



Original paper

That is Not My House? Household Renters' Flood Preparedness Intention in The East Coast Region of Malaysia

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Abstract By integrating the Theory of Planned Behavior (TPB) and the Health Belief Model (HBM), this study examines factors influencing flood preparedness intention among household renters in the East Coast Region of Malaysia. The study utilized purposive sampling, involving the collection of data from 150 household renters residing in the East Coast Region of Malaysia through an online survey. The collected data were then analyzed using Structural Equation Modeling (SEM) with Smart Partial Least Squares (SmartPLS). The results revealed that past experience (PE) was positively associated with both perceived severity (SEV) and susceptibility (SUC). However, both SEV and SUC were not correlated with attitude (ATT). Among the three determinants originating from TPB, only ATT was found to be correlated with flood preparedness intention (INT). It is worthy to notify that trust in public protection (TPP) played a moderating effect on the relationship between ATT and INT. The findings will offer valuable insights for policymakers, renters, landlords, and community organizations to develop targeted interventions and bolster flood preparedness among household renters in the East Coast region, ultimately fostering resilience and mitigating the impact of future flood events. Besides that, this study provides firsthand information on the predictors of flood preparedness behavior among household renters in the East Coast Region, Peninsular Malaysia.

Keywords: Disaster Risk Reduction, Flood Preparedness Intention, Renters, Flood

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1. INTRODUCTION

Climate change is widely recognized as a primary factor driving the escalation in both the frequency and severity of flooding incidents across the globe. Flood has been recognized as the most common and damaging natural disaster in several parts of the world (Zeleňáková *et al.* 2019; McGrath *et al.* 2019). Amongst the Association of Southeast Asian Nations (ASEAN) member states, Malaysia is considered to have the highest percentage of the population that is exposed to flooding (Martin 2019). The hardest hit areas are those located along the east coast of peninsular Malaysia, in the state of Kelantan, Terengganu, and Pahang (Hashim *et al.* 2019; Nor Diana *et al.* 2019). The increasing number and impact of disasters have created a greater need to reevaluate and find more effective ways to be prepared and respond to these events (Kirschenbaum *et al.* 2023).

Addressing the challenges posed by climate change-induced flooding requires a multi-faceted approach, especially flood preparedness. Disaster risk reduction is a fundamental component of social and economic development, primarily to ensure future development sustainability. Since the effects of climate change are so severe, there is a need for all countries to embrace the disaster risk reduction approach to reduce the adverse effects of climate change. Han *et al.* (2017) and Lindell (2013) revealed that disaster preparedness is an effective strategy to reduce the effects of disasters. Specifically, flood disaster preparedness has been highlighted as an effective way to manage flood disaster risk (Yin *et al.* 2021).

However, flood disaster preparedness among citizens seldom receives attention, and necessary intervention must be taken to prevent the problem (Tariq *et al.* 2021). Although flood occurs frequently and is the most severe of all disasters in Malaysia, citizens' preparedness to face flood is still low (Mohammed Nawi *et al.* 2021). Past studies had carried out the studies on flood preparedness but in different settings and subjects such as community (Noor Diyana *et al.* 2020) and Small and Medium Enterprises (SMEs) (Hashim *et al.* 2021). However, studies on flood preparedness intention among renters are relatively limited, and several potential research gaps can be explored in this area. The connection between owning a home and susceptibility to flood has been documented in studies, revealing that renters are more vulnerable to disasters compared to homeowners (Ma and Smith, 2020). Schuessler *et al.* (2023) argue that renters faced difficulties in receiving assistance because of informal leasing arrangements, which hindered their ability to provide evidence of their residence. Costa *et al.* (2022) emphasized that renters behave similarly to uninsured homeowners. Numerous research studies have demonstrated that homeowners, as opposed to those who rent, exhibit greater preparedness and responsibility toward safeguarding their homes (Baker 2011; Najafi *et al.* 2015; Mulilis *et al.* 2000).

Renters face challenges in terms of preparedness compared to homeowners due to factors such as frequent relocation, limited access to public health education, and fewer financial resources to invest in mitigation efforts (National Academies of Sciences, Engineering, and Medicine 2020). Those who lack the means to afford alternative accommodations often find themselves residing in damaged, unsafe, uncomfortable, and unhealthy living conditions (Duvat *et al.* 2021; Taheri Tafti and Tomlinson 2021). There is substantial evidence highlighting the unequal effects of disasters on renters (Fussell and Harris 2014), who are predominantly lower-income individuals spending a significant portion of their income on housing expenses (Desmond 2018). According to Howe (2011), it is unlikely for renters to invest in structural adjustments to their rented properties since their occupancy is typically

temporary. These disparities between homeowners and renters can significantly impact their capacity to anticipate, prepare for, respond to, and recover from disasters (Lee and Van Zandt 2019). Therefore, this research aims to investigate the factors that impact the intention of flood preparedness among household renters in the East Coast region of Malaysia. By addressing this knowledge gap, we can gain a better understanding of the factors influencing flood preparedness intention among renters. The findings of this study can provide valuable insights for the development of targeted interventions, policies, and educational campaigns aimed at promoting flood resilience within rental communities.

2. THEORETICAL RESEARCH FRAMEWORK

The Theory of Planned Behavior (TPB) (Myers and Goodwin 2012; Masser *et al.* 2012) and the Health Belief Model (HBM) (Reams *et al.* 2013; Semenza *et al.* 2011) are two commonly utilized theories for predicting intention and behavior. According to Najafi *et al.* (2017), TPB and HBM have demonstrated efficacy in forecasting disaster preparedness behavior, specifically in relation to flood disasters. TPB posits that the relationship between individuals' attitudes (ATT) towards preparedness, their subjective norms (SN), and their perceived behavioral control (PBC) over the adoption of preparedness measures can be used to predict their intention to engage in disaster preparedness activities (Paton 2019). Dooley *et al.* (1992) utilized HBM to investigate the impact of individuals' perceived susceptibility to threat (SUC) and their assessment of the severity of the threat (SEV) on an individual's level of disaster preparedness. Hence, the primary objective of this research was to investigate the factors that influence the intention of flood preparedness among individuals who rent houses in the East Coast Region of Malaysia. This was achieved by integrating the extended Theory of Planned Behavior and Health Belief Model. The study utilized Smart PLS-SEM to examine various factors, including past experience (PE), perceived susceptibility (SUC), perceived severity (SEV), attitude (ATT), subjective norms (SN), perceived behavior control (PBC), trust in public protection (TPP), and flood preparedness intention (INT).

Individuals' encounter with floods shape their instincts and reinforce their adaptability in flood mitigation (Burke and Lobell 2010; Gómez-Baggethun *et al.* 2012). According to Kuhlicke *et al.* (2020a), households that have experienced flooding tend to enhance their resilience, particularly regarding the protection of tangible possessions such as cars, radios, and televisions. Moreover, individuals residing in flood-prone and low-lying areas without proper warning systems and awareness are more susceptible to the destructive impacts of floods (WHO 2020). Past experiences (PE) during disasters motivate individuals to consider adaptive behaviors, acknowledging the potentially severe consequences of flooding, which can significantly affect their livelihoods and the lives of others (Kuhlicke *et al.* 2020a; Kuhlicke *et al.* 2020b). Kurata *et al.* (2022) discovered that experiences with typhoon-related flooding had a direct and significant influence on perceived severity (SEV). Various factors, including personal experiences with natural disasters, level of alertness, and preparedness, contribute to individuals' belief in the likelihood of severe consequences during flood events and were identified as significant contributing factors to perceived severity. Based on these observations, we hypothesize the following:

Hypothesis 1. (H1). There is a positive relationship between PE and SEV

Hypothesis 2. (H2). There is a positive relationship between PE and SUC

The consideration of flood risk perception in flood risk management is consistently highlighted as an important aspect of the social context (Renn 2009; Brown and Damery 2002). This is crucial because it influences the attitude of residents living in flood-prone areas when they encounter a flood event. Risk perception refers to the assessment of both the perceived likelihood of a hazard and the perceived probability of its outcomes, often focusing on negative consequences (Lechowska 2018). Previous studies on natural hazards have long recognized the relationship between risk perception (including perceived severity and susceptibility) and attitude (Marti *et al.* 2018). When individuals are provided with risk information regarding the severity of the threat, their perceived vulnerability, and their ability to minimize the risk, they are motivated to take measures to protect themselves from the perceived health threat (Westcott *et al.* 2017; Tang and Feng 2018). During natural disasters, having detailed and reliable information becomes crucial. In times of flooding, affected individuals heavily rely on the community's disaster response and the government's support in terms of relief, rescue operations, and resources for rehabilitation due to their authority (Madhuri Tewari *et al.* 2015). Kurata *et al.* (2022) discovered that the latent variable of perceived vulnerability has a significant direct and indirect impact on individuals' attitudes toward behavior. Additionally, they found that perceived severity also significantly influences individuals' attitudes toward behavior. The findings indicate that people's behavioral perspective regarding flood disasters is influenced by factors such as the potential impact on their livelihood, the financial burden of rebuilding assets, and the worst-case scenario of loss of life (Kurata *et al.* 2022). Based on these observations, we hypothesized the following:

Hypothesis 3. (H3). There is a positive relationship between SEV and ATT

Hypothesis 4. (H4). There is a positive relationship between SUC and ATT

Subjective norm refers to the social factor that exerts pressure on an individual, leading them to either approve or disapprove of engaging in a particular behavior, based on the beliefs of others (Asare and Heights 2015; LaMorte 2019). In behavior theory, various norms have been identified to explain behavior and play a role in behavior change. Social norms are often seen as potential influencers by many social psychologists. The perception of risk, to some extent, may not directly originate from the risk itself but can indirectly shape individuals' adoption of adaptive behaviors or protective actions through the influence of social norms (Lo 2013). McIvor and Paton (2007) highlighted the significant relationship between subjective norms and disaster preparedness, as individuals are more inclined to engage in preparatory actions when facing an earthquake. However, it is argued that subjective norm is considered a weak indicator of behavioral intentions due to the influence of individual preferences and social factors (Prasetyo *et al.* 2020; Armitage and Conner 2001). The indicators of subjective norm highlight that people's actions in the community contribute to establishing a pattern that sets an example for and enhances their response to flood disasters, as well as the development of government policies related to disaster risk reduction (Kurata *et al.* 2022). Individuals who are more vulnerable to flood disasters and are familiar with the flood warning systems implemented in their community experience less stress and anxiety in ensuring the safety of their families from the harmful effects of flooding, owing to the knowledge shared within the community, similar to the findings of Kusumastuti *et al.* (2021). This is evident through the significant direct impact of subjective norms on perceived behavioral control (Kurata *et al.* 2022). Based on these observations, we hypothesized the following:

Hypothesis 5. (H5). There is a positive relationship between SN and ATT

Hypothesis 6. (H6). There is a positive relationship between SN and PBC

Hypothesis 7. (H7). There is a positive relationship between SN and INT

Attitude toward behavior refers to the extent to which a person evaluates a behavioral interest as favorable or unfavorable, considering its potential outcomes (Ajzen 2012; LaMorte 2019). It can be described as an individual's positive or negative evaluative response toward a person or thing, typically rooted in their beliefs and expressed through their feelings or behavioral tendencies (Eagly and Chaiken 2005). It involves the assumption that engaging in the desired behavior will lead to beneficial outcomes (USAID 2017). Asare and Heights (2015) conducted a study in which over 80% of the participants demonstrated a significant link between an individual's positive attitude and their behavioral intention to follow through with the behavior

Hypothesis 8. (H8). There is a positive relationship between ATT and INT

Perceived behavioral control refers to an individual's perception of their ability to perform a specific behavior, considering its level of ease or difficulty (Asare and Heights 2015; Ajzen 2012; Demirel 2018). It can vary depending on specific conditions and activities (LaMorte 2019). In the Theory of Planned Behavior, perceived behavioral control is a key element that distinguishes it from the Theory of Reasoned Action (Ajzen 2012). Currently, perceived behavioral control is associated with self-efficacy, which involves decision-making based on situational factors (Ajzen 2012; Bandura 1982; Mimiaga *et al.* 2009). In the study conducted by Kurata *et al.* (2022), it was found that perceived behavioral control had a significant impact on the intention to follow through with a behavior. Indicators such as knowledge and previous experiences in implementing preventive measures played a substantial role in influencing individuals' intentions to comply with regulations in disaster response. Individuals who have experienced flood disasters have a heightened awareness of hazards and apply the knowledge they have gained from those experiences to prevent future occurrences (Mondino *et al.* 2020). Based on these observations, we hypothesized the following:

Hypothesis 9. (H9). There is a positive relationship between PBC and INT

Attitude is a widely studied factor in understanding human social behavior and plays a crucial role in shaping intentions and behaviors (Fishbein and Ajzen 2011). Generally, when individuals have a more positive attitude toward a specific behavior, they are more likely to engage in that behavior, and vice versa. Therefore, when individuals are faced with the risk of floods, their likelihood of implementing flood prevention measures increases if they have a more positive attitude toward such measures (Wang *et al.* 2022). However, the relationship between attitude towards flood preparedness and intention to prepare can be weakened when individuals have higher levels of trust in public protection. Grothmann & Reusswig (2006) surveyed citizens in Cologne, Germany, and found that those who had greater confidence in public flood protection tended to perceive lower flood risks and take fewer precautionary measures. Based on the above discussion, it becomes evident that people may be less inclined to prepare for flood risks due to their belief that the government has already taken sufficient measures to protect them. This assumption significantly impacts their attitude toward flood

preparedness and diminishes their perception of risk. Therefore, based on these observations, we hypothesized the following:

Hypothesis 10. (H10). The positive relationship between ATT and INT will be weakened when TPP is higher

3. METHODOLOGY

3.1 Instrument Development

This study utilized a questionnaire consisting of two sections: 1) capturing the demographic profile of the respondents and 2) measuring items related to ten latent constructs mentioned in the research model. The measurement items for the constructs were derived from previous studies and adjusted as necessary. Specifically, the measurement items for flood preparedness intention, attitude towards flood preparedness, subjective norms, and perceived behavior control were adapted from the works of Ajzen (1991), Najafi *et al.* (2017), and Ng (2022). Besides that, the measurement items for perceived susceptibility and perceived severity were adapted from Ejeta *et al.* (2016), while items related to past experience and trust in public protection were derived from Gumasing *et al.* (2022) and Terpstra (2011) respectively. Furthermore, to address the issue of social desirability bias (SDB), measurement items were adopted from Fischer and Fick (1993). To mitigate the potential for common method variance (CMV), Podsakoff *et al.* (2003) recommended using different anchor scales for measuring independent and dependent variables as a procedural approach. Employing distinct scales helps alleviate the perception of item similarity and redundancy among respondents, thereby reducing biases in item comprehension, memory retrieval, and judgment. To achieve this, a five-point Likert scale was used to measure the exogenous variables, while a seven-point Likert scale was utilized for measuring the endogenous variables, thereby minimizing the impact of CMV.

3.2 Sampling and Data Collection

This study employed purposive sampling due to the unavailability of a comprehensive list of household renters in the East Coast region of Malaysia. In alignment with the study's objectives, the primary aim is to investigate the factors influencing renters' intentions for flood preparedness in Malaysia's East Coast region, encompassing the states of Pahang, Kelantan, and Terengganu. Hence, the study population consists of all renters residing in these East Coast regions of Malaysia. Renters are often more susceptible to the impacts of flooding due to their limited control over the physical characteristics of their rented properties. They may face challenges in implementing structural modifications or making significant changes to their homes to mitigate flood risks. Therefore, renters must recognize their vulnerability and take proactive measures to prepare for floods. The survey was conducted using Google Forms and distributed online through social media platforms such as Facebook and WhatsApp groups for one month. The sample size was determined based on the power of analysis, considering the number of predictors. Following the recommendation of Gefen *et al.* (2011), a minimum sample size of 92 was determined with a power of 80%, a medium effect size, and a significance level

of $p = 0.05$. Ultimately, 150 completed questionnaires were returned, indicating that the sample size was sufficient for the study. The results showed that the majority of participants in the study were female (60.7%), while the remaining 39.3% were male. The reason for the greater representation of female respondents was because, as indicated by Mohammad-Pajooch and Ab Aziz (2014), females were considerably less prepared for flood disasters when compared to males. The exclusion of women from decision-making processes constitutes a significant contributing element to the heightened vulnerability of women in the context of disasters, whether in developed and developing nations (Hamidzada and Cruz 2020).

Moreover, a significant proportion of respondents fell within the age range of 25 to 34 years old. Most of the survey participants fall within the category of young renters, in line with Ismail *et al.*'s (2021) findings that the majority of renters are young individuals. This trend is driven by the substantial housing expenses, leading young people to opt for renting instead of buying a house. Geographically, the highest percentage of respondents came from Pahang (43.3%), followed by Terengganu (32.7%) and Kelantan (24%). Regarding the types of communities represented, 41.3% were from sub-urban areas, 39.3% from urban areas, and 19.3% from rural areas.

Table 1. Respondents' Descriptive Statistics (n = 150).

Characteristics	Category	Frequency (N= 150)	Percentage (%)
Gender	Male	59	39.3
	Female	91	60.7
Age	15 – 24 years old	57	38
	25 – 34 years old	67	44.7
	35 – 44 years old	19	12.7
	45 years old and above	7	4.6
States	Kelantan	36	24
	Pahang	65	43.3
	Terengganu	49	32.7
Types of community	Rural	29	19.3
	Sub-urban	62	41.3
	Urban	59	39.3

4. RESULTS

The primary objective of this study was to examine the association between variables in the research model. To achieve this, the data were analyzed using Smart PLS (Ringle *et al.* 2015), which is a covariance-based structural equation modeling (SEM) technique. Following the approach suggested by Hair *et al.* (2019), this study employed a two-stage analysis. Firstly, the measurement model was assessed to determine convergent validity and discriminant validity. Secondly, the structural model was tested using the bootstrapping method with a resampling technique of 5,000 iterations (Hair *et al.* 2019). This approach was chosen to evaluate the hypotheses formulated in the study.

4.1 Common Method Variance

This study used single-source data in which the dependent variable and the independent variables were answered by the same person simultaneously; hence, procedural and statistical methods were employed to overcome issues related to CMV (MacKenzie and Podsakoff 2012; Ngah *et al.* 2020). The procedural methods that were applied have been discussed in the section on instrument development. For the statistical method, the results of the MLMV depict (refer Table 2) that the R^2 change with and without marker (MV) included is less than the threshold of 0.09 (Lindell and Whitney 2001). In other words, there is no significant difference in both the Beta (β) value and R^2 changes with the addition of marker variables. Hence, this result has provided another clue to CMV's insubstantiality of CMV and therefore, it can be concluded that CMV was not an issue of this study.

Table 2. A Comparison of R^2 value between baseline model and marker included the model

	SUC	SEV	ATT	PBC	INT
R^2 without Marker Variable	0.556	0.465	0.552	0.474	0.420
R^2 with Marker Variable	0.556	0.465	0.552	0.474	0.423

4.2 Measurement Model

For the measurement model, the criteria for convergent validity and discriminant validity must be fulfilled. Generally, convergent validity can be established if the loading reaches a value of 0.50 or higher (Hair *et al.* 2019), the average variance extracted (AVE) reaches a value of 0.5, and composite reliability (CR) achieves a minimum value of 0.7 (Hair *et al.* 2019). Table 3 shows that the convergent validity is acceptable because the outer loading, AVE, and CR are higher than the threshold values, thus confirming that the convergent validity is not an issue in the study.

Table 3. Convergent Validity

Construct	Indicator	Outer Loading	CR	AVE
ATT	ATT1	0.952	0.974	0.926
	ATT2	0.980		
	ATT3	0.954		
INT	INT1	0.945	0.965	0.902
	INT2	0.958		
	INT3	0.946		
PBC	PBC1	0.886	0.854	0.666
	PBC2	0.896		
	PBC3	0.641		
PE	PE1	0.830	0.949	0.758
	PE2	0.830		
	PE3	0.891		
	PE4	0.886		
	PE5	0.912		

	PE6	0.870		
SEV	SEV1	0.898	0.949	0.788
	SEV2	0.926		
	SEV3	0.843		
	SEV4	0.943		
	SEV5	0.822		
SN	SN1	0.895	0.845	0.654
	SN2	0.915		
	SN3	0.568		
SUC	SUC1	0.932	0.961	0.832
	SUC2	0.944		
	SUC3	0.888		
	SUC4	0.945		
	SUC5	0.847		
TPP	TPP1	0.883	0.940	0.798
	TPP2	0.925		
	TPP3	0.882		
	TPP4	0.882		

After the convergent validity was fulfilled, the discriminant validity of the model was tested. Discriminant validity is confirmed if the heterotrait–monotrait (HTMT) values are lower than 0.9 (Franke and Sarstedt 2019). The results depicted in Table 4 satisfy the HTMT criterion, indicating that all the values were lower than the proposed 0.9. Hence, the results of this study proved that the model met the discriminant validity requirements of the tested constructs and items.

Table 4. Heterotrait–monotrait (HTMT)

Construct	ATT	INT	PBC	PE	SEV	SN	SUC	TPP
ATT								
INT	0.664							
PBC	0.885	0.631						
PE	0.407	0.343	0.418					
SEV	0.445	0.425	0.474	0.726				
SN	0.875	0.635	0.889	0.602	0.661			
SUC	0.384	0.343	0.373	0.791	0.822	0.642		
TPP	0.419	0.313	0.476	0.113	0.113	0.408	0.049	

4.3 Structural Model

After the measurement model assessment, the multicollinearity test was performed to ensure no collinearity issues in the model before evaluating the structural model. Collinearity was assessed with the variance inflated factor (VIF) values, which must be lower than the threshold value of 5 (Hair *et al.* 2017). Table 5 shows that all the VIF values were less than five, indicating no collinearity problem between the predictor variables. Subsequently, hypothesis testing was conducted by applying a bootstrapping technique. Figure 1 demonstrates the structural model of the study. Table 5 provides the results of hypothesis testing, whereby five out of nine direct effect hypotheses were supported.

For H1, which posited that past experience (PE) positively influences perceived severity (SEV), the results demonstrated a positive relationship ($\beta = 0.682$, $t = 14.063$, $LL = 0.586$, $UL = 0.750$, $p < 0.001$). Therefore, H1 was supported. For H2, it was suggested that PE positively influences perceived susceptibility (SUC), and the results showed that PE had a positive relationship with SUC ($\beta = 0.746$, $t = 20.766$: $LL = 0.677$, $UL = 0.797$, $p < 0.001$). Therefore, H2 was supported. Regarding H3, it was proposed that SEV positively influences attitude (ATT), and the results showed that SEV had no positive relationship with ATT ($\beta = 0.086$, $t = 0.895$: $LL = -0.057$, $UL = 0.256$, $p > 0.005$). Therefore, H3 was not supported. Besides that, H4 also was not supported in this study since there was no positive relationship between SUC and ATT ($\beta = -0.096$, $t = 0.990$: $LL = 0.266$, $UL = 0.051$, $p > 0.005$). For H5, H6, and H7, on the relationship between SN and ATT, SN and perceived behavioral control (PBC), and SN and flood preparedness intention (INT), ($\beta = 0.745$ $t = 9.653$: $LL = 0.602$, $UL = 0.855$, $p < 0.001$), ($\beta = 0.689$, $t = 11.742$: $LL = 0.57$, $UL = 0.769$, $p < 0.001$), and ($\beta = 0.131$, $t = 1.081$: $LL = -0.06$, $UL = 0.339$, $p > 0.005$), respectively, the values confirmed positive relationships between SN and ATT, and SN and PBC. However, there was no positive relationship between SN and INT.

Besides that, H8 showed that ATT had a positive influence on INT ($\beta = 0.365$, $t = 2.834$: $LL = 0.135$, $UL = 0.558$, $p < 0.005$). Thus, H8 was supported. However, there was no relationship between PBC and INT ($\beta = 0.068$, $t = 0.654$: $LL = -0.108$, $UL = 0.235$, $p > 0.005$). Finally, trust in public protection (TPP) negatively moderated the relationship between ATT and INT ($\beta = -0.136$, $t = 3.263$: $LL = -0.205$, $UL = -0.073$, $p < 0.001$) (refer Table 6). Therefore, H10 was supported. This study also examined the coefficient of determination (R^2). R^2 is a statistical measure that quantifies the predictive capability of a model. It is bounded between 0 and 1, where a larger value signifies a greater degree of predictive precision (Hair *et al.* 2017). According to Chin (1998), the R^2 value should be larger than 0.1. Figure 1 illustrates that the R^2 values of all endogenous variables are within the defined threshold. The results found that 44.3% variance occurred in flood preparedness intention, interpreted by attitude, subjective norms and perceived behavior control, 47.4% variance occurred on perceived behavior control by subjective norms, 55.2% variance occurred on attitude by perceived susceptibility and perceived severity, 46.5% variance occurred on perceived severity by past experience, and 55.6% variance occurred in perceived susceptibility by past experience.

Table 5. Direct Path Coefficient

	Relationship	Beta	SE	t-value	p-value	f ²	VIF	LL	UL
H1	PE -> SEV	0.682	0.049	14.063	0.000	0.870	1.000	0.586	0.750
H2	PE -> SUC	0.746	0.036	20.766	0.000	1.255	1.000	0.677	0.797
H3	SEV -> ATT	0.086	0.096	0.895	0.185	Nil	2.680	-0.057	0.256
H4	SUC -> ATT	-0.096	0.097	0.990	0.161	Nil	2.616	-0.266	0.051
H5	SN -> ATT	0.745	0.077	9.653	0.000	0.830	1.493	0.602	0.855
H6	SN -> PBC	0.689	0.059	11.742	0.000	0.902	1.000	0.570	0.769
H7	SN -> INT	0.131	0.121	1.081	0.140	Nil	2.421	-0.060	0.339
H8	ATT -> INT	0.365	0.129	2.834	0.002	0.071	3.362	0.135	0.558
H9	PBC -> INT	0.068	0.104	0.654	0.257	Nil	2.678	-0.108	0.235

Table 6. Assessment of Moderation Analysis

		Beta	SE	t-value	p-value	f ²	VIF	LL	UL
	TPP x ATT ->								
H10	INT	-0.136	0.042	3.263	0.001	0.041	1.406	-0.205	-0.073

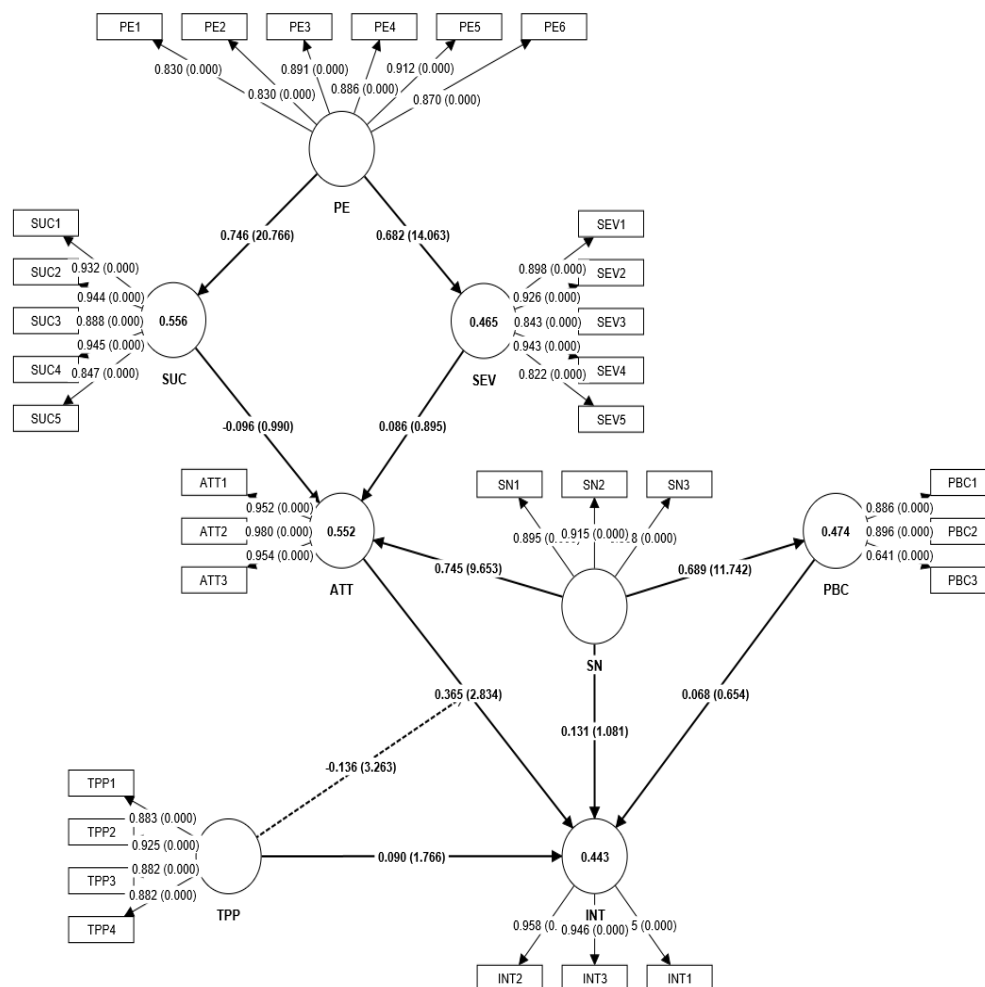


Figure 1. Theoretical Research Framework.

4.4 PLS-Predict

Assessing a statistical model’s predictive power is a crucial element of any study (Shmueli *et al.* 2019). Shmueli *et al.* (2016) developed PLS predict, a holdout-sample-based procedure that generates case-level predictions on an item or a construct level to reap the benefits of predictive model assessment in PLS-SEM. PLS predict offers a means to assess a model’s out-of-sample predictive power. In order to examine the predictive power, the researchers need to look at the value of PLS – LM of all items for each construct. Comparing the RMSE values from the PLS-SEM analysis with the naïve LM benchmark (Table 7), it is found that the PLS-SEM analysis produces lower prediction errors for constructs attitude (ATT), flood preparedness intention (INT), and perceived susceptibility (SUC). In these constructs, the values of all items for PLS RMSE were lower than LM RMSE. In this situation, the LM produces RMSE values that have higher prediction errors than PLS-SEM-based RMSE. Therefore, the constructs such as ATT, INT, and SUC were found to have high predictive power. Meanwhile, perceived behavior control (PBC) and perceived severity (SEV) were found to have a medium predictive power since the majority of the items for these constructs have negative values.

Table 7. Predictive Power

	PLS RMSE	LM RMSE	PLS - LM	Q ² predict	Result
ATT1	0.668	0.711	-0.043	0.467	High Predictive Power
ATT2	0.646	0.676	-0.030	0.516	
ATT3	0.672	0.692	-0.020	0.480	
INT1	1.297	1.401	-0.104	0.278	High Predictive Power
INT2	1.353	1.467	-0.114	0.249	
INT3	1.252	1.337	-0.085	0.324	
PBC1	0.786	0.789	-0.003	0.384	Medium Predictive Power
PBC2	0.748	0.773	-0.025	0.398	
PBC3	1.122	1.116	0.006	0.113	
SEV1	1.029	1.020	0.009	0.418	Medium Predictive Power
SEV2	1.015	1.073	-0.058	0.422	
SEV3	1.138	1.209	-0.071	0.339	
SEV4	1.007	1.085	-0.078	0.384	
SEV5	1.084	1.152	-0.068	0.219	
SUC1	1.079	1.122	-0.043	0.464	High Predictive Power
SUC2	1.079	1.162	-0.083	0.465	
SUC3	0.947	0.993	-0.046	0.507	
SUC4	1.049	1.067	-0.018	0.434	
SUC5	1.036	1.099	-0.063	0.402	

5. DISCUSSION

In order to gain deeper insights into the factors driving household renters' motivation to prepare for flood risk, this study devised a comprehensive theoretical framework incorporating the Theory of Planned Behavior (TPB) and the Health Belief Model (HBM). The framework was tested using a sample of household renters residing in the East Coast Region of Malaysia,

an area that had previously experienced severe pluvial flooding events. The results demonstrated that the framework exhibited a robust explanatory capacity for predicting residents' flood preparedness intentions. Furthermore, the findings indicated that the framework served as a valuable tool for assessing residents' perceptions of flood risk and their inclination to engage in risk-reducing behaviors.

Firstly, this study found that past experiences were positively correlated with perceived severity and susceptibility (H1 and H2 were supported). The present study's findings are consistent with the study of Gotham (2017), Zaalberg *et al.* (2009), and Zhang *et al.* (2021), which concluded that the higher the public's threat appraisal of flood risk, the higher the perception of severity and susceptibility of the flood. According to Terpstra (2011), risk perception as it pertains to flooding is the process by which individuals estimate the perceived probability and severity of flood damage in the future. Direct experience with flooding is one important factor that increases both risk perceptions (Bradford *et al.* 2012). Personal experiences in a disaster motivate people to consider adaptive behavior, including the implication of possible severe effects of flooding which may significantly affect their livelihood and people's lives (Kuhlicke *et al.* 2022a).

Next, the present study hypothesized that perceived severity and perceived susceptibility would be positively associated with individual attitudes toward flood preparedness (H3 and H4). However, the findings of the study found that both hypotheses were not supported. These findings were contrary to the findings of Ng (2022) who found that risk perception did positively associated with attitude towards flood preparedness. Research centered on risk perception attitude (RPA) has explored the relationship between risk perception and changes in attitudes and behaviors (Rimal and Juon 2010). Kellens *et al.* (2011) consider the study of flood risk perception as research on human consciousness, emotions, and behaviors concerning hazards. Besides that, Raaijmakers *et al.* (2008) specify the definition of flood risk perception as a combination of three specific factors of risk—awareness, worry, and preparedness. Knowledge of public risk perception is meant to assure an improvement in the effectiveness of flood risk management (Kellens 2011). People's consciousness, awareness, and knowledge of risk perception are vital in ensuring the effectiveness of flood preparedness. However, Lechowska (2018) contends that people underestimating the flood risk is a major problem and a challenge in managing it. When individuals perceive the risk of floods to be low or negligible, they may exhibit a complacent attitude toward flood preparedness. They might underestimate the severity of potential impacts or believe that the likelihood of a flood affecting them personally is minimal. Besides that, there is no correlation between perceived severity and susceptibility and attitude because renters' attitudes towards flood preparedness may be influenced by their confidence in the effectiveness of protective measures. If they perceive that existing flood mitigation measures (such as levees, floodwalls, or early warning systems) adequately protect them, they may be less motivated to take additional personal preparedness actions.

This study also hypothesized that subjective norm had positively associated with attitude, perceived behavior control, and flood preparedness intention. The present study found that subjective norms only correlated with attitude and perceived behavior control. This finding is in line with the study carried out by Kurata *et al.* (2022) and Kusumastuti *et al.* (2021). They contend that people feel less stressed and anxious to secure their families from the hazardous effects of flooding due to community-related knowledge and this is evident with subjective norms having a positive impact on attitude and perceived behavior control.

Previously, this study hypothesized that attitude, subjective norm, and perceived behavior control were predicted to be associated with flood preparedness intention. However, the only attitude was found to be associated with flood preparedness intention. This finding is paralleled with the study of Zaremohzzabieh *et al.* (2021) and Ong *et al.* (2021). Rostami-Moez *et al.* (2020) explained that people will be more likely to prepare for disaster when they are aware of the benefits of disaster preparedness. This study also found that perceived behavioral control did not correlate with flood preparedness intention and it is in line with the study of Zaremohzzabieh *et al.* (2021). Ng (2022) contends that although people prepare for disaster, they still cannot control the outcome since the impacts of a disaster are often insurmountable and beyond human imagination.

Last but not least, this study also employed trust in public protection to examine its moderating effect on the relationship between attitude and flood preparedness intention. The present study found that trust in public protection negatively moderated the positive relationship between attitude and flood preparedness intention. Although laypeople lack the expertise needed to calculate the actual level of protection provided by flood protection facilities, they can deduce the likelihood of flooding based on the level of trust inspired by their observations. Grothmann and Reusswig (2006) surveyed citizens in the German city of Cologne and found that those citizens who had more confidence in public flood protection showed lower perceptions of flood risk and took fewer precautionary measures. Meanwhile, Terpstra (2011) also found that the perception of flood risk is reduced by a high level of trust in flood protection facilities, which in turn discourages citizens from planning to prepare for potential flood disasters. This conclusion was also supported by subsequent studies (Wachinger *et al.* 2013; Buchanan *et al.* 2019). Papagiannaki *et al.* (2019) used survey data from a representative sample of Greek households to show that trust in government flood control measures reduced flood fear, leading to lower levels of preparedness. As Poussin *et al.* (2014) mentioned, trust in public flood protection brings a sense of security and therefore may be an important reason why residents are reluctant to take preventive measures. Based on the discussion above, it can be concluded that renters who have experienced floods will harbor a sense of vulnerability, anticipating future exposure to floods, with a high likelihood of enduring significant impacts similar to their previous encounters. However, their inclination to prepare for future floods tends to diminish as they perceive that the government has already taken and will continue to implement suitable measures to safeguard them from flood disasters.

5.1. Theoretical Contribution

The paper contributes to the existing available studies of disaster risk reduction in Malaysia. The model integrated the Theory of Planned Behavior (TPB) and the Health Belief Model (HBM) which provides new insight into the Malaysians' available studies about flood disaster risk responses, especially among household renters. Through literature reviews and the results of this study, this paper identified attitude towards flood preparedness as the most significant factor influencing flood preparedness intention. Besides that, this study provides firsthand information on the predictors of flood preparedness behavior among household renters in the East Coast Region, Peninsular Malaysia. Therefore, the research model developed in this study has the potential to be expanded and adjusted for assessing the effectiveness of flood disaster response in other countries prone to natural disasters. Besides that, Samah *et al.* (2019) believed that some TPB improvements are required because several activities associated with

disaster preparedness cannot be sorted into only the three primary factors of the TPB model. Hence, this study also includes a moderating variable (trust in public protection) and other additional variables (past experience, perceived severity, and perceived susceptibility) to enhance the existing models.

5.2. Practical Implication

Promoting flood preparedness among household renters can have several practical implications to enhance their intention and ability to mitigate flood risks. According to Ridzuan *et al.* (2022a), Malaysia does not have a comprehensive legal framework in place to effectively combine policies and mechanisms for managing floods. Directive No. 20 was created to address general disasters rather than specifically targeting floods. Besides that, the Malaysian government has already provided financial assistance to the individuals affected by the floods, offering temporary relief. Nonetheless, it is crucial to establish a long-term strategy that envisions and develops policies to support flood victims, especially those belonging to low and middle-income groups. This would enable them to recover, sustain their livelihoods, and contribute towards reducing economic inequality within the country (Ridzuan *et al.* 2022b). Therefore, this study is valuable as it provides important information for policymakers to develop a robust public policy specifically related to floods. The proposed policy should consider a broad range of individuals, and it is crucial to include household renters as one of the key concerns in the policy.

The present study found that the renters' intention to prepare for a flood is reduced when they realized that the authorities have taken necessary measures to protect them from flood. Rahman *et al.* (2021) contend that the efficacy of disaster risk management policies and interventions is contingent upon the extent of disaster risk perception and knowledge among households. In this scenario, the government must enhance communication and emphasize that mitigating flood risks is a collective responsibility shared by both the authorities and the public. Increasing renters' knowledge and awareness about flood risks and the importance of preparedness is crucial. Providing accessible and targeted educational materials can help renters understand the potential consequences of floods, the steps they can take to protect themselves and their belongings, and the resources available to them. This can be achieved through informational brochures, online resources, workshops, or community outreach programs.

Engaging landlords and property managers in promoting flood preparedness is vital, as they play a significant role in facilitating or hindering renters' ability to take preventive measures. Encouraging landlords to implement flood-resistant measures in rental properties, such as installing flood barriers or raising electrical outlets, can contribute to renters' safety and preparedness. Building partnerships with property management associations and providing resources and guidelines for landlords can help in achieving this collaboration. Renters should be included in local emergency planning efforts. Collaborating with local authorities and emergency management agencies to ensure that renters are considered in emergency response plans and that they receive timely and relevant information during flood events can enhance their preparedness. This can involve the inclusion of renters' contact information in emergency notification systems and the provision of evacuation routes and shelter information specific to rental communities.

5.3. Limitations and Future Research

As powerful as the results were presented, the authors acknowledge several limitations in this paper. The study solely considers household renters residing in the East Coast region of Malaysia. The analysis could be more inclusive if it included residents living in other parts of Malaysia, namely from the Western, Northern, Sabah, and Sarawak. A future study including the rest of Malaysia may integrate additional latent variables to develop a more extensive model applicable to natural disaster-prone countries.

While the study had a sufficient sample size for testing the research model, the unavailability of a comprehensive list of household renters necessitated the use of purposive sampling techniques. Consequently, findings derived from this technique cannot be extrapolated to the broader population. According to Levy and Lemeshow (2013), purposive sampling techniques often exhibit limitations in terms of representativeness and generalizability. Non-probability sampling methods typically do not achieve representativeness and generalizability due to the systematic exclusion of some sample elements (Lynch, Jr. 1982; Ferber 1977; Stuart 1976). However, obtaining a sample that accurately reflects a population of interest is frequently impractical (Cheah *et al.* 2020). Despite the utilization of advanced sampling techniques by researchers, the representativeness of a sample is still susceptible to many challenges, including unequal selection probabilities, non-response, and non-coverage (Kalton and Flores-Cervantes 2003).

Calder *et al.* (1981) emphasized the conceptual distinction between theory application and effects application research. In the context of theoretical application, the level of concern for sample representativeness is minimal (Calder *et al.*, 1981), as the objective is not to extrapolate findings to a real-world context, but rather to investigate a specific study setting for the purpose of examining an effect (Cook *et al.* 1979). Researchers assess a certain theory's applicability to various study settings while testing a set of formal hypotheses (Lichters *et al.* 2015). Therefore, the effects found in the research are utilized to evaluate the state of the theory. It is the theoretical explanation that is expected to be generalizable and not the particular effects obtained (Calder *et al.* 1981). In this case, sample representativeness is of secondary concern when comparing models, as long as specific sample characteristics are not an integral part of the theory (Calder *et al.* 1981). As illustrated in Table 1, a significant proportion of the participants were female and belonged to the younger demographic. Hence, there is a possibility of some sample bias. Nevertheless, the primary focus of this study revolves around individuals who rent houses in the East Coast Region, irrespective of their gender and age. Therefore, the impact of sampling bias is negligible. In addition, the primary objective of this study is to empirically examine the validity of the theoretical effects posited by the suggested framework (theory application). Hence, sample representativeness is of little concern in this study (Calder *et al.* 1981).

6. CONCLUSION

In Malaysia, floods are the prevailing natural calamity, with a frequent occurrence. Despite their regularity, the impact of floods is significant, leading to the loss of both lives and property (Ridzuan *et al.* 2022c). Flood preparedness is a multifaceted and ongoing process that requires collaboration among governments, communities, and various stakeholders. By adopting comprehensive strategies and investing in long-term planning and infrastructure,

societies can mitigate the risks associated with flooding and build resilience to better withstand such events. Renters are often more vulnerable to the impacts of flooding because they may have limited control over the physical characteristics of their rented properties. They may lack the ability to implement structural modifications or make significant changes to the property to mitigate flood risks. Therefore, renters need to understand their vulnerability and take proactive measures to prepare for flooding. Flood preparedness measures can help protect the lives and well-being of renters during flood events. By being aware of flood risks, understanding evacuation routes, and having an emergency plan in place, renters can take appropriate actions to ensure their safety and that of their household members. Renters need to protect the property they are renting from flood damage. While renters may not be able to make structural modifications, they can take preventive measures such as moving belongings to higher ground, using sandbags to block water entry points, or using flood-resistant materials for valuable items. These actions can help minimize potential damage and reduce the financial impact on both the renter and the property owner. Renters should engage in open communication with their landlords or property managers about flood risks, previous flooding incidents in the area, and the availability of flood insurance coverage for the rented property. Collaborating with landlords can lead to a better understanding and implementation of flood preparedness measures within the property. Active involvement of renters in community-wide flood preparedness initiatives can contribute to overall community resilience. By participating in community emergency response programs, attending local flood awareness events, and sharing information with neighbors, renters can contribute to a more resilient community that is prepared to handle flood events effectively.

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.

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Appendix 1. The Measurement Items of the Study

Variables	Code	Items
Past Experience (PE)	PE1	I have experienced several heavy floods in the past.
	PE2	I have experienced flood where people in my area were left homeless.
	PE3	I have experienced flood where our house was destroyed and damaged.
	PE4	I have experienced flood where our house was drawn by floodwater.
	PE5	I have experienced flood where our properties and assets were submerged in water.
	PE6	I have experienced flood that is traumatizing that I couldn't sleep.
Perceived Susceptibility (SUC)	SUC1	I think the place where I am living is prone to flood disaster.
	SUC2	I think my house is prone to flood disaster.
	SUC3	I think my family members and I are prone to flood disaster.
	SUC4	I think my property is prone to flood disaster.
	SUC5	I think electricity and water supplies in my area are prone to flood disaster.
Perceived Severity (SEV)	SEV1	I think if a major flood event occurs, the place where I am living could be affected severely.
	SEV2	I think if a major flood event occurs, my home could be damaged severely.
	SEV3	I think if a major flood event occurs, my family members and I could be affected severely (injured or killed).
	SEV4	I think if a major flood event occurs, my property could be damaged severely.
	SEV5	I think if a major flood event occurs, electricity and water lines could be damaged severely, and supplies could be interrupted.

Attitude (ATT)	ATT1	My attitude toward making preparation for flood is effective.
	ATT2	My attitude toward making preparation for flood is useful.
	ATT3	My attitude toward making preparation for flood is beneficial.
Subjective Norms (SN)	SN1	My family or friends think that I should make preparation for flood.
	SN2	In regard to making preparation for a flood, doing what people think I should do is important.
	SN3	I feel under social pressure to make preparation for a flood.
Perceived Behavior Control (PBC)	PBC1	I am confident that I could make preparation for a flood if I wanted to.
	PBC2	Whether I make preparation for a flood is entirely dependent on me.
	PBC3	Making preparation for a flood is an easy thing for me.
Trust in Public Protection (TPP)	TPP1	I am confident that the flood defenses along my residential area are maintained well.
	TPP2	I have confidence in the technological skills of flood risk managers.
	TPP3	I have confidence in the strength of the flood defenses in my residential area.
	TPP4	I am confident that there are sufficient, properly qualified people working with the flood management authorities.
Flood Preparedness Intention (INT)	INT1	I expect to make preparation for a flood.
	INT2	I plan to make preparation for a flood.
	INT3	I will make preparation for a flood.
