, 2009). Thus, the definition of supply chain resilience is not consensual. For instance, Fiksel (2006) perceived supply chain resilience as the tolerance of disruptions in a system. In addition, Falasca et al. (2008) stated that it is the ability to reduce vulnerability of the disruptions and to speed up recovery back to normal performance. For Ponomarov & Holcomb (2009), it is the adaptability of the supply chain for the unpredicted events, and ability to respond and recover from disruptions by maintaining the connectedness and control of the desired structure and function of the operations.

For Pires Ribeiro and Barbosa-Povoa (2018), it is to prepare, respond and recover from disruption as the essential phases in a resilient supply chain in order to return to a positive and stable operation within the acceptable cost and time. Thus, supply chain resilience definitions basically consist of 2 main parts, the first part is the ability/ capability to "cope with", "respond to", "tolerate" the disruption and the second part is the capability to "recover", "bounce back" to a desirable or normal state. Some researchers (e.g. Fahimnia & Jabbarzadeh, 2016; Ortiz-de-Mandojana & Bansal, 2016; Rajesh, 2018) consider resilience as a part of sustainability. As for this paper, supply chain resilience is defined as the ability to survive during the disruption or overcoming any lack in the specific given time to achieve the objective sustainably.

As mentioned earlier, supply chain resilience evolved from supply chain risk management. The objective of risk management in supply chain is to ensure continuity from the first echelon of the suppliers to the end echelon of customers without interference (Waters, 2011). Jüttner et al. (2003) defined supply chain risk management as "the identification and management of risk for the supply chain, through a co-ordinated approach amongst supply chain members, to reduce supply chain vulnerability as a whole". The vulnerability of the supply chain is to sense the presence of risk in the supply chain. Vulnerability is the probability of risk occurring and is commonly discussed in supply chain risk or risk management by some of the researchers (Behzadi et al., 2018; Wagner & Bode, 2006). Vulnerability could be reduced by increasing resilience (Soni & Jain, 2011). Hence, the purpose of supply chain risk management is to reduce supply chain vulnerability by increasing resilience in supply chain. Moreover, the purpose of supply chain resilience is parallel with supply chain risk management (Jüttner & Maklan, 2011).

Like any type of supply chain, for example, lean supply chain has the characteristics of zero waste and optimum inventory. As for supply chain resilience, these characteristics may be known as formative/ constituting elements (Christopher & Peck, 2004) or enablers (Roberta Pereira et al., 2014), while others may see them as "antecedents" (Ponomarov & Holcomb, 2009; Scholten et al., 2014). Although there is a common pattern in supply chain resilience definition as mentioned earlier but the current literature indicated significant disparity in the characteristics (Jüttner & Maklan, 2011), that each approach deem vital to construct "resilient supply chain". For instance, Ponomarov and Holcomb (2009) believed that to be resilient means preparedness, responsiveness, recovery/ stabilization and also collaboration/ integration while Wang and Ip (2009) stated it requires redundancy. Geng et al. (2013) voted for recovery and adaptability and as for Franklin and Todt (2014) is responsiveness, flexibility, visibility/information sharing and knowledge exchange / risk awareness (training). Since supply chain resilience is evolved from supply chain risk management and the agility of the people involved in the chain, it has two elements, planned and adaptive (Lee et al., 2013). Planned resilience is the preparedness before disaster, whereas adaptive resilience is the skill to adapt after disaster.

1.2. Performance measurement of supply chain resilience

As described above, supply chain resilience is the ability of the system to recover from or move to a desirable state from the disruption. Thus, the objective of performance measurement of supply chain resilience is to measure the "ability to recover"/ "recovery" /"bounce back" activities and relate it to the disruptions. Qiang et al. (2009) suggested to measure the cost needed to deal with the demand uncertainty

and supply disruption. This model is good to provide an overview of the cost needed to keep a supply chain robust, but it does not involve the "recovery" process needed in resilience.

Pettit et al. (2013) proposed a unique concept on measuring resilience by having a balance in between vulnerability measures and capability measures. The valuable finding in this tool is to provide the strength and weakness of the organization and it is able to relate the 14 capabilities (flexibility in sourcing, flexibility in order fulfilment, capacity, efficiency, visibility, adaptability, anticipation, recovery, dispersion, collaboration, organization, market position, security and financial strength) to 6 types of vulnerability (turbulence, deliberate threats, external pressures resources limit, sensitivity, connectivity and supplier/customer disruption). Soni et al. (2014) managed to quantify resilience measures and related them differently. They provided a deterministic modelling to measure 10 enablers which are agility, collaboration, information sharing, sustainability, risk and revenue sharing, trust, visibility, risk management culture, adaptive capability and lastly structure. The limitation of this model is the relationships of the subsystem with the enablers are not considered. Li et al. (2017) proposed a simulation method based on Monte Carlo simulation to measure resilience. It focused on two delivery measures: the quantity delivered and the average delivery distance. In this method, the maximum allowable recovery time is used as the time interval for internal system disruption.

Van Wagenberg et al. (2018) suggested to quantify resilience measures with the concept of "a thermometer effect" based on Bayesian Belief Network (BBN). The performance measures and metrics considered are agility (velocity & visibility), collaboration (information sharing, trust & attuning strategies), supply chain (re)engineering (redundancy & flexibility) and lastly supply chain risk management culture (risk thinking & risk measures). Karl et al. (2018) summarized the key performance indicators (KPIs) used in supply chain resilience from the year of 2000 to 2017. This paper identified 4 significant KPI elements of supply chain resilience as order and delivery lead time, on-time delivery, supplier delivery efficiency and customer satisfaction. In this paper, it is also found that visibility and information sharing are very important measures for pre-disruption, during disruption and post-disruption.

The next section illustrates the problem statement followed by section 3 on the research questions that this paper tries to answer. Section 4 explains the purpose of this study which covers the objective and scope. Subsequently, the research methodology which concentrates on the method used in the research and the concept of a financial survival bag. Thereafter is the findings of the research which are focused on the first section of the questionnaire and the explanation of the concept of financial survival bag. Last section is the conclusion where summaries and limitations of this paper are described with recommendations for future research.

2. Problem Statement

An idea or a research question arises after many unpredictable turbulences had taken place recently, for example the earthquake in Japan 2011, Ebola in Africa in 2014, and Typhoon Lekima 2019. This always leads to humanitarian supply chains with the first thought to save lives. But then what happens to the business organization? Can the business still carry on? Approximately 40% of organizations that were seriously affected by disruption would go insolvent, one year after disruption 25% of organizations would close and followed by 75% without a continuity plan would fail after three years of the disruption (Federal

Emergency Management Agency [FEMA], 2016). In this turbulent business world, supply chain that is designed and managed just to reduce cost, enhance delivery and improve quality may be incapacitated after a disruption. This situation has propelled the growth of supply chain resilience. Resilience is an indicator to ensure business continuity. Building resilience in organizations or in their supply chains is an important factor (Hohenstein et al., 2015).

Malaysia as a developing country still remains favourable among the investors (Malaysia Investment Development Authority [MIDA], 2017) .Based on SME annual report 2016/2017 (SME Corp Malaysia, 2017), 98.5% of the enterprises in Malaysia are SMEs and yet according to the Malaysia department of Insolvency (Malaysia department of Insolvency [MdI], 2017), 38,093 companies were insolvent in Malaysia (by force and voluntarily) which saw an increase from 2,754 in the year of 2016 to 38,093 in 2017. In SME annual report 2017/2018 (SME Corp Malaysia, 2018) SMEs faced with cash flow problem accounted for 35.9% of all SMEs. Of these, 71% is due to high cost of doing business, 45.8% because of late payment by customer/ clients, 43% caused by Goods and Services Tax (GST) and lastly 27.5% due to high import cost as a result of the weak Ringgit. Cash flow is a fundamental part of financial supply chain. In this context, to grow continuously in the Malaysia economy, any organization must be resilient.

The current development in resilient supply chain performance measurement aspect is lacking of robust empirical and analytical research to ensure that one is ready to face any disruption. The previous studies do not provide measures that reveal the resiliency of resilience in the supply chain. The "recovery" process that constitutes "redundancy" and "flexibility" (Sheffi, 2005; Xu, 2008) is not clearly measured. The performance measurement methods or tools provided are still very general. The findings from Pettit et al. (2013) has once again highlighted the weakness in redundancy (capacity) and flexibility although they do provide recovery as a measure but the recovery measure constitutes the factors of crisis management, resources mobilization, communications strategy and consequence mitigation with imprecise variables. The suggested performance measures and metrics (financial survival bag) would provide the quantitative measures for supply chain resilience.

3. Research Questions

This paper tries to answer the questions listed below:
- How familiar are Malaysia SMEs manufacturers with supply chain resilience?
- How long does a SME manufacturer in Malaysia take to recover from a financial crisis?
- What is a "financial survival bag"?
- What is in the "financial survival bag"?

4. Purpose of the Study

Supply chain resilience involved planning resilience and adaptive resilience (Lee et al., 2013). Thus, the purpose of this paper is to investigate the familiarity of supply chain resilience among the Malaysia SMEs Manufacturers. Secondly to identify the average recovery period from their past experience. Lastly to propose a financial survival bag. The familiarity of supply chain resilience is important for an organization, as it tells how well an organization planned for the disruptions (planned resilience). For

example, at what stage of familiarity the organization knows about supply chain resilience, only heard about it or understand it and yet no action for it or understand it and do not know what to do, and/or understand and already have planning/ working on the action to be taken. The importance of identifying the average recovery period could reflect, firstly, the experience they have in the past. It tells how well they can adapt to the disruptions (adaptive resilience). Secondly, it helps in future planning. For instance, it takes 3 months to recover from a disruption, the redundancy of resources/ buffer of stock may require up to 3 months' supply to stop the ripple effect from the disruption.

Planned resilience and adaptive resilience are not sufficient to overcome disruption. To have a complete supply chain resilience, an auxiliary tool maybe required. Hence, the proposed Survival Bag concept. With this tool, it could increase the survival rate/ recovery rate/ be more resilient. This concept will be explained in the following section. The challenge in this study is the unprecedented and some perplexing paradigms used in this research field. Supply chain resilience will be pivotal to determine the survivability of an organization in this sophisticated century. Thus, this study is at a stage of vital importance in the exploitation and utilization of supply chain resilience.

The scope of study is limited to the SMEs manufacturing sector in Malaysia. The disruptions in this study focus on financial crisis (credit risk) only. Normal/ common supply chain starts from suppliers where products are supplied by suppliers and end with customers/ end users. However, financial supply chain reverses the normal supply chain. Financial supply chains start from the payment from customers/ end users that make payment to the organization and it ends with the expenses of the organization such as suppliers, utility, etc. Supply chain resilience in this paper is known as organization resilience.

5. Research Methods

This paper adopts a survey/ short interview approach to SME manufactures with the help of SME Corp Malaysia. A multi-method sampling was conducted with the first batch of 200 questionnaires being distributed via post and email using systematic random sampling from the list of SMEs found in SME Corp Malaysia's website. Second sampling was a stratified random sampling, where "cold-call" visits were made to distribute 300 questionnaires to selected SMEs industrial areas from north, central and south peninsula Malaysia. Third sampling was a simple random sampling where 300 questionnaires were distributed and face to face short interviews were conducted in SME Corp Malaysia (HQ) in KL Sentral. A total of 800 questionnaires were distributed. 280 respondents responded to the survey. Face to face short interview was implemented to simplify and reduce the survey answering process. The advantage of face to face short interview was that respondents can have a better understanding about the new concept of financial survival bag. Some of the measures proposed are surprisingly new to the respondents including factoring which has been in Malaysia for more than 20 years and crowdfunding. The questionnaires were designed to be answered by the people relevant to financial supply chain management/ financial decision makers (CEO, CFO, GM, etc.) or directors within the organization. As the response required seniority level, the questionnaire was limited to 3 sections.

The first section consists of 12 close ended questions where 4 questions are about the demography of the respondents. The questions cover the experience of the respondents in supply chain, their organization age, and the type of industries and the size of their organization. Three questions are about

supply chain resilience and ISO related. The objective of these three questions is to understand the familiarity of respondents with resilience and their plan for resilience. Another 4 questions, are about their past experience with financial crisis. Their past experience on financial crisis will reveal how adaptive the respondents are and the robustness of their respective industries. The last question on the possible barriers they may face when implementing supply chain resilience allows the respondents to select more than one answer. The list of barriers were adopted from Roberta Pereira et al. (2014). From the response, 86% of the respondents are directors/ CEOs/ owners/ financial decision makers and 14% by others which included HR, admin and GM. The list of 12 questions is provided in Table 01.

Table 01. First section of the survey questions

No.	Questions
Q1	No. of years your organization has been established?
Q2	No. of years of experience you have in supply chain?
Q3	Please indicate the primary activity of your organization
Q4	Total of full time employees
Q5	How familiar are you with resilient supply chain?
Q6	Is your organization ISO 22301 and ISO 31000 certified?
Q7	If your organization has not been certified with ISO 22301 and ISO 31000, do you intend-to consider it in the future?
Q8	Will financial crisis affect your organization performance (profitability)?
Q9	If financial crisis does affect your organization performance (profitability), in what way the impact will be felt?
Q10	Did your organization experience any financial crisis before? If yes, how long does it take your organization to recover from it?
Q11	In your opinion, what is a healthy debt ratio?
Q12	What are the possible barriers that your organization will face in creating resilient supply chain?

Second section of the questionnaire is a list of performance measures and metrics for the "financial survival bag" suggested based on the literature review (Table 02). For this section, the respondents were required to rate the selected performance metrics according to the importance and applicability of the metrics for the financial survival bag using a 4 point Likert scale. Lastly, the third section is an open ended question for respondents to suggest any additional performances measures/ metrics. The data analysis of the second and third sections of this questionnaire are not included in this paper. As the objective of this paper is to investigate the understanding/ familiarity of supply chain resilience among Malaysia's SMEs manufacturers and to explain the concept of the proposed financial survival bag.

6. Findings

In this paper, the findings will only discuss the first section of the survey covering 12 closed ended questions. Secondly, the concept of a financial survival bag with suggested performance measures/ metrics is described.

6.1. Finding on the first section of the survey

Data obtained from the survey reflects the current situation on the understanding of supply chain resilience as more than 75% of the respondents are considered matured SMEs which has been established for more than 5 years. Secondly, 70% of the respondents have more than 5 years of experience in supply chain area. In this survey, the types of industries are randomly selected. According to the result, food and beverages industries are more willing to respond to the survey with 32% followed by 20% from transport machinery industries and the balance from other industries. Other industries include organic manufacturing and cosmetic manufacturing. Based on SME Corporation Malaysia definition for manufacturing SMEs, 19% of the respondents are from medium manufacturing, 67% are from small manufacturing and 14% are from micro manufacturing.

After questions 1 to 4 were analyzed, question 5 explains the familiarity of resilience in the SMEs manufacturers in Malaysia. In this question, the definition of resilient supply chain management is explained to ensure the word "resilience" is not just a jargon word for something that they practice frequently without knowing it is resilience. The definition was explained face to face for short interview and as for mail/ email, respondents can find the definition in the cover letter attached with the survey. About 70% of the manufacturing SMEs in Malaysia are familiar with resilient supply chain management. From the data obtained, 44% of the respondents are slightly familiar with resilient supply chain management, after explanation but they are still unclear about the action to be taken to respond to disruption. As for the categories of familiar (21%) and very familiar (4%) have already implemented resilient supply chain management. As such, the majority (75%) of the manufacturing SMEs in Malaysia have not implemented resilient supply chain management. From the result, the ISO certification is expected to be low on ISO 22301 for Business Continuity Management Systems and ISO 31000 for Risk Management. Only 1% of the SMEs manufacturers are certified with ISO 31000 but not ISO 22301. The majority of the SMEs manufacturers do not know the existence of these two ISO certifications. Among the 280 respondents, 31% will consider the certification of ISO 22301 or ISO 3100 in the future. 35% will not consider these ISO certifications unless to meet their customer requirement and lastly 34% will not consider certification in the future. ISO 31000 is more common compared to ISO 22301. Only 1 out of 280 respondent is working towards ISO 22301. According to the respondent, this is one of the criteria set by their customer for an overseas project. Nevertheless, it is difficult to obtain information and knowledge on being resilience in Malaysia.

The following question is about the experience of SMEs manufacturers with financial crisis. 11% of the respondents declared their business are not affected by financial crisis. However, 89% of the respondents are affected by financial crisis either as the primary source (financial crisis caused by their own management) example credit risk or the secondary source (financial crisis caused by other disruption) example global financial crisis. More than 50% of the respondents declared themselves as unprofitable during financial crisis, whereas 31% declared themselves as profitable and 11% chose not to answer. The experience in financial crisis may be confidential to some companies so they choose not to answer and they contributed 38% . In general, SMEs manufacturers which recovered within 1 to 2 years contributed 37%. 10% of the SMEs recovered within one year and the shortest recovery was within one month. The following question on healthy debt ratio is purely based on the respondents experience in their industries. Majority of

the SMEs preferred the debt ratio to be from 0.4 to less than 0.6 which accounted for 31%. Follow by 29% on zero debt to less than 0.2 which are more conservative and 28% from 0.2 to less than 0.4. SMEs that consider from 0.6 to less than 1 are risk takers which contributed 11%. The last question of the survey is about the possible barriers they may face in creating resilient supply chain management in their organization. Out of 280 respondents, only one respondent expressed that they are working towards creating resilience as required by their customers. This is a multiple answer question, according to Pareto analysis which is also known as 80/20 rule. Factors such as financial weakness, lack of information/knowledge on resilience, lack of coordination and control, complexity of resilience, lack of capacity, lack of collaboration and lack of flexibility are identified as 80% of the problems faced by SMEs. Other barriers mentioned by SMEs are government policies such as Goods and Services Tax (GST) which they think are the barrier for them to implement new concept in their organization.

6.2. Concept of Financial survival bag (financial supply chain resilience)

Survival bag is a bag of basic tools and supplies prepared in advance to help one to survive during disaster/ emergency. The survival bag concept can be illustrated as one who prepares to climb a mountain be it Mount Everest or just Mount Kinabalu in Malaysia (business owner determines where to start business). He/She choose to bring nothing or prepare a haversack (survival bag) for the trip. The preparations for Mount Everest and Mount Kinabalu are different. How well prepared is one's survival bag will determine the rate of one's survival. In order to survive, one needs to have the skills to use the tools and supplies and/or the experience in the past to increase the survival rate. Hence, the concept of survival bag meets the criteria of planned and adaptive resilience (Lee et al., 2013) or according to Ge et al. (2016) is adaptive and transformability of resilience. In this connection, to measure resilience is to measure the ability to recover. In other words, to measure resilience is to measure the ability to prepare and use the survival bag.

In this paper the performance measures and metrics suggested will solely focus on survival from financial credit risk. The survival bag contains mainly general tools and supplies that may help an organization to survive during financial crisis. This financial survival bag is a general guideline for many manufacturers, where it can vary according to their organization size, experience and strategy to use it. A routine check on the financial survival bag is necessary as some of the term and conditions used in the metrics may change from time to time. The tools/ items in the survival bag can be categorized into two types: Internal (A) and external (B) in seven areas (measures). Internal (save oneself) means it is within the organization control for example financial reserve fund, which is within the capability of an organization. External (wait for rescue team) means beyond the control of an organization for example ability to refinance. Some metrics can be both internal or external for example, delivery cost. If organizations do their own deliveries it will be considered internal. If they use third party logistics (3PL) it will be considered external. It can be a combination or mixture of both. The seven areas (measures) suggested are Financial, Cost, Time, Quality, Flexibility, Information sharing and Relationship.

Table 02. Suggested performance measures for the financial survival bag

Measures, Metrics & Type: Internal(A)/ External(B)			Description	Literature references
Financial	Portfolio diversification level	A	Ability to invest in multi production/ portfolio eg. product innovation, finding new market, diversify into many business, etc. to reduce the magnitude of disruption	(Achim & Borlea, 2012; Arnold & Soederhuizen, 2018; Avramidis et al., 2020; Barthélemy et al., 2017; bin Ibrahim, 2010; Brandon-Jones et al., 2014,; Casey & O'Toole, 2014; Castellani, 2018; Che & Liebenberg, 2017; Colicchia & Strozzi, 2012; Degryse et al., 2018; Ivashina & Scharfstein, 2009; Jiménez, et al., 2017; Park, 2011; Pettit, 2008)
	Financial reserves and liquidity level	A	Ability to keep/invest reserve funds in assets and liquidated when needed to sustain operations during disruption	
	Insurance investment level	A	Ability to invest into insurance against liability from credit risk	
	Factoring level	B	Ability to discount on invoice for immediate cash to sustain operations during disruption	
	Refinancing level	B	Ability to refinancing debt to avoid negative impact on credit score and insolvency	
Cost	Manufacturing cost level	A	Ability to reduce the manufacturing/ production cost	(Acquaye et al., 2018; Anand & Grover, 2015; Azzone et al. , 1991; Bai & Sarkis, 2014; Bai & Sarkis, 2011; Beamon, 1999; Behzadi et al., 2018; Bichou, 2015; Chan & Qi, 2003; Chan, 2003; Chung et al., 2018; Esfahbodi et al., 2016; Govindan et al., 2015; Gunasekaran et al., 2004; Joshi et al., 2011; Maestrini et al., 2017; Mishra et al., 2018; Olugu & Wong, 2009; Palandeng et al., 2018; Prajogo et al., 2016; Rangaswamy & Subramanya, 2010; Thanki & Thakkar, 2018; Truong Quang & Hara, 2018; Tseng et al., 2018; Wong & Wong, 2008)
	Delivery cost level	A/ B	Ability to reduce delivery cost, transportation cost and logistics cost	
	Inventory and Ordering cost level	A	Ability to reduce inventory and ordering costs	
Time	Manufacturing lead time level	A	Ability to reduce total amount of time required to produce a product	
	On time delivery level	A/ B	Ability to reduce delivery time to customer and from supplier	
	On time payment level	B	Ability to increase customer payment on time	
Quality	Rework and scrap level	A	Ability to reduce number of rework and scrap	
	Customer satisfaction level	B	Ability to meet customers satisfaction in terms of reducing customers complaints	
	Supplier performance level	A &/ B	Ability to increase supplier's performance in terms of reducing supplier's reject rate, supplier's	
Flexibility	Demand flexibility level	A/ B	Ability to accommodate customers' orders without affecting the supply chain	(Azadeh et al., 2014; Beske-Janssen et al., 2015; Franklin & Todt, 2014; Golgeci & Ponomarov, 2013; Gong et al., 2014; Govindan et al., 2015; Ivanov et al., 2014; Kumar et al., 2014; Pettit et al., 2013; Rajesh et al., 2015; Scholten et al., 2014)
	Supply flexibility level	A/ B	Ability of supplier to meet production needs without affecting the supply chain	
	Production flexibility level	A	Ability of the production systems to meet customers' needs without affecting the supply chain	
Information sharing	Risk management training level	A	The amount of risk management training for employees on risk management or related skills within the organization	(Azadeh et al., 2014; Brandon-Jones et al., 2014; Dominguez et al., 2018; Franklin & Todt, 2014; Johnson et al., 2013; Panahifar et al., 2018; Pettit et al., 2013; Rajesh, 2018; Rajesh & Ravi, 2015; Rajesh et al., 2015; Saberi et al., 2019; Scholten et al., 2014; Soni & Jain, 2011; Soni et al., 2014; Yu et al., 2018)
	Anticipation level	A &/ B	Ability/ experience to discern potential future events / situations such as forex, weather, forecast economic growth, etc.	
	Disruption information shared level	B	Willingness to share negative information caused by financial crisis, such as, downsizing of the organization from customer to supplier or vice versa	

Relationship	Customer loyalty level	B	Ability to keep/ maintain customers' loyalty	(Abdullah, 2016; Belleflamme et al., 2014; Drover et al., 2017; Faisal et al., 2006; Kumar et al., 2014; Malliari & Sirkeci, 2017; McKenny et al., 2017; Schmitt,2011; Schwienbacher, 2018; Soni et al., 2014; Taha & Macias, 2014; Walthoff-Borm et al., 2018; Kong & Xiang, 2008; Zhao et al., 2018)
	Risk sharing level	B	Willingness of external {partners (supplier &/or customer)} & internal {employees} to help and share the risk together such as currency volatility risk, or delay in salary etc.	
	Crowdfunding level	B	Ability to raise funding from equity, employees, business partners, public, families/ friends etc. without losing permanent ownership	

7. Conclusion

This paper has provided a general understanding of supply chain resilience definitions and past research on its performance measurement. According to the survey results, 70% of Malaysia's SMEs manufacturers are familiar with supply chain resilience but 44% of them are considered only slightly familiar which means they have only heard of supply chain resilience but have no idea on the action to be taken. Malaysia's SMEs are encouraged to start planning and prepare for disruptions. As preparation, it is suggested to reserve enough resources for not less than 3 years. This is based on the findings from the survey where 37% of respondents recovered within 1 to 2 years, with 38% of the respondents declared having no experience in financial crisis and 1% preferred not to answer. Financial weakness, lack of information, lack of coordination and control, complexity of resilience, lack of capacity, lack of collaboration and lack of flexibility are cited as the main barriers in building a supply chain resilience by 80% of the respondents. Furthermore, this paper has proposed the concept of a financial survival bag to measure resilience. With the resilience in mind while preparing for the survival bag, one must be able to use the tools/ supplies to survive. The survival bag is not a guarantee for survival but is a set of tools/ supplies to increase the survival rate. This survival bag is prepared mainly for financial crisis (credit risk). It is strongly encouraged to check the performance measures/ metrics periodically as they may "expire" from time to time. The tools/supplies in the survival bag may vary based on different countries, organization size and maturity/experience of the organization. The suggested financial survival bag contains 7 performance measures (financial, cost, time, quality, flexibility, information sharing and relationship) and 23 performance metrics.

The limitation of this paper is that the suggested survival bag is specially made for Malaysia and if it is to be used in a different country, the tools and supplies may vary accordingly. As Malaysians are generally considered to be more conservative, questions related to money are less likely to be answered by the respondents. For example, 38% of the respondents consider never experience financial crisis before and yet 75% of the respondents are considered mature SMEs which have been established for more than 5 years. Based on this outcome, the robustness level in Malaysia SMEs manufacturers is high. Yet data by SME Corp Malaysia showed 35.9% of SMEs are faced with cash flow problems. Thus, the data collected for recovery period can only be used as a reference. They may change depending on the situation, organization size and experience of the organization. Furthermore, to determine whether the 1 to 2 years recovery period is too long or too short, it must be compared with the average longevity of business life span. If the average business life span is 5 years, then 1 to 2 years of recovery is considered too long. In future, it is

recommended that more research should be conducted on the average business life span of organizations in Malaysia to ensure their long term survivability. Secondly, SMEs are encouraged to self-equip with the knowledge and skill on how to survive. Last but not least, future opportunities for research should focus on the preparation of survival bags for different types of business disruption and for different industries.

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