

-RESEARCH ARTICLE-

ENHANCING GLOBAL BUSINESS RESILIENCE: DISASTER PREPAREDNESS STRATEGIES AMONG MSME MANUFACTURERS IN NORTHERN PENINSULAR MALAYSIA

Mohamad Syafiqi Hashim

School of Economics, Finance and Banking, UUM Institute of Risk Management, Universiti Utara Malaysia, 06010 Sintok, Kedah, Malaysia

Email: m.syafiqi.hashim@uum.edu.my

ORCID ID: <https://orcid.org/0000-0002-1082-6223>

Arpah Abu Bakar

School of Economics, Finance and Banking, UUM Institute of Risk Management, Universiti Utara Malaysia, 06010 Sintok, Kedah, Malaysia

Email: arpah@uum.edu.my

ORCID ID: <https://orcid.org/0000-0002-4538-0487>

Zairol Azhar Auzzir

School of Economics, Finance and Banking, UUM Institute of Risk Management, Universiti Utara Malaysia, 06010 Sintok, Kedah, Malaysia

Email: zairol@uum.edu.my

ORCID ID: <https://orcid.org/0000-0001-6318-0035>

—Abstract—

The concept of disaster preparedness is closely linked to the coping strategies employed by firms, particularly in the manufacturing sector, to deal with disasters, especially for MSMEs. The study focuses on analysing different mitigation measures implemented to enhance the disaster preparedness index of MSMEs. The data was collected from MSME manufacturers through stratified random sampling in Penang and Kedah. The study had a response rate of 27.4%. The index is later used to assess the significant connections between disaster preparedness levels and the characteristics of MSMEs. In addition, this study highlights the main obstacles that may hinder their investments in

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protective measures to address both current and future disasters in their communities. In terms of the findings, it is interesting to note that medium-sized manufacturers with legal ownership structures have a strategic advantage when it comes to becoming more resilient in the face of disasters. These manufacturers tend to have higher levels of preparedness compared to smaller manufacturers. Regarding policy implications, it is advisable for MSME manufacturers who are impacted or may be impacted to establish a sustainable work environment with greater levels of preparedness. This will help them become more resilient to disasters and maintain their competitiveness both locally and internationally. To enhance their global business resilience capacities over the long term, it is crucial for potentially affected and affected MSMEs to take advantage of disaster risk financing programmes offered by governments and other organisations, both locally and internationally.

Keywords: Disaster preparedness; MSME manufacturers; Business Resilience; risk management, Awareness of Preparedness.

INTRODUCTION

SMEs play a crucial role in driving economic growth, especially in developing countries such as Malaysia ([Razak, Abdullah, & Ersoy, 2018](#)). So far, they have not only provided financial support for many families, but also created opportunities for local businesses by offering a range of jobs and supply chain possibilities. Due to limited financial resources and smaller organisational structures, MSMEs are more susceptible to the impact of natural disasters. Research indicates that small and medium-sized enterprises (MSMEs) are vulnerable to various types of disasters, including those caused by nature and human activities. This vulnerability is influenced by factors such as limited financial knowledge and the geographical location of the businesses ([Utami, Santosa, & Leila, 2021](#)). Therefore, their business operations may face significant disruptions in the event of a disaster.

Consequently, the impact of property and premises damages can disrupt the ongoing business operations of manufacturing MSMEs, resulting in significant losses to raw materials and finished goods. Although the impact of disasters is felt worldwide, it is evident that the most vulnerable countries, particularly those with limited resources, face greater challenges in recovering from these events. Numerous MSMEs in developing nations find themselves ill-equipped to handle disasters, as they lack the necessary insurance coverage. This is often due to financial limitations or the inability to afford such insurance policies ([Pathak & Ahmad, 2016](#)).

The ongoing COVID-19 pandemic has greatly affected many MSMEs. They have encountered various challenges, including decreased demand, disruptions in the supply chain, and shortages of raw materials. This has created a state of uncertainty for these

businesses. These circumstances are forcing numerous MSMEs to close their businesses, while others are barely surviving. Additionally, some MSMEs are facing the risk of running out of stock soon, as they lack the necessary financial and managerial resources in comparison to larger companies (Sari & Kusumawati, 2022).

MSMEs in developing nations often encounter various constraints that hinder their ability to engage in disaster risk management (DRM) strategies. These constraints include operating informally, which prevents them from accessing insurance, limited diversification of supplies and customer bases, and non-compliance with regulations. As a result, the employees of these MSMEs face heightened disaster risks (Skouloudis et al., 2023). Investing in DRM resources offers economic benefits, which is the ultimate goal of any business within a country. Investing in disaster risk prevention and preparedness strategies is more cost-effective than paying for losses after a disaster.

The primary disaster in Malaysia is flooding (Auzzir, Haigh, & Amaratunga, 2018). Approximately 1,000 out of 10,000 manufacturing-based small and medium enterprises (SMEs) in Seberang Perai and the surrounding areas were severely affected by the major flood in Penang in 2017, resulting in estimated losses of nearly RM200 million. This information was provided by Datuk Dr Ooi Eng Hock, the Chairman of the Penang Branch of the Federation of Malaysian Manufacturers (FMM). The Ministry of International Trade and Industry reported that the major flood in 2014 affected 38 percent of the 34,211 SMEs in the state of Kelantan, amounting to over 13,000 businesses (Reserve & Rao, 2019).

Therefore, an important lesson learned from previous disasters, such as the floods in Thailand and Kelantan, is the need to ensure adequate insurance coverage for MSMEs. These enterprises play a significant role in stimulating economic activities in developing countries (Perwaiz, 2015). One lesson learned from these tragic events is the limited disaster resilience capacities of affected SMEs. The majority of small and medium-sized enterprises (SMEs) faced significant challenges in their survival following the occurrence of disasters in countries such as Japan, Thailand, and Malaysia. Prior to the disasters, there was a lack of government and stakeholder intervention in assisting SMEs in addressing these issues, particularly in developing countries such as Thailand and Malaysia (Auzzir et al., 2018; Hashim, Ng, Talib, & Md Tamrin, 2019).

This study is motivated by recent developments and focuses on three specific objectives. An analysis is conducted on the mitigation measures implemented by MSME manufacturers to develop the disaster preparedness index for MSMEs. The second objective is to examine the correlation between disaster preparedness levels and owner and business characteristics of MSME manufacturers using an index. The third objective is to analyse the deterrent factors that influence MSME manufacturers' investment in protective measures for their businesses to mitigate future disasters.

LITERATURE REVIEW

Past studies in literature have examined the concept of preparedness. Disaster management considers this aspect as crucial. The study of disaster management has emphasised the significance of this concept in both theoretical and practical aspects. According to [Staupe-Delgado and Kruke \(2018\)](#), the concept of preparedness is focused on saving lives. Furthermore, certain studies have identified it as a means to improve the management of response activities during a disaster. Disaster preparedness plays a crucial role in minimising casualties during a disaster.

Past studies have defined preparedness as the proactive behaviour of individuals to take specific measures in order to mitigate or minimise the risks associated with a disaster, based on their perception ([Samah, Zaremohzzabieh, Shaffril, D'Silva, & Kamarudin, 2019](#)). This concept refers to the ability and knowledge of individuals, households, communities, businesses, organisations, and governments to recover and respond to potential disaster situations. These efforts are based on the contributions of various individuals, ranging from those who provide first aid training to households that maintain a stock of medicine. The government and supporting agencies play a crucial role in saving the victim in this situation. The mentioned strategies are directly related to the concept of preparedness, particularly for MSMEs ([Hanggraeni, Ślusarczyk, Sulung, & Subroto, 2019](#)).

[Rohith, Kolathayar, Priyatham, Kumar, and Nikil \(2017\)](#) suggest that preparedness can be assessed by observing individual-level actions taken to combat a disaster. DRM investments can enhance the competitiveness of MSME businesses in localities both before, during, and after a disaster. Businesses can enhance their long-term competitiveness by effectively managing and mitigating risks, including those associated with small but frequent disasters such as floods. Businesses that have made significant investments in risk management have the potential to outperform their peers financially ([Kaplan & Mikes, 2016](#)).

Prior research has shown variations in preparedness levels based on enterprise types ([Josephson, Schrank, and Marshall \(2017\)](#)), premise ownership ([Orhan \(2016\)](#)), legal ownership ([Sydnor, Niehm, Lee, Marshall, & Schrank, 2017](#)), business ownership ([Chinh, Bubeck, Dung, & Kreibich, 2016](#)), and past disaster experience ([Becker, Paton, Johnston, Ronan, & McClure, 2017](#)).

[Rohith et al. \(2017\)](#) argue that implementing a greater number of coping strategies increases preparedness levels and enhances an organization's disaster resiliency over time. Preparedness is crucial for assessing the disaster resilience of business organisations, including MSMEs. MSMEs can enhance their business resilience by

reducing vulnerabilities through improved preparedness levels. [Nayab and Dahl \(2023\)](#) focused on the development of coping capacities and strategies.

The impact of disasters on MSMEs is significant worldwide, particularly in developed countries like Belgium, Germany, and Japan. One example is the bankruptcy of 656 small and medium-sized enterprises (SMEs) that employed over 10,000 workers in the year following the earthquake that occurred in March 2011. Disasters have negatively impacted the infrastructure, economic conditions, and supply chains of affected areas, resulting in harmful consequences for the surrounding localities. The 2021 flooding caused significant damage in Germany and Belgium, extending into neighbouring countries ([Zander, Nguyen, Mirbabaie, & Garnett, 2023](#)). The flood resulted in estimated losses of billions of euros and caused the deaths of over 200 people, as well as significant damage to homes and businesses in multiple areas.

Developing countries experience a greater impact of disasters compared to developed countries. The 2011 Bangkok flood caused significant disruption to a large number of MSMEs, with at least 550,000 businesses affected. Among these, 90% were SMEs, resulting in over 2 million job losses ([Marks & Elinoff, 2020](#)). The flood caused a 37% decrease in Thailand's national GDP. Indonesia experiences significant climate-induced disasters such as floods, fires, and extreme waves. Among these, floods are the most frequent occurrence ([Escap, 2016](#)).

The implications of natural disasters may vary depending on the region's external and internal vulnerabilities. The highest recorded incidences and damages of floods are found in Sumatera and Java, while Java has the highest incidences and damages of landslides. Java had the highest number of tornadoes and the most damage caused by them. Earthquakes were most common in West Java and Nusa Tenggara ([Jasmine et al., 2021](#)). The 2018 Palu Earthquake-Tsunami in Central Sulawesi resulted in the loss of 2200 lives and caused damage to approximately 68,000 houses, 176 health facilities, and 1509 education buildings. Additionally, economic infrastructures in 13 economic centres and 9,718 hectares of agricultural land were also affected ([Team, 2018](#)). The total estimated cost of the disasters was IDR19.96 trillion, with over half of this amount attributed to the housing and economic sectors.

According to [Perwaiz \(2015\)](#), only 14% of small and medium-sized enterprises (SMEs) affected by the 2011 Bangkok flood in Thailand were covered by flood insurance. The Indonesian Financial Services Authority conducted a study which found that only 3 percent of the 64 million Indonesian MSMEs have natural disaster insurance. This results in a protection gap of USD1.4 billion when compared to developed insurance markets. The pandemic exacerbated the conditions in Indonesia, with 55.2% of MSMEs experiencing a decline in sales, 4.5% of MSMEs experiencing no growth, and 36.7% of

MSMEs reporting no sales during the pandemic ([Sudjatmoko, Ichsan, Astriani, Mariani, & Clairine, 2023](#)).

[Table 1](#) presents a comparison of DRM models in developed economies and Malaysia. Japan's disaster management framework has been developed and strengthened through experiences with major disasters, including the Ise Bay typhoon in 1959, the Niigata earthquake in 1964, the Miyagi earthquake in 1978, the Kobe earthquake in 1995, and the Great East Japan earthquake and tsunami in 2011 ([Center, 2021](#)). The DRM framework encompasses prevention/preparedness, mitigation, emergency response, and recovery/reconstruction and rehabilitation, addressing all stages of a disaster. The national and local governments have distinct roles and responsibilities, while public and private sector stakeholders, including SME operators, collaborate to implement countermeasures against the disasters they face. The DRM of Taiwan focuses on enhancing the disaster resilience of SMEs in order to support investment and trade sectors during the prevention and preparedness phase.

It is necessary to increase disaster awareness and improve the resilience capacities of SMEs. The study aims to achieve three specific objectives: firstly, to identify natural hazard threats to businesses in the logistics and auto part industries and propose mitigation strategies using ICT-based disaster pre-emptive mechanisms; secondly, to share best practices regionally to assist small and medium-sized enterprises (SMEs) in implementing disaster pre-emptive mechanisms; and finally, to enhance the awareness levels of SMEs regarding natural disaster risks ([Canton, 2021](#)).

[Li, Wang, Jin, Huang, and Xia \(2020\)](#) found that various internal, population-related, and macro variables are important factors in determining long-term business performance following Hurricane Katrina in 2005. [Sydnor et al. \(2017\)](#) found that the long-term business operations following Hurricane Katrina in 2005 were affected by both the impact of the disaster and the characteristics of the owner and business.

Table 1. Comparative analysis of DRM models for MSMEs in Malaysia versus two developed economies

Criteria	Malaysia		Japan		Taiwan	
	DRM - Resilience Policies for MSMEs	Prevention	National Security Council	Prevention	Coverages for BCP development	Prevention
During		Financial supports for disaster prevention strategies			During	
Recovery		Emergency Fund Program	During	Consultation service provisions for financing	Recovery	Loans and credit guarantees programmes for disasters-affected SMEs
		Recovery	Infrastructure, grants, subsidies or financing programmes			
Financing related to Disaster	<p>Disaster Relief Fund sourced by Government A disaster fund was established in 2006 and called as National Disaster Trust Fund managed by the National Disaster Management Agency (NADMA). The fund was set up under Section 10 of the Financial Procedure Act 1957 [Act 61], with an initial budget of RM50 million.</p> <p>Disaster Relief Facility (DRF) by Bank Negara Malaysia (BNM) DRF is offered to micro enterprises and SMEs affected by floods in districts identified by NADMA as flood disaster areas to enable them to resume their business operations. It provides financing for repairs and replacement of assets damaged by natural disasters and for the working capital.</p>		<p>Great East Japan Earthquake Restoration Special Financing Loans (i.e., with low interest and long term) for affected SMEs were duly offered by Japan Finance Corporation and Shoko Chukin bank. Also, interest-free loans intended to cover direct damages such as the collapse of SMEs in the zones related to the nuclear events.</p> <p>Financing Program for Small-Scale Enterprises Management Improvement Loans (i.e., non-collateral, no-warranty, wider credit and lower-interest) for affected SMEs were duly offered by Japan Finance Corporation. The guidelines to resume SME businesses were issued by the associations/ societies of commerce and industry.</p>		<p>Credit Guarantees and Loan Programmes for Disaster Recovery Financial supports for recovery to disasters-affected SMEs were offered since May 2006 in relation to premises, plants, raw materials, and damaged products.</p> <p>Credit Guarantees and Loan Programmes for Enterprises Affected by Typhoon Morakot Loan and credit guarantees for disasters-affected SMEs were offered since September 2009 which suffered severe damages and losses from the floods.</p> <p>Among others, the programmes covered short-term BCP strategies and the setup of backup facilities for affected SMEs.</p>	

Source: (Center, 2021)

METHODOLOGY

Research Framework

So far, different studies have used different approaches to disaster preparedness. This is mainly because different activities are seen as preventive measures for different types of disasters, and they vary depending on social, cultural, or geographical factors (Tierney, Lindell, & Perry, 2002). Therefore, this study utilises the framework established by (Baker, 2011) to assess disaster preparedness, as shown in Figure 1.

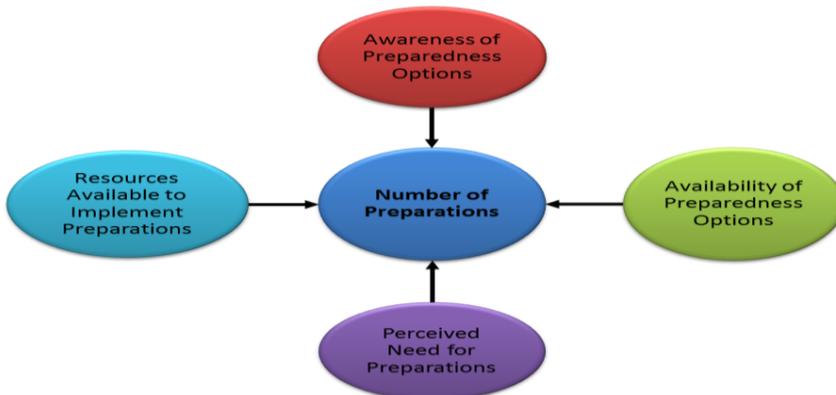


Figure 1: Conceptual framework in explaining preparedness actions

Source: (Baker, 2011)

In a study conducted by Baker (2011), a disaster preparedness index was created by tallying the reported preparations made by 1, 200 residents in various counties of Florida, United States, after a recent hurricane struck. The counties included in the study were located in the eastern, northwestern, western coastal, and inland regions of Florida. According to Baker (2011), an increase in the number of preparations is linked to a higher disaster preparedness index. For comparison, the participants were divided into two groups: one with lower preparedness and the other with higher preparedness. Based on Figure 1, the analysis on the distribution of number of preparations among the respondents led to the separation of the two groups using breakpoints. When computing the disaster preparedness index, all preparations were given equal weightage.

Research Design and Survey Response Rate

The survey questionnaires were sent via email to a sample of 365 MSME manufacturers in the states of Kedah and Penang. This study made use of the existing SME directory found in the SME information portal managed by the Secretariat to the National SME Development Council (NSDC). The sample was drawn proportionally from each type of the enterprises. The population and sampling frame of this study are provided in Table 2.

Table 2: Population and the stratified proportionate sampling size of manufacturing MSMEs

Enterprise	Number of Companies	% of Population	Sample Size
Medium	164	2.3	8
Small	1,538	21.3	78
Micro	5,533	76.4	279
Total	7,235^a	100.0	365^b

Source: Department of Statistics, Malaysia (2021)

Note: ^a refers to the total number of manufacturing MSMEs in Kedah and Penang obtained from SME Bank Group (2021), ^ba sample of 365 observations is minimally required to be chosen from the total population for reaching the 95% significance level in the produced results (Cavana, Delahaye, & Sekeran, 2001).

In general, the survey received a response rate of approximately 27.4 percent, with most MSME respondents completing the Malay-based version of the questionnaires. Although the response rate was deemed low, it is like other studies conducted in the Asia Pacific region, including those in Malaysia. As an example, surveys conducted in the business sector, focusing on both MSMEs and large firms, typically receive a response rate of around 10 percent to 20 percent in Malaysia (Hazman, 1998; Hooi, 2013). In addition, the survey conducted by the Small and Medium Industries Development Corporation (SMIDEC) in 2008 had an average response rate of 18 percent among the Malaysian SME respondents, which was determined through email communication. Given the typically low response rate, this necessitates for a test on whether MSME non-respondents would have responded differently. The problem of non-response bias was measured by employing a wave analysis in which the responses were accordingly divided into three waves namely those who replied before issuing the first reminder, those who replied in the post of first reminder and before issuing the second reminder and those who replied in the post of second reminder.

Study Area and Data Sampling

This study focuses on the MSME operators in the manufacturing sector in the northern states of Peninsular Malaysia, specifically Kedah and Penang as shown in Figure 2.



Figure 2: Map of Peninsular Malaysia and districts of Kedah and Penang

Note: The maps of Peninsular Malaysia and Kedah and Penang states are provided for illustrative purposes.

These MSMEs are referred to as entrepreneurs with sales turnovers of no more than RM50 million or full-time employees of not exceeding 200 workers (Mohd Ruslan, 2018). Small and medium-sized enterprises (SMEs) in the manufacturing sector played a significant role in Malaysia's economy in 2020. They contributed 20.7 percent of the SMEs GDP, making them the second-largest contributor after SMEs in the services sector. These manufacturing SMEs held a stake of 62.1 percent of the SMEs GDP. For this study, data was gathered using online survey forms that included a mix of multiple choice, open-ended, and closed-ended questions. The respondents we are focusing on are MSME owners and individuals who are responsible for managing their respective businesses.

Questionnaire

The questionnaire covers a substantial number of questions in four sections. Section one compiles essential data on the business characteristics possessed and/or managed by the respondents. Section Two explores different types of natural hazards that can affect their business operations, detailing the experiences, damages, and losses caused by these disasters. Section Three evaluates the businesses' present and future preparedness to confront both current and emerging natural hazards. Additionally, Section Four focuses on individuals' personal viewpoints and their readiness to participate in future DRM initiatives.

Data Analysis

Cross Tabulation with Fisher's Exact Test

Analyse cross tabulation, also known as a contingency table or crosstab, involves comparing the frequency distribution of two categorical variables, specifically row and column variables.

Small sample analysis commonly employs the Fisher's exact test, which remains applicable across all sample sizes. When dealing with small expected counts, one typically performs the Fisher's exact test to evaluate the null hypothesis of independence (Fisher, 1970). If the variables are independent (meaning they have no relationship as indicated by a value of $p > 5\%$ or 0.05), then the test results will be considered "statistically insignificant" and the null hypothesis (H_0) cannot be rejected. Therefore, we can conclude that there is no correlation between the variables.

RESULTS

Table 3 provides the descriptive statistics of the MSME respondents.

Table 3. Information on the MSME businesses

	Total	
	#	%
Registered business		
MSME Operators	100	100.0
Business owner		
Yes	93	93.0
No	7	7.0
Designation		
CEO, ED, MD	60	60.0
SGM, GM, VP, Manager,	32	32.0
Others (e.g., Owners)	8	8.0
	Total	
	#	%
Gender		
Male	55	55.0
Female	45	45.0
Involved sector		
Manufacturing	100	100.0
Types of SME by total workers		
Micro	37	37.0
Small	43	43.0
Medium	20	20.0
Types of SME by annual sales revenue		
Micro	37	37.0
Small	43	43.0
Medium	20	20.0
Legal ownership		
Sole trader	58	58.0
Partnership	15	15.0
Private limited company	27	27.0
Main premise ownership		
Own	49	49.0
Rent/lease	43	43.0
Work from home	8	8.0
Businesses affected by natural hazard in the last five years		
Yes	73	73.0
No	27	27.0
Types of natural hazard faced in the last five years		
Pandemic/epidemic	73	73.0
Floods	55	55.0
Haze	10	10.0
Tsunami	6	6.0
Typhoon/storm	5	5.0
Heat waves/extreme heat	3	3.0

Earthquake	-	-
Wildfire	-	-
Volcanic eruption	-	-
Landslides	-	-
Drought	-	-
Insect infestation	-	-
Note: # is the number/value of frequency and % is the value of percentage.		

Mitigation Measures Implemented by MSME Manufacturers for Disaster Preparations

Table 4 presents the percentage of MSME manufacturers who have implemented measures to address risks associated with natural disasters from 2017 to 2021.

More than half of the participants indicated that they made sure to follow the standard operating procedures (SOP) mandated by the government. They are more inclined to have robust safeguards in place, thereby minimising their vulnerabilities to potential disasters. Following that, a significant portion of respondents mentioned that they strategically designed their supply chains to mitigate any potential disruptions to their business operations. Additionally, a considerable number of participants reported investing in insurance schemes to protect their valuable business assets. Other preparation levels were significantly higher, with percentages ranging from 25 percent to 8 percent in a descending order.

Table 4: Mitigation measures implemented by MSMEs for disaster preparations

No.	Preparedness/Mitigation Measures	Percent of Respondents
(1)	Ensured the compliance with standard operating procedures (SOP) issued by the government	55.0
(2)	Planned your supply chain to minimize disruptions	33.0
(3)	Obtained property insurance	29.0
(4)	Changed business model/ventured into new business lines	25.0
(5)	Made premise improvements	23.0
(6)	Obtained medical/life insurance for business owner/business partners/employees	19.0
(7)	Relocated your stock/equipment	17.0
(8)	Obtained business interruption insurance	9.0
(9)	Back up your business data in another location	8.0
(10)	Installed anti-disaster devices	8.0

Disaster Preparedness Index

The preparedness index is calculated based on the various measures implemented by households. (Baker, 2011). Considering households as a unit of analysis, this concept can also be applied to businesses, particularly MSME operators. Table 5 displays the distribution of preparedness index scores among the MSME respondents. Based on the number of measures taken, MSMEs can be categorised into two groups: those with a high level of preparedness and those with a low level of preparedness. Therefore, none of the MSME manufacturers indicated that they produced all 10 preparations as listed in Table 5. As an illustration, 8.0 percent of the enterprise types consisted of medium-sized manufacturers who were classified as highly prepared (i.e., four up to seven preparations), while 40 percent of them fell into the low preparedness category (i.e., zero up to three preparations).

Table 5: Disaster preparedness measures among the MSME respondents

Aggregate Score	Percent of Respondents	Preparedness Level	Score Interval	Maximum Percent of Respondents	Highest Group of Enterprise
0	10.0	Low	0 – 3	40.0	Small
1	15.0				
2	27.0				
3	37.0	High	4 – 7	8.0	Medium
4	6.0				
5	1.0				
6	3.0				
7	1.0				

Relationships between Disaster Preparedness and MSME Manufacturers' Characteristics

Table 6 displays the various factors related to disaster preparedness that have been examined and evaluated in previous studies. Afterwards, the researchers examined the variables to determine their connections with the disaster preparedness levels of the MSME respondents, whether they fell into the low or high category. Due to the limitations of chi-square tests when expected counts of variables are less than five, Fisher's Exact Tests were used instead at a significance level of five percent. Therefore, Table 7 presents the findings regarding the statistical significance of variables related to disaster preparedness.

Table 6: Disaster preparedness-related variables

		Business Characteristics								Owner Characteristic	
		Type of Enterprise		Premise Ownership		Legal Ownership		Business Ownership		Past Disaster Experience	
Previous studies*:		(Josephson et al., 2017)		(Orhan, 2016)		(Sydnor et al., 2017)		(Chinh et al., 2016)			
Preparedness Level	Score Interval	Max % of Respondents	Highest Group	Max % of Respondents	Highest Group	Max % of Respondents	Highest Group	Max % of Respondents	Highest Group	Max % of Respondents	Highest Group
Low	0 – 3	40.0	Small -sized operators	42.0	Premise owners	56.0	Sole trader	84.0	Business owners	64.0	Yes (Non-first timers)
High	4 – 7	8.0	Medium -sized operators	7.0	Premise owners	5.0	Private limited	9.0	Business owners	9.0	Yes (Non-first timers)

Note: * indicates that the past authors who utilized the following variables of disaster preparedness (and recovery) in their analyses, respectively.

According to [Table 7](#), it was found that the four variables - types of enterprise, premise ownership, business ownership, and past disaster experience - have no significant association with the level of disaster preparedness. However, it is worth noting that the variable of legal ownership is the only factor that has been found to have a significant association with the level of disaster preparedness. Therefore, it can be inferred that medium-sized manufacturers with robust legal ownership structures demonstrate greater readiness to enhance business resiliency. This makes them more resilient to disasters compared to small manufacturers in both states. For example, medium-sized manufacturers often establish strong relationships with multiple affiliates who can offer valuable guidance on disaster management, business recovery, and emergency response plans. By adopting such a proactive approach, it can greatly improve their ability to handle unexpected situations. This finding is consistent with previous research conducted by ([Dahlhamer & D'Souza, 1997](#)). On the other hand, numerous small-sized businesses, lacking robust disaster preparedness strategies, rely solely on the owners' expertise for decision-making, as they lack adequate support services.

Table 7: Statistical significance of disaster preparedness variables

Variable	p-values of Fisher's Exact Tests (Exact Significance 2-Sided)	Remarks
Types of Enterprise	0.34	Fail to reject H_0
Premise Ownership	0.35	Fail to reject H_0
Legal Ownership	0.01*	Reject H_0
Business Ownership	0.17	Fail to reject H_0
Past Disaster Experience	0.72	Fail to reject H_0
Note: * indicates the null hypothesis, H_0 : two variables are independent of each other to be rejected at the five percent significance level.		

In addition, medium-sized manufacturers with established legal ownership structures often facilitate quicker decision-making processes during and after a disaster. With the presence of an owner or management team already in place, these manufacturers can quickly evaluate the situation, allocate resources, and execute effective strategies to minimise the effects of the disaster. In addition, these manufacturers are often perceived as having superior access to resources and funding. Through established relationships with financial institutions, insurance providers, suppliers, or investors, businesses can benefit from quick access to capital or insurance coverage in the aftermath of a disaster. This enables them to recover and resume operations as soon as possible. In addition, manufacturers who incorporate disaster scenarios into their succession planning can ensure a seamless transfer of leadership and decision-making responsibilities in the event of unexpected circumstances. With a smooth transition, manufacturers can continue their business operations and effectively address the challenges posed by

disasters. In general, the business features, particularly the legal ownership structure, can enhance the long-term resilience of a manufacturing MSME by effectively navigating and recovering from unforeseen events or disasters.

Major Obstacles in implementing Mitigation Measures

Implementing mitigation measures to protect MSME manufacturers from the impacts of future natural disasters may face significant obstacles, as shown in [Figure 3](#).

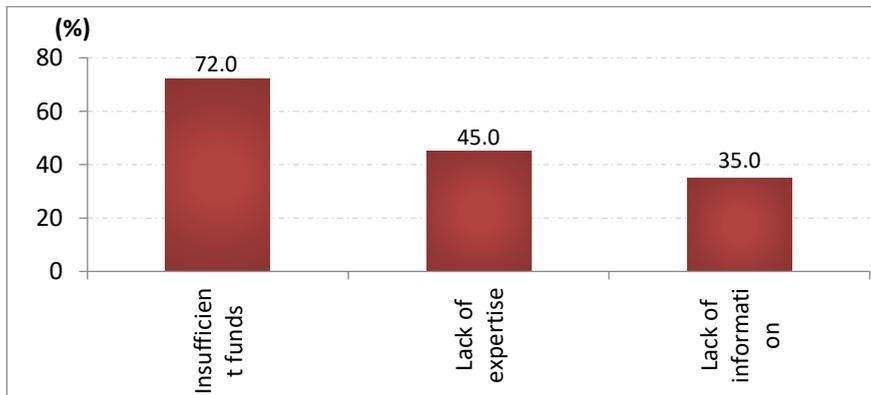


Figure 3: Three major obstacles in taking mitigation measures

From [Figure 3](#), it is evident that the main challenge faced by the MSME respondents in implementing measures to protect their businesses from natural hazards is the lack of funds. This obstacle was reported by 72 percent of the respondents, making it the most significant barrier. With limited financial resources, MSMEs may face difficulties in allocating their available resources towards comprehensive disaster preparedness strategies and business continuity planning (BCP). This can leave them more susceptible to the damages, losses, or disruptions caused by disasters. Equally significant, the MSME respondents seem to face challenges due to a lack of expertise and information, with values of 45 percent and 35 percent, respectively. These factors can hinder the ability of MSMEs to effectively prepare for disasters and implement desired mitigation measures. This can have a significant impact on the disaster preparedness strategies of MSME manufacturers.

Inadequate funding often poses a challenge for MSMEs when it comes to making investments in infrastructure upgrades, business continuity planning, employee training, emergency supplies, and insurance coverage. In addition, the limited expertise may hinder MSMEs' capacity to accurately evaluate risks, create efficient emergency strategies, allocate resources effectively, access technical resources and knowledge, and provide adequate training to employees. Moreover, the scarcity of information can hinder their ability to adopt optimal practices, comply with regulations, access support services, receive timely warnings, and establish effective channels for risk

communication, particularly in times of disasters. Hence, it is extremely crucial for MSME manufacturers to overcome these limitations and continually improve their disaster preparedness strategies or capabilities for enhancing the long-term business resiliency of MSMEs against the effect of any natural hazard in their localities, respectively.

CONCLUSION

This study examines a stratified random sampling of 100 MSME manufacturers in both Kedah and Penang states. The study aims to analyse the different mitigation measures implemented by MSME manufacturers to develop a disaster preparedness index for MSMEs. This index will then be used to measure the relationships between disaster preparedness levels and the characteristics of the owners and businesses of these manufacturers. Additionally, the factors that discourage MSME manufacturers from investing in protective measures for their businesses against future disasters are identified. One interesting finding from the study is that medium-sized manufacturers, specifically those with pre-existing business characteristics like legal ownership, tend to have higher levels of preparedness for disasters. This is in comparison to small-sized manufacturers in the Kedah and Penang states. It suggests that the size and legal structure of a business may play a role in its ability to bounce back from disasters.

Typically, the consequences of natural disasters can be quite significant for small and medium-sized manufacturers who do not have effective risk management strategies in place, unlike larger companies. Therefore, it is essential for MSME manufacturers who may be impacted by natural disasters to establish a sustainable working environment that can withstand such events. This will enable them to maintain critical operations and ensure the long-term resilience of their businesses. In addition, it is crucial to implement sustainable livelihood recovery strategies that prioritise the collective survival or recovery of local businesses and affected communities. Thus, in order to harness the potential of MSMEs as crucial drivers of local socio-economic recovery, it is essential to make sufficient investments and develop innovative solutions. These should not only address infrastructure restoration and financial support, but also be guided by a strong socio-economic policy framework.

In addition, the federal and state governments have important responsibilities in disaster preparedness and post-disaster recovery. They must ensure that the business environment remains stable, especially for affected MSMEs, so that they can develop effective strategies and make informed decisions during the recovery process. In addition, governments can encourage a wide range of collaborations and networking channels among MSMEs, industry associations, and other relevant stakeholders. Through the organisation of forums, conferences, and networking events, the exchange of valuable insights, knowledge, and resources pertaining to disaster preparedness can

be effectively facilitated. Through the exchange of information, MSMEs can enhance their disaster preparedness strategies and strengthen their collective resilience capabilities. In addition, governments can strengthen their collaborations with private sector entities, international organisations, and NGOs to implement comprehensive disaster preparedness initiatives. Through this approach, the collective knowledge, resources, and connections of MSME entities can be utilised to take advantage of training opportunities, technological access, funding options, and other forms of support. This will ultimately strengthen the long-term resilience of MSMEs.

In addition, governments and other organisations can create disaster risk financing programmes that provide local MSMEs with access to affordable or soft loans, grants, emergency funds, and financial incentives. The specific design of these programmes aims to bolster the long-term business resilience of MSMEs. Governments can allocate funds to invest in disaster preparedness strategies, such as insurance coverage, training programmes, infrastructure improvements and upgrades, and BCP. Besides that, governments can organise workshops, training sessions, and capacity-building programmes to educate and expose MSMEs to disaster preparedness strategies. These programmes cover a range of selective topics, including risk assessment, BCP, emergency response planning, and relevant regulatory compliance. MSMEs can enhance their knowledge and skills to effectively prepare for and respond to both current and future disasters in their local areas. The BCP guidelines for Japan were published in 2006 by the SME Agency. Support tools, such as appropriate methodologies, were provided to SMEs based on their enterprise level. These tools aimed to enhance private sector disaster reduction activities during the prevention/preparedness phase. In addition, the Japan Finance Corporation offers financial assistance, such as low-interest loans, to support small and medium-sized enterprises (SMEs) in acquiring disaster prevention tools that comply with the Business Continuity Planning (BCP) guidelines. During times of disasters, consultation services such as backup facilities, loans, tax subsidies, deduction programmes, and psychological clinics are provided to support small and medium-sized enterprises (SMEs) that have been affected locally.

Theoretical and Managerial Implications

This study employed qualitative methods to collect and analyse data in order to examine the mitigation measures implemented by MSME manufacturers for the development of the MSMEs' disaster preparedness index. The study's results support the existing literature. Furthermore, it enhances the existing literature. This study aims to examine the integration of awareness, resource availability, options availability, and individuals' perception into a comprehensive framework for disaster management preparation. This approach has been infrequently utilised in the past. This study addresses the lack of research in this particular area. The proposed framework strongly discusses the role of preparedness at different levels of the community including individuals, groups, NGOs,

governments and other stakeholders of the society. Therefore, discussion on their role is also key for there is also major contribution to the present body of literature. This study is conducted in two states of Malaysia. Most of the studies in past were conducted in context of European of developed countries. Therefore, this study also enhances the body of limited literature in this aspect.

By implementing those measures, the governments can significantly contribute to enhancing the long-term business resiliency of MSMEs. Thus, it is vital that the governments to prioritize in providing proper financial supports and resources to help local MSMEs enhance their disaster preparedness capabilities since they constitute as the backbone of a state's economy and play a primary role in the nation's overall economic recovery and stability.

LIMITATIONS AND FUTURE DIRECTIONS

Although the researchers of this study made an effort to address various aspects, there are still some limitations that need to be acknowledged. For this study, qualitative analysis was employed to collect and analyse data, with a moderate sample size. Future research can enhance the sample size in upcoming studies. For this study, a qualitative approach was utilised. For more comprehensive analysis of the data, it would be beneficial for future studies to consider utilising a mixed method approach. One tool that could be considered for this purpose is Smart PLS 4. This research will enhance the validity of the findings. In addition, a stratified sampling technique was employed in this study to ensure a representative sample of respondents. For greater generalizability of the results, it is advisable to consider utilising cluster-based sampling in the future.

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