Factors influencing flood disaster preparedness initiatives among small and medium enterprises located at flood-prone area

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ARTICLE INFO

ABSTRACT

This paper highlights the factors affecting SMEs flood disaster preparedness located in Segamat District of Malaysia. An interviewer-assisted survey using a set of flood disaster preparedness questionnaire (developed and validated by a team of disaster management experts from various background) were implemented among Small and Medium Enterprises (SMEs) business owners and managers (n = 253). The analysis of regression provided insights into the various factors affecting the contribution of small and medium-sized businesses towards flood preparedness activities. Findings demonstrated that risk perception is the most consistent factors in influencing preparedness actions. Besides that, previous experiences on floods, retails sectors and male ownership also contributed to a high level of flood disaster preparedness engagement. This research gave insight at why small and medium-sized businesses are involved in disaster preparedness activities which includes discussion from a review of previous findings.

1. Introduction

The study of disaster management and business organisation is becoming an increasingly popular field today. There have been numerous previous studies which explored the various aspects of disaster management and impact including the effect of implementing disaster preparedness activities. Tierney et al. [1] are amongst the earliest scholars who researched disaster preparedness involving firms in a chemical processing company. Drabek [2] conducted a study on the disaster preparedness of private business where the extent of evacuation planning involving 65 tourist firms included a written plan, property protection, staff training, exercise and drill, and employer commitment. Dahlhamer & Souza [3] further explored preparedness of private firms by comparing the preparedness of two business sample locations (Memphis and Des Moines) based on the previous earthquake disaster and Midwest Flood respectively. Tierney [4] also researched the Northridge Earthquake impact on businesses and identified earthquake preparedness measures that businesses had undertaken before the disaster. A more recent study was conducted by Sadiq [5], focusing on determining the effects of organisational size on preparedness actions.

The sudden impact of disaster does not only affect domestic activities (household and local community) but also pose a serious concern to commercial businesses which can include structural damage, interruption of utility services and an indirect cause of productivity loss (travel immobility of both customers and workers to the business premises) [4]. These impacts of disasters can be reduced through preparedness activities undertaken by organisations. Disaster preparedness comprises of activities designed to enhance the ability of businesses in undergoing emergency actions to protect properties, contain disaster damage and promote engagement of post-disaster restoration and early recovery [6]. The preparedness activities conducted by organisations are often influenced by several factors.

Terminologies such as "determinant "and "predictor" are used interchangeably amongst scholars. In disaster preparedness, these terms are used to describe factors that influence the preparedness activities. These preparedness factors are measured to explain their effects towards the preparedness level. Likewise, the preparedness level is often measured based on a list of activities conducted to mitigate disaster events. Preparedness activities (preparedness measure or preparedness action) are frequently associated with "anticipatory action," "hazard adjustment," or "mitigator" activities, referring to a set of activities performed for disaster preparation and mitigation.

The level of preparedness can be determined by the participation of business organisations in preparedness activities. The preparedness activities are composed of tangible and measurable actions that must be carried out in order to meet the preparedness objectives. Previous research quantified preparedness action using simple arithmetic addition of preparedness lists, but those methods did not discuss or assign weightage to the preparedness activities assuming each of the activities to be of similar scale. With the possibility of under- and over-estimation of some preparedness levels, this study intend to determine the weightage of preparedness activities in order to measure preparedness levels. Sadiq [5] exemplifies why preparedness activities (hazard adjustment) are weighted differently. He categorises preparedness activities into two categories: passive and active preparedness. Active preparedness activities are constructive steps taken by organisations to minimise the risk of environmental hazards, while passive preparedness activities are measures in which an organisation simply discusses possible actions.

1.1. Factors affecting disaster preparedness

Scholars have not straightforwardly discussed factors affecting preparedness activities of the organisation on disaster event. There are very few studies which focused on the organisational level as compared to studies on the individual, households and community level [7,8]. Nevertheless, the importance of organisational preparedness has been given due emphasis by few scholars where pioneering works involving organisational preparedness have been published as early as 1978 [1,9,10]. Factors affecting preparedness has become an increasing concern as it affects the commitment and engagement of an organisation in preparedness activities.

Few studies viewed preparedness activities as the hazard adjustment towards disaster risks [11,12]. Lindell & Perry [13] highlighted hazard adjustment as an action taken to lessen the impact of extreme events in the surrounding. Amongst the factors affecting preparedness activities as reported by previous scholars are annual sales turnover, business sector, business size (measured by the number of employees), ownership status of the business premise, availability of other branches (franchise), risk perception and previous experience on disasters.

In a study carried out to assess the factors influencing disaster preparedness activities, Dahlhamer & Souza [3] explored the determinants and variation of disaster planning comparing business population in Memphis/Shelby County, Tennessee (N = 737), and Des Moines/Polk County, Iowa (N = 1079) in the United States. Similarly, Han & Nigg [14] investigated 3075 business organisations in Santa Cruz County, United States that were affected by the Loma Prieta earthquake in 1989 whereas Howe [15] conducted a study in Sarasota County, Florida, United States on hurricane preparedness and risk perception. Additionally, Sadiq & Graham [7] also conducted a study on 2008 U S. workers to estimate the determinants of preparedness at the organisational level.

In this study, the factors affecting engagement in disaster preparedness activities which was identified based on previous studies and included were (1) hazard knowledge, (2) risk perception, (3) previous experience, business owner's or decision maker's characteristics (age, gender, and race); and (4) business organisation characteristics (annual income, age of business, sector, company's size and two-floor premise).

1.1.1. Hazard knowledge

Hazard knowledge promotes risk perception, which in turn promotes preparedness actions [15]. The knowledge of hazards studied by Howe [15] in hurricane preparedness centres on the information-seeking behaviour of the respondents. It was reported that web-based knowledge source on risk information has led to immersive engagement in preparedness activities. In another study, knowledge of disaster preparedness is also positively associated with pre-evacuation activities [16].

1.1.2. Risk perception

Risk perception is defined as the degree of risk or damage that an individual perceived as a result of hazard or disaster [16]. Risk perception of owners and decision-makers are generated by the perceived likelihood (severity and probability) of future disaster event [14]. Han & Nigg [14] measured risk perception in terms of the characteristics of the event hazard including probability and severity. The risk perception is revealed to be positively significant and consistently provide a positive effect in promoting engagement in preparedness activities. Focusing on the hurricane (and storm surge), Howe [15] who measured risk perception by summing up twelve items which represents the probability and severity of direct damages to business owner found that organisation that adopts higher risk perceptions are more likely to engage in extensive preparedness activities. Sadiq & Graham [7] also performed a similar study on risk perception; however, the authors were not able to find significant relationship between risk perception and disaster preparedness in their study.

1.1.3. Previous experience

Being directly or indirectly involved in a disaster has been associated with high engagement in preparedness activities as it force upon experience of dealing with the worst during disaster events on the affected individual or organization. The individual experience of dealing with disruption and damage actively stimulate the organisation to be better prepared for future events [4]. Several studies have also reported that having previous disaster experience influences the engagement in disaster preparedness action [3,17] especially when severe damage had caused a long period of recovery [4,17]. Similarly, a study on household experience also reported a significant positive association between previous experiences with preparedness planning on subsequent flood occurrences [18].

1.1.4. Business Owner's or Decision-Maker's characteristics

A study by Josephson, Schrank, & Marshall [17] on small business owners, found that owner characteristics influenced the level of disaster preparedness action. Similarly, a study by Mohammad-pajooh [18] on Kuala Lumpur household revealed that age and gender are positively correlated with disaster preparedness actions. From a business organisation perspective, Han and Nigg [14] alongside Howe [15] discovered that owner and decision-makers' characteristics have no significant influence on disaster preparedness actions.

1.1.5. Ownership status

Property ownership status is associated with an organisation's having a stable financial condition [3] and thus, is capable of taking extra precautionary steps against disaster. In this case, owners are not restricted in any way to invest in their facility as compared to renters who may be less motivated in doing so. An owner is more involved in preparedness action than those who lease business premises [3,14,15]. A study reported that owners tend to invest more in property protection especially in terms of construction (flood wall embankment), preparing emergency equipment, and also purchasing recovery insurance [18]. In the same aspect, Howe [15] also commented in his study it is potentially improbable that renters invest on structural adaptation to their rented business premise since occupying the business premise is only a temporary plan. In addition to that, the owner or landlord of the premise may also restrict and require further approval with extensive process for any significant structural change in the rental contract.

1.1.6. The business age (Years of operation)

The age of a company indicate the business maturity and stability. The longer the business has been operating, it is expected that the higher the engagement in disaster preparedness actions. Han & Nigg [14] reported that the age of the organisation does affect disaster preparedness action but in a weaker, negative association. Similarly, Tierney [4] found that newer businesses tend to increase their preparedness level

following the Northridge earthquake event as compared to an older company. Thus, contrary to the. Hypothesized expectation, the number of years a business has been in operation seems to be a weak predictor of disaster preparedness [15].

1.1.7. Sector differences

The disaster preparedness varies according to the sector as preparedness is associated with the specific needs and conditions of each sector. Early studies on disaster preparedness in the business sector showed that the financial, real estate, and insurance sectors are the most prepared for disaster [3,14]. Dahlhamer & Souza [3] revealed that business sectors such as finance, insurance, and real estate businesses were also significantly more engaged in conducting preparedness activities. Their findings are consistent with those of Han & Nigg [14] who found that financial firm, insurance, and real estate sectors are more engaged compared to wholesale or retail companies. Furthermore, sectors such as mining, agriculture, forestry, fishing, and communications also demonstrated significant participation in disaster preparedness. Howe [15] reported that service sectors engaged in fewer preparedness actions than economics, finance, insurance, and real estate businesses. However, Sadiq & Graham [7] found no association between sectors of business while Kreibich et al. [19] reported contradicting findings where different sectors demonstrated different levels of engagement in preparedness. The researchers found that the manufacturing and agricultural sectors show the highest engagement in preparedness activities while the financial sector showed the lowest preparedness level. Thus, evidence from previous research confirms that sector differences influence preparedness level through the policies and strategies implemented by sectors in each location.

1.1.8. Organisation size

The organisation's size can be measured by the number of employees or workers who work full time at the business premise [3,14]. Sadiq & Graham [7] highlighted that the organisation size can also be measured in terms of employer level or facility level. However, for small-scale business, the organisational size will only be more focus on facility-level when there are not more than two branches or franchises. Several scholars reported that organisational size greatly influences their engagement in disaster preparedness actions [4,7,9,14,15]. [5] conducted a direct comparison between small and large organisations and found that large organisation engage in preparedness activities better than small organisations since the larger company have better resources and can accommodate preparations better [15]. Moreover, the lack of staff in assigning preparedness activities is also a possible factor of low-level disaster preparedness in small organisations [3].

1.1.9. Franchise availability

The availability of business's franchise or branch in another location can be associated with high business resources. Thus, the ability to prepare for a disaster is considered less burdening for these companies. Franchise is also often instructed by the headquarters to engage in disaster preparedness [3]. However, only one study reported the availability of franchise in increasing disaster preparedness engagement [3] while most of the study reported that franchising does not contribute directly to disaster preparedness engagement [7,14,15].

The purpose of this study is to identify associated factors predicting disaster preparedness level among SMEs. Based on the factors discussed in the above, the following research questions were generated to investigate the various factors affecting disaster preparedness level of SMEs:

RQ 1. Do SMEs with high-risk perception, good hazard knowledge, and previous experience have correspondingly high levels of disaster preparedness?

RQ 2. Do SME business owner's characteristics such as age, gender, and race relate to the level of disaster preparedness?

RQ 3. Do various SME businesses' characteristics such as annual income, the age of the company, sector differences, availability of franchise relate to a high level of disaster preparedness?

2. Methodology

2.1. Research design

This study adopts a cross-sectional design in assessing preparedness level through preparedness activities focusing on floods cases among (small and medium) business organisations. By providing a "snapshot" of the business organisation and its preparedness activities at a specific point in time, an overall picture of SMEs preparedness level can be obtained by assessing demographic characteristics of the business, its owners' and decision-makers' attributes, and the current preparedness level implemented by SMEs.

2.2. Sampling strategy

This study employs a systematic random sampling technique. Using a list of SMEs provided by the Segamat District Office, a systematic random sampling was conducted. To begin, the list of SMEs provided were numbered sequentially. Then a SME was chosen at random. This was followed by systematically sampling the next SME at a repeating interval; which is every fourth of the SME in the list (obtained by dividing the total number of sample population with calculated sample size required).

2.3. Sample location/population

The study was conducted in the Segamat Town of Johor in the Southern part of Peninsular Malaysia (as illustrated in Fig. 1). The Segamat town is a business centre and is situated near the Segamat River, a high-risk flood area. The unit of analysis in this study is the SME located in this flood-prone town where recurring floods was known to submerge the surrounding areas. Approximately about 1600 SMEs in Segamat Town have been affected by the recent floods in year 2017 conceded by the local district's office. Questionnaires were directly administered to business owner's and manager's available in the premise during data collection from July 2018 until December 2018. The study's target sample size was determined to be 384 samples, and approximately 337 SMEs participated in the study. Due to additional data screening and deletion by the Rasch model, the total number of SMEs participating in this study has been reduced to only 253.
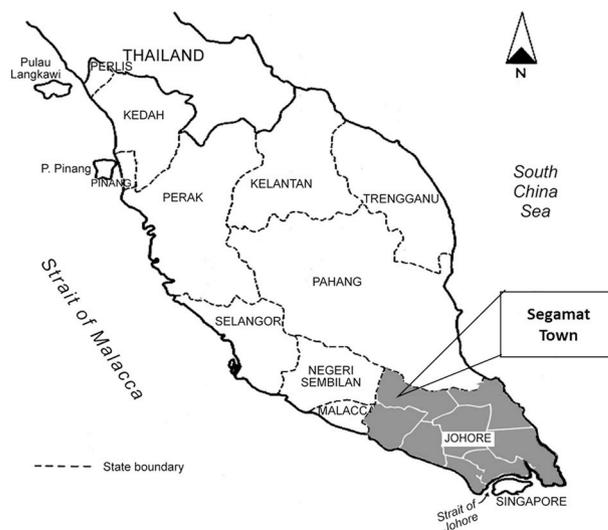
Fig. 1. Maps of the study area-Segamat Town.

The SMEs in Segamat District can be primarily classified into two categories; manufacturing sectors as well as services and other sectors (as illustrated in Fig. 2). However, this study only included services and other sectors as they are more densely populated in the study area while there were only few manufacturing SME besides the fact that the nature of disaster preparedness for manufacturing industries are relatively different compared to services and other sectors. Services sectors includes Medium-sized enterprises are defined as companies with sales revenues ranging from RM3 million to RM20 million, or with 30–75 full-time employees. A small sized enterprise, on the other hand, is defined as a company with a sales turnover of RM300,000 to RM3 million or 5 to 30 full-time employees. Finally, a micro-sized enterprise is one that has less than RM300 million in sales or fewer than 5 employees. In Malaysia, SMEs made up 97.3% of all registered businesses (approximately 645,136) [20].

2.4. Instrumentation

The primary instrument used in this research is a set of a validated questionnaire. The questionnaire was validated in a focus group discussion with eight (8) experts in the field of disaster management and representatives from SMEs, as listed below:

   i. Non-Governmental Organisations (Malaysian Red Crescent Society)
  ii. National Disaster Management Agency (NaDMA)
 iii. Malaysia Civil Defense Force (APM)
 iv. SME Corporation Malaysia
  v. Fire and Rescue Department of Malaysia (BOMBA)
 vi. Department of Occupational Safety and Health (DOSH), Malaysia
vii. Others (Academician and industry representative)

The questionnaire contains items on the following topics: (1) business owner's or decision maker's characteristics (age, gender, and race), (2) business characteristics (annual income, age of business, sector, company's size and two-floor premise), (3) hazard knowledge, (4) risk perception, (5) previous disaster experience and a (6) 37-item scale of disaster preparedness actions.

The business characteristics include the measure of annual business turnover (categorized as micro, small and medium) defined by the SMEs definition, business sector, ownership status of the premise, and business size based on the number of full-time employees, and the foundation years in determining the age of the business (Table 1).

In determining the hazard knowledge of the respondents, several

Table 1
Business characteristics of organisations.

Please select your company in the following category
1. Yearly turnover: less than RM 300,000, RM 300,000 to less than 2 million or RM 3 million to less than RM 20 million
2. The sector of industries: Retail & wholesale, Services or Others
3. Years of foundation: < 5 years, 5–10 years, > 10 years
4. Number of full-time employees: Less than 5, 5 to 19, 20 to 30, 50 to 99, 100 to 300 staff
5. Ownership Status: Own or rent a business premise

questions were modified from previous studies to determine their perceived knowledge on flood hazards that may impact SMEs in that area and the impact on SMEs itself (Table 2).

Risk perception involves measuring respondents' perception of risk (Table 3) and is sometimes investigated alongside the previous experience. It demonstrates the perceived risk of a flood happening, and the precautionary action organisations will take based on their belief of the flood assumption. In this study, the risk perception demonstrates the probability and magnitude of damage and feelings of anxiety about the damage that can result from floods. The possibility of damage, future flood prediction, and magnitude of the flood impact was solicited using a five-pointing rating scale with the probability rating of (1) very unlikely to (5) very likely.

Previous experience was measured using the indication of any previous experience of dealing with a flood (Table 4). There were two categories of flood experience administered in this study, which were (1) experience of flood in the business premise; and (2) experience of flood at a household level. The inclusion of household-level experience was to examine whether the experience and impacts of the flood at a household level potentially influence the engagement in preparedness actions. The option for the questions was either a (1) "yes" for having previous experience or (2) "no" for never experiencing a flood event. The choice

Table 2
Hazard knowledge on flood events (3 items).

| With regards to flood events, do you or someone else in your company … |
| --- |
| 1. Know the risk of natural disasters (floods, landslides, etc.) on your business premises? |
| 2. Understand the situation categorized as a hazard arising from the occurrence of natural disasters such as floods? |
| 3. Recognize if evacuation (moving) preparation needs to be done when floodwater starts to rise? |
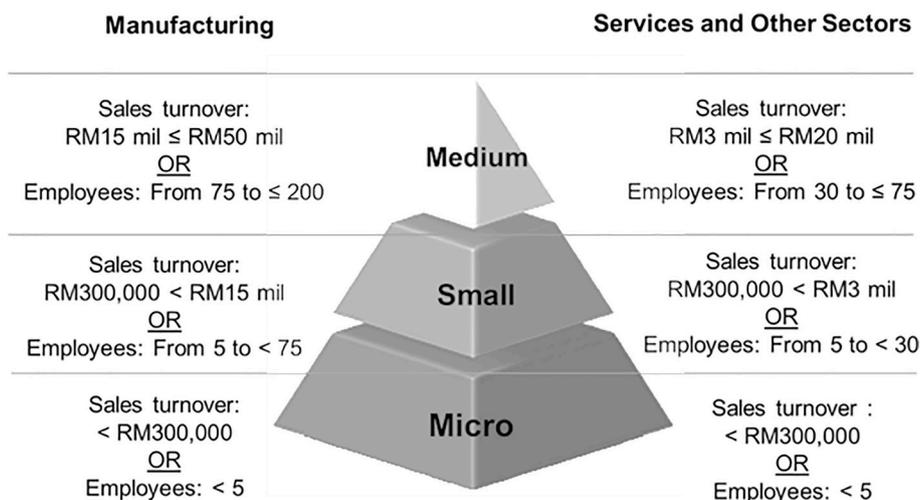
Fig. 2. SME definition based on categories.
Source [20].

Table 3
The probability of perceived damage that may occur (6 items).

In your opinion, is it possible that floods will cause …
1. Damage to your property or business operations?
2. Your on-premises assets (such as furniture, machinery, appliances, etc.) to be badly damaged or destroyed?
3. Your business premise (building structure) to be severely damaged or destroyed?
4. Supplies (electricity, telephone, water, etc.) to be interrupted?
5. You or some of your employee to be hurt (wounded or lost)?
6. A possibility that you or your employee may encounter a fatal accident?

Table 4
Flood disaster experience (3 items).

Please choose the answer for the following statements about your experience with flood
1. Have your company experienced a flood case before?
2. How frequent has flood occurred in your business premise?
3. Have you experienced a flood at home?

of frequency of flood experience intensity provided were (1) 1–2 times flood cases, (2) 3 to 5 times flood cases, and (3) more than five-time flood cases.

The dependent variable consolidated in this study was the flood preparedness level determined by a list of preparedness activities engaged by SMEs. In total, a set of 37-item instrument was finalized for data collection. The 37-item of preparedness activities encompassed a range of actions including evacuation planning, emergency communication, management coordination on flood event, efforts in physical structure modification of the business premise to increase flood-resistant, availability of emergency supply, backup, and sheltering plan. These activities were assigned with a different value of preparedness score (weightage) to distinguish between activities that require more effort and resources and those that less. Conducting additional activities, like restructuring a business premise or preparing an emergency supply, and less resources-intensive activities, such as informing employees on how to request immediate assistance, will be weighted differently in order to quantify their relative importance.

A preparedness score is a numerical value used to categorise the degree of difficulty associated with preparedness activities. The preparedness index is calculated by adding together the preparedness activities to determine the preparedness level of each SME. In this analysis, the Rasch model is used to calculate the score for preparedness activities (dependent variables), which has the effect of assigning an index score to each preparedness activity. The degree of difficulty associated with each preparedness activity will be determined by the index score assigned to it, which will range from easiest to most difficult to complete. In this paper, the preparedness score was converted to a ranked preparedness index. The activities were then aggregated to determine each SME's degree of preparedness (preparedness level). SMEs that score highly on preparedness are more likely to engage in additional activities than those that score poorly on preparedness. To summarise, organisations that have stronger disaster preparedness capabilities are more likely to adopt or carry out all types of disaster preparedness activities. Meanwhile, an organisation that is not prepared for disasters will struggle to participate in the majority of disaster-prevention programmes.

2.5. Data analysis

The socio-demographic data of the business and owners were analysed based on the aspects of descriptive analysis. Subsequently, the correlation test between flood preparedness level with risk perception, hazard knowledge, and socio-demographic characteristics were also conducted. The score of preparedness activities (perform by Rasch model) is then converted to the index value for comparison.

Subsequently, a multivariate analysis (multiple regression) was conducted to analyse how preparedness activities (treated as a dependent variable) is related to business and owner's characteristics, risk perception, hazard knowledge and previous experience. A total of 11 independent variables were tested against the dependent variable (preparedness level) using the Multiple Linear Regression method.

3. Result

3.1. Socio-demographic characteristics

A total of 253 respondents completed the survey as shown in Table 5. The age of the respondents ranges from 21 to 88 years where the mean ($\pm$SD) age of the respondents was 38.87 ($\pm$15.63). There were 146 (57.7%) male and 107 (42.3%) female respondents where there were 141 Malay respondents (55.7%), 104 Chinese respondents (41.1%), and 8 (3.2%) Indian respondents.

The mean ($\pm$SD) number for years of the business establishment was 13.13 ($\pm$16.14). The ownership status refers to the person who owns the business premise and represents 53 (20.9%) respondents while business owners who rented premises were about 200 (79.1%) respondents. The annual income comprised of the Micro-level (less than RM 300, 00.00) which was about 192 (75.9%) respondents, Small (RM 300, 00.00 - < RM 15 million) about 48 (19.0%) respondents and Medium (RM3 million – RM 20 million) about 13 (5.1%) respondents.

There are two major sectors covered in this survey, namely, (1) retail and wholesale which representing about 107 (42.3%) SMEs (major sector), and (2) services representing about 130 (51.4%) SMEs. Other sectors, such as construction, agriculture, and transportation are labelled as others (16 SMEs, 6.3%). The size of the company is determined by the number of staff. In the current study, there are 199 (78.7%)

Table 5
Demographic characteristics of the business owner's and SMEs.

Demographics parameters	N = 253	(%)
Age		
<30	115	34.1
31 to 49	153	45.4
>50	69	20.5
Gender		
Male	146	57.7
Female	107	42.3
Ethnicity		
Malay	141	55.7
Chinese	104	41.1
Indian	8	3.2
Ownership status		
Owns the premise	53	20.9
Rents the premise	200	79.1
Annual income (per year)		
Micro (less than RM 300,00.00)	192	75.9
Small (RM 300,00.00 - < RM 15 million)	48	19.0
Medium (RM3 million – RM 20 million)	13	5.1
Sectors		
Retail & wholesale	107	42.3
Services	130	51.4
Others	16	6.3
Years of establishment		
<5 years	61	24.1
5–10 years	93	36.8
>10 years	94	37.2
Number of employees		
<5 staff	199	78.7
5- 19 staff	50	19.8
20-30 staff	4	1.6
Availability of franchise		
Yes	51	20.2
No	202	79.8
Availability of upper floor in premises		
Yes	44	17.4
No	209	82.6

companies with employees of less than 5 staff, 50 (19.8.1%) companies with 5–19 staff, and 4 (16%) companies with 20–30 staff. Indicators of business premises with extra benefits of designated storage for their goods and facilities are measured by the availability of franchise and the availability of the second floor on the premise. SMEs that own another franchise or business premises in a different location is recorded at 51 (20.2%) while about 44 (17.4%) companies have an upper floor or 2-story business premise.

3.2. Preparedness index score (dependent variable)

Table 6 presents the index rank of preparedness action by the SMEs/respondents involved in this study. The Rasch model was used to calculate the index score, which assigns a different value or weightage to each individual preparedness item ([21]. This index score was then ranked from the most frequently performed activities (ranked as 1) to the least frequently performed activities (ranked as 37). The score of preparedness levels of SME will be computed based on this preparedness

Table 6
The index rank of 37-item scale on Flood Disaster Preparedness Actions.

Preparedness Actions	Index Rank
Informed how to request for immediate assistance	1
Provide first aid box	2
Informed employee methods of establishing contact with another employee	3
Established a system for business communication in case of emergency	4
Determined steps for safe removal of people and safe shutdown of the process	5
Backup all important documents (Hardcopy or electronic form)	6
Made arrangement to move the business/inventory to another location during flood	7
Established method to determine who is in the facility when flood warning is issued	8
Identified places to relocate of employees	9
Seeking information from newspaper, radio, television and other communication media	10
Purchase optional flood insurance	11
Taken precaution against data loss	12
Electrical, plumbing, and ventilation/air conditioning equipment are installed above flood elevation	13
Provide first aid training to employees	14
Seeking information and written brochures from government agencies	15
Clean drainage and waterway to promote water flow during heavy rain	16
Identified emergency transportation for employees	17
Training for survival in disaster event/emergency	18
Prepared power generator backup in case of power shutdown/electrical failure	19
Influence employee to have a disaster plan at home	20
Undertaken flood emergency drill/exercise	21
Provide written flood disaster plan	22
Provide training on flood to employees	23
Prepared where to relocate an employee in business premise during flood case	24
Prepared provision if employees are forced to remain at the business premise	25
Provide education kit to employees on their role during disaster	26
Have had engineer or other qualified personnel to assess the structural safety	27
Raise the premise elevation to prevent floodwater from entering	28
Provide a waterproof bag for keeping documents or important inventory	29
Brace shelves or heavy object that might move during a flood	30
Provide education kit to employees on their role during disaster	31
Prepared "Disaster supply kit" (stored extra canned food, water, batteries, torchlight)	32
Establish a special management committee on disaster management	33
Ensure employees attended a meeting or received written information on flood preparedness	34
Construct barriers (embankment, beams, floodwalls) to stop floodwater from entering the building	35
Provide sandbag to stop floodwater from entering the premise	36
Provide emergency boat	37

score index (index rank) of each activity. The most frequent undertaken measure is informing employee on how to request for immediate actions (1), followed by the provision of first aid kit in business premises (2) and informing employee on how to make contact with another employee (3). The least conducted activities were the provision of an emergency boat (37) and the provision of sandbag to stop floodwater from entering the premise (36) [21].

3.3. Factors affecting preparedness levels of SMEs

The simple linear regression was conducted to investigate the relationship between flood preparedness levels and the factors affecting preparedness. The results revealed that risk perception is a significant factor in influencing a high preparedness level ($p < 0.001$) while the other factors do not demonstrate any significant relationship in a simple linear analysis.

The multiple regression model of predicting factors that influence preparedness actions is presented in Table 7. The table represent the value of unstandardized beta (*B*), standard error (*SE*), the standardized beta (*β*), the *t*-test statistic (*t*), the probability value (*p*) and the Tolerance and Variation inflation factor (VIF) values. The model explains about 27% of the variance in the preparedness level of flood disaster amongst SMEs. Further diagnostics analysis was also run to confirm whether the regression model meets all the regression assumptions. Based on the observed Tolerance and VIF, there is no evidence of multicollinearity among the independent variable Multicollinearity is a concern when the value of the VIF is above 10, with a tolerance value greater than 0.10, as recommended by Hair et al. (2010). The presence of independence error, Durbin Watson test (1.25), where a value closer to 2.0 indicates congruency to the assumption was also not identified. The examination of the residual scatterplot also meets the assumption of linearity and homoscedasticity.

Four factors were identified as a significant predictor of SMEs engagement on disaster preparedness. The most consistent factor is risk perception ($p < 0.05$) which denoted a significant positive score, indicating that a high-risk perception towards flood events raised the engagement of SMEs in business preparedness activities. Similarly, previous experience of flood in premises was also reported as a significant predictor of disaster preparedness ($p < 0.05$). Premises with experience in flood engage less in disaster preparedness activities than premises that have not to experience flooding. The owners and decision maker's characteristics that were positively significant associated with disaster preparedness activities is gender ($p < 0.05$) where male owners showed higher engagement compared to female owners. Furthermore, sector difference is also associated with the disaster preparedness level of SMEs. While other variables are controlled, the retail sector ($p < 0.05$) is a positive significant predictor of SMEs' engagement in disaster preparedness as compared to service sectors.

4. Discussion

The findings from this regression analysis enabled the comparison between factors that influence business to engage in disaster preparedness activities. Previous literature reported various factors that affect disaster preparedness engagement [4,5,7,9,14,15,17]. The inconsistencies observed in the outcome were due to various reason, such as the sample variance (unit of analysis) and the types of disasters. To some extent, findings were idiosyncratic to researchers or professionals, depending on the extent of coverage required and allowed [22].

Risk perception was confirmed to be a strong predictor of SMEs preparedness engagement in this study. Business owners and decision-makers who believe that flooding leads to risk of damages (in terms of products and/or equipment, furnitures and tools) showed a positive association with the preparedness level. The findings of this study were consistent with Han & Nigg [14] who studied business decision-makers' characteristics on the 1989 Loma Prieta Earthquake.

Table 7
The result of Multiple Linear Regression between Factors and Preparedness Level.

Factors	B	SE	β	t	P	Tolerance	VIF
Constant	0.385	0.497		0.774	0.440		
Hazard knowledge	0.007	0.034	0.12	0.195	0.845	0.830	1.200
Risk perception	0.131	0.015	0.675	8.662	**<0.001	0.512	1.952
Previous experience (premise)	−0.045	0.126	−0.297	−3.577	**<0.001	0.452	2.213
Previous experience (home)	−0.056	0.119	−0.035	−0.472	0.637	0.557	1.796
Ownership	−0.085	0.117	−0.47	−0.732	0.465	0.760	1.316
Age							
<5 years	0.051	0.113	0.030	0.453	0.651	0.730	1.370
5–10 years	0.149	0.100	0.097	1.489	0.138	0.731	1.367
Sector							
Retail	0.380	0.189	0.253	2.008	*0.046	0.196	5.106
Services	0.230	0.182	0.155	1.264	0.208	0.207	4.831
Size							
Small	.007	.234	.004	.029	.977	0.171	5.847
Medium	-.165	.230	-.087	-.719	.473	0.210	4.757
Upper floor	−0.220	0.127	−0.113	−1.741	0.083		
Gender							
Male	0.186	0.090	0.124	2.077	*0.039		
Ethnicity							
Malay	−0.133	0.248	−0.089	−0.536	0.593		
Chinese	0.016	0.247	0.011	0.065	0.949		
F = 4.834		R = 0.521		Adj. R² = 0.215			
sig –F = 0.00		R² = 0.271		f² = 0.27			

*sig-p <0.05.
**sig-p <0.001.

Similarly, previous experience of flood cases in business premises was also a strong predictor associated with high engagement in disaster preparedness. However, this reported a negative association where business premises that have experience flood tends to have low-level of flood preparedness which was similarly found in previous studies [15]. The negative association in this study was perhaps anchored on the personal experience of the past flood disaster event; i.e.: their previous experiences which observed potentially insignificant damages or effect. With the increased frequency of low impact flood disaster experienced in flood-prone location, business owners may become complacent, relaxed or even indifferent due to the desensitization of repeated exposure to flood. This fatalistic mindset contributes to a lower degree of preparedness for those residing in more vulnerable regions [15].

Different sector may have different financial resources and capability. For example, finance, real estate, and insurance sectors were found to be more prepared in disaster preparedness actions [3,14]. However, the current study focuses on small-scale businesses where only retail and wholesale alongside service sector was accounted for. The retail and wholesale sector were a statistically significant predictor on disaster preparedness engagement when other variables are controlled.

On the other hand, the role of gender was also reported to influence engagement in disaster preparedness. Male was associated with significantly more positive engagement in disaster preparedness activities. These findings contradict with Josephson et al. [17], who found female ownerships tend to have higher preparedness in disaster prevention.

Although hazard knowledge acts as an indicator for an individual to detect dangerous situation and initiation of preparedness activities, findings showed that this variable was a weak predictor in preparedness engagement. This finding contradicts with a study conducted by Sherman et al. [16]; where knowledge stimulates the respondent to evacuate while Howe's [15] found that web-based knowledge-seeking behaviour was more likely to prompt preparedness action than those who depend on other sources.

The ownership status of the business premise is an insignificant predictor in this study which is incongruent with previous studies [9, 15], where ownership rather than rental status was more likely to cause the owner to be engaged in preparedness activities. In this study, the results revealed that the age of business was also not directly associated with the preparedness level. In terms of business size, the number of full-time employees acts as an indicator where a larger resources company is usually associated with a high level of preparedness. In this study, about 75.9% of business operated with less than five employees, thus, the regression analysis failed to confirm the association between company size and preparedness level.

5. Conclusion

SME businesses that are most likely to have better engagement in flood disaster preparedness are business owners and decision-makers with high-risk perceptions and male ownership since fatalistic attitude leads to less engagement in preparedness. The retail and wholesale sector engaged in more preparedness measure as compared to the services sector where risk perception is the most consistent predictor of flood preparedness among SMEs. This study provides insights into the local factors that influence disaster preparedness which can benefit relevant parties in enhancing flood preparedness by training SMEs with disaster preparedness knowledge to increase the risk perceptions.

The reason why the SME did not participate in preparedness activities was also not adequately addressed in this study. Renters, for example, will not participate in business premises modification because the owner may have limited permission. The same is true for activities such as providing an emergency boat, which may be limited if the business premises do not have enough storage space.

The level of preparedness of small businesses is determined by their commitment to several preparedness activities. The impact of these preparedness activities on disaster readiness in disaster event, on the other hand, is still unknown. More research is needed to determine the significance impact of each of the activities in SME preparedness. Future research could look into whether the most commonly practised preparedness activities are effective and sufficient in assisting organisations in reducing the effects of natural hazards.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgement

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