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Enhancing community-based earthquake disaster management: resident preferences and adaptive capacity for resilience

Bih-Chuan Lin^a and Chun-Hung Lee^b

^aDepartment of Architecture and Interior Design/Graduate School of Architecture, Da Yeh University, Dacun, Changhua, Taiwan, R.O.C; ^bDepartment of Natural Resources and Environmental Studies, College of Environmental Studies Oceanography, National Dong Hwa University, Hualien, Taiwan, R.O.C

ABSTRACT

Earthquake disasters remain a persistent global challenge, requiring innovative approaches to disaster management. Community-based earthquake disaster management (CBEDM) integrates social, environmental, and political factors, emphasizing residents' adaptive capacity and disaster prevention preferences. This study employs the Choice Experiment (CE) method within an adaptive capacity framework to "quantify residents' preferences, adaptive behaviours, and willingness to participate (WTP)" in CBEDM scenarios. Using the Random Parameter Logit (RPL) model, the research reveals strong community support for CBEDM programs and highlights three key findings: first, "collaboration between local governments, non-profits, and communities enhances disaster preparedness and post-disaster recovery"; second, "active community participation reduces disaster impact and raises awareness"; third, "empowering social organizations ensures efficient recovery services and social inclusion." These insights provide evidence-based recommendations for aligning disaster management strategies with residents' preferences and fostering adaptive behaviours to mitigate earthquake risks.

HIGHLIGHT

1. Collaboration between local governments, non-profits, and communities is crucial in strengthening community preparedness and adaptive capacity, ultimately improving post-disaster recovery effectiveness.
2. The active involvement of community residents in disaster prevention plans enhances their awareness of disaster prevention and reduces the impact of disasters on their communities.
3. Empowering social organisations to assist in community-based disaster management contributes to the efficient delivery of recovery services, promotes social inclusion, and ensures transparency and accountability.

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Community-based earthquake disaster management (CBEDM); adaptive capacity; resilience; choice experiment method; willingness to participate (WTP)

CONTACT Bih-Chuan Lin bihchuan@mail.dyu.edu.tw; Chun-Hung Lee chlee@gms.ndhu.edu.tw

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1. Introduction

The impact of global warming on natural disasters has led to an increase in their occurrence and severity, including earthquakes, landslides, tsunamis, typhoons, droughts, and floods (Adger 2006; Intergovernmental Panel on Climate Change (IPCC), 2014; International Federation of Red Cross and Crescent Societies (IFRC), 2009). These disasters have significant consequences, such as loss of life, property damage, and depletion of natural resources. However, accurately predicting earthquakes remains a challenge due to the complex nature of the underlying processes (Hendriks and Opdyke 2022; Cui et al. 2018). In addition, population growth, urban development, and aging infrastructure pose significant challenges to urban resilience in the face of climate change-related disasters (Bixler et al. 2021; Bai et al. 2018). Extreme weather events are becoming more frequent, leading to substantial economic and social impacts (U.S. Geological Survey (USGS), 2020). Taiwan, in particular, has experienced an increasing number of earthquakes, highlighting its vulnerability to seismic risks. While countries cannot prevent earthquakes from occurring, proactive prevention and preparedness measures can help mitigate their impacts (IPCC, 2014; Botzen et al. 2009).

While prior research has established the role of global warming in exacerbating natural disasters (Bai et al. 2018; Bixler et al. 2021), studies exploring its specific implications for earthquake resilience strategies remain sparse. Unlike other climate-related disasters, earthquakes necessitate localized, community-driven approaches due to their unpredictable nature and the immediate reliance on community response post-impact. This study seeks to address this gap by investigating resident preferences and adaptive behaviors within a Community-Based Earthquake Disaster Management (CBEDM) framework, with a particular focus on Taiwan as a seismically active region.

Adaptive capacity is crucial in disaster management and community resilience—it is a community's ability to minimize exposure and vulnerability to hazards and mitigate their impacts (Adger 2006; Gallopín 2006; Engle 2011). Research on the adaptive behaviours of residents and their preferences for community-based earthquake disaster management (CBEDM) is limited, and there is often a lack of community participation in disaster management policies (Lin 2023; Lin and Lee, 2023; Huq 2016).

While foundational studies by Adger (2006) and Gallopín (2006) emphasize the theoretical importance of adaptive capacity, empirical investigations quantifying resident-driven preferences for disaster resilience remain underdeveloped. This study employs the Choice Experiment (CE) method to fill this gap, offering a novel approach to quantifying resident preferences for disaster management strategies and contributing to an evidence-based understanding of CBEDM's effectiveness.

A new development paradigm addresses these gaps by prioritizing bottom-up planning and maximum community participation in disaster prevention and management sustainability (Lin 2023; Lin and Lee, 2023; Lin and Lee, 2023). This approach involves communities in shaping disaster prevention and adaptation strategies and emphasizes the importance of community input and active participation (Lin and Lee 2024; Lin and Lee, 2023; Tariq et al. 2021; Cui et al. 2018). Unlike top-down approaches, this paradigm shifts the focus to empowering communities as primary actors in disaster management. The current research builds on this paradigm by integrating resident preferences into CBEDM frameworks, thus addressing a significant gap in the existing literature and policy. The present study proposes

an adaptive evaluation framework to assess people’s preferences for CBEDM and their views on disaster prevention and adaptation. This framework combines community adaptive and coping capacity, disaster prevention awareness, and organizational resilience (Figure 1) (Lin 2023; Lin and Lee, 2023; Hendra and Kismartini 2018). The information obtained can assist the government in modifying its disaster management strategies to meet the needs of community residents (Lin 2023; Lin and Lee, 2023; Tariq et al. 2021; Cui et al. 2018).

The government could implement various stages to enhance community capacity for disaster prevention, such as implementing disaster education programs (Lin 2023; Lin and Lee, 2023; Tariq et al. 2021; Cui et al. 2018), fostering open communication and collaboration (Lin and Lee, 2023; Sathurshan et al. 2022; Wu and Chang 2018), investing in resilient infrastructure and early warning systems (Lin and Lee, 2023; Haworth et al. 2018; Tang et al. 2010), encouraging community participation in decision-making (Lin and Lee, 2023; Wu and Chang 2018), leveraging local knowledge and resources (Lin and Lee, 2023; Carpenter and Brock 2008), and strengthening social networks and support systems (Lin and Lee, 2023; Lin and Lee, 2023; Wu and Chang 2018).

This study advances the understanding of CBEDM by integrating resident-driven preferences into the adaptive evaluation framework, distinguishing it from previous research. (Suryawan and Lee 2023; Lin and Lee, 2023; Huq 2016). Through an evidence-based analysis of factors such as education, house ownership, and disaster awareness, this research provides a comprehensive lens on how community-specific strategies can enhance resilience and mitigate disaster impacts.

In conclusion, building adaptive capacity and implementing effective CBEDM strategies are crucial in enhancing community earthquake resilience (Figure 1). Active

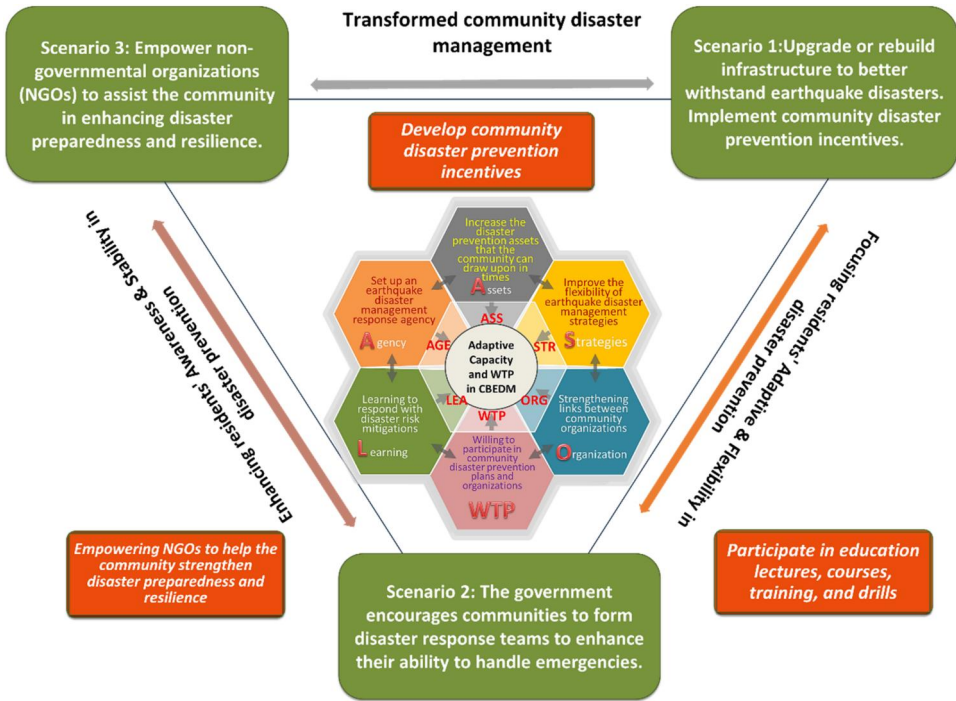


Figure 1. Conceptual framework of community-based earthquake disaster management.

community involvement, investment in resilient infrastructure, promotion of disaster education and awareness, and utilization of local resources and knowledge can significantly reduce the impact of earthquakes and create a more resilient and sustainable society in the face of climate change-related challenges.

2. Literature Review

2.1. Adaptive capacity in earthquake disaster management

Adaptive capacity refers to the ability of a system, community, or individual to adjust, modify, or change their characteristics and actions to respond effectively to and cope with changes, shocks, or stresses. Adaptive capacity is crucial in building resilience in environmental change, social systems, and disaster risk reduction (Lin and Lee 2024; Lin and Lee, 2023; Adger et al. 2007). In simpler terms, adaptive capacity is the capability of a system or person to adapt to changing circumstances and challenges—ensuring communities and individuals can effectively deal with unexpected situations and remain strong in adversity is essential (Lin 2023).

Adaptive capacity involves learning, flexibility, and problem-solving skills, which enable entities to anticipate, prepare for, and recover from adverse events, thus minimizing impacts and seizing opportunities (Lin 2023; Lin and Lee, 2023; Adger et al. 2007). Adaptive capacity in disaster management specifically refers to anticipating, handling, and recovering from the consequences of earthquakes and other disasters. Various studies, such as those by Adger et al. (2007) and Lin and Lee (2023), have emphasized that adaptive capacity hinges on access to resources, information, social networks, and governance structures. However, limited attention has been given to quantifying how community preferences influence the development of adaptive capacity, a gap this study addresses by integrating resident-driven perspectives into CBEDM. Communities can enhance their adaptive capacity by investing in risk reduction education, infrastructure development, and emergency preparedness planning. These measures better equip communities to withstand and recover from disasters (Lin 2023; Lin and Lee, 2023; Muttarak and Lutz 2014).

Governments should consider adaptive capacity a vital element in developing effective disaster management plans. Considering factors such as disaster-related experience, risk perception, and awareness helps create strategies aligned with community needs and abilities (Lin 2023; Lin and Lee, 2023; Tobin 1999). Additionally, involving residents, who often serve as first responders, in planning can tap into their valuable disaster response knowledge (Paton 2007). In earthquake disaster management, adaptive capacity enables communities to anticipate, cope with, and recover from impacts. This study builds on frameworks such as those proposed by Lin (2023) and Jia et al. (2021), integrating economic and behavioral dimensions to enhance the relevance of CBEDM strategies. (Figure 1)

2.2. Capacity building in earthquake disaster management

Capacity building is a crucial process that involves developing the necessary skills, knowledge, and resources to effectively prepare for, respond to, and recover from

disasters, with a particular focus on earthquake disaster management (Lin and Lee, 2023; Devendra and Akhilesh, 2014; King and Cruickshank 2012). It aims to strengthen the capacity of individuals, organizations, and communities to deal with disasters effectively (Johnston et al. 2022; Lin 2023; Lin and Lee, 2023). Previous studies, such as Hagelsteen and Becker (2013), highlight that capacity building must extend beyond technical skills to foster collaboration among local communities and stakeholders. This study aligns with such approaches, emphasizing capacity building as an interactive process involving training, infrastructure investments, and institutional support to enhance CBEDM. Capacity building plays a critical role in disaster management by enhancing individuals, communities, and organizations' skills, knowledge, and capabilities in disaster preparedness, response, and recovery (Lin 2023; Johnston et al. 2022; Lin and Lee, 2023). One achieves capacity through selecting and training individuals who can plan, coordinate, and intervene during crises. Investing in capacity-building can strengthen disaster management processes, leading to more effective disaster response and a more resilient population (Lin and Lee 2024; Devendra and Akhilesh, 2014; Hagelsteen and Becker 2013). This study also builds upon findings by Deng et al. (2019), which emphasize the critical role of capacity building in disaster recovery. By integrating community participation into capacity-building processes, we provide actionable insights to enhance CBEDM sustainability.

Local communities are vital in effective disaster management and rapid recovery. Therefore, it is important to build the capacity of local communities and young people to reduce the impact of disasters. Community resilience starts by involving them in disaster management activities, including planning, training, drills, and preparation (Lin 2023; Lin and Lee, 2023; Deng et al. 2019; Devendra and Akhilesh, 2014). Facilitating disaster preparedness, response, and risk reduction necessitates emphasizing and collaboratively creating the concept of capacity building as a new impetus (Lin and Lee, 2023; Tadele and Manyena 2009). This approach involves focusing on community disaster prevention training, establishing disaster prevention teams or institutions, providing basic earthquake disaster training, promoting information sharing and coordination within the community, and other capacity-building measures.

2.3. Integration of adaptive capacity and capacity building in CBEDM

While adaptive capacity provides the foundation for communities to anticipate and respond to disasters, capacity building operationalizes this potential by equipping individuals and institutions with the tools and knowledge necessary for effective disaster management. This study bridges these two dimensions, offering an integrative framework that evaluates resident-driven preferences to enhance CBEDM strategies. This study aims to enhance the community's ability to cope with disasters by considering adaptive capacity and capacity building from the perspective of earthquake disaster prevention (Lin 2023; Lin and Lee, 2023; Devendra and Akhilesh, 2014). Community participation in disaster prevention activities fosters interactive partnerships among stakeholders involved in regional development and disaster prevention-related activities. This collaborative approach strengthens communities' earthquake

disaster prevention capabilities, enabling them to respond more effectively to disasters and sustainably manage capacity building in earthquake disaster management (Lin 2023; Lin and Lee, 2023; Devendra and Akhilesh, 2014).

3. Study area and research method

This research delves into the preferences and behaviours of a community when it comes to managing and adapting to earthquake disasters. It examines interviews with stakeholders, specifically looking at the community's present circumstances and aspirations for improvement with the five dimensions of adaptive capacity in the context of CBEDM. The information gathered from these interviews can offer valuable insights for designing the attributes and levels within a CBEDM framework. In the following section, we introduce the study area and outline this study's research methodology.

3.1. Study area

In the Circum-Pacific seismic zone, Taiwan is highly susceptible to frequent and powerful earthquakes. This vulnerability is especially prominent in eastern Taiwan, where earthquakes often occur in clustered patterns, resulting in significant disasters. Notably, Taiwan has witnessed two major earthquakes measuring 7.1 on the Richter Scale: the Taichung quake in 1935 and the Zhongpu quake in 1941 (Central Emergency Operations Center (CEOC); National Fire Agency (NFA), 2021). These events claimed the lives of over 3,000 and 4,500 individuals, respectively, while extensively damaging infrastructure.

More recently, two other significant earthquakes occurred: the Jiji quake on September 21, 1999, with a magnitude of 7.3, resulting in 2,415 fatalities, and the magnitude 6.4 earthquake striking north of Hualien on February 6, 2018. The latter primarily affected older soft-story buildings and led to significant casualties in Hualien City and Sincheng Township (Central Emergency Operations Center (CEOC); National Fire Agency (NFA), 2021). Hualien City and Sincheng Township were selected for this study based on their distinct urban-suburban characteristics and historical exposure to seismic risks. Hualien City, a densely populated urban area with diverse economic activities, offers insights into urban earthquake preparedness and resilience. In contrast, Sincheng Township, a suburban region with a smaller, more tight-knit population, represents a different community structure that relies heavily on local resources and social networks for disaster response. By analyzing these two distinct areas, the study captures a broader spectrum of community dynamics and preferences for CBEDM strategies.

Hualien City comprises six joint district offices divided into 44 administrative districts, with a population of 99,500. Sincheng Township covers nine villages with a population of 203,307 (Statistical Information Network of Hualien County (Taiwan)), 2022). The selection of these regions also considered demographic diversity, infrastructure characteristics, and their representation of Taiwan's seismically active

identified five domains of adaptive capacity regarding climate change. This research formed a solid foundation for our attribute selection. Second, Grothmann and Patt (2005) explored the perceptual dimension of adaptive capacity, which provided valuable insights into community perspectives on climate change adaptation. Third, we conducted an extensive literature review on disaster management to gather comprehensive knowledge on effective strategies and approaches. Fourth, we obtained insights from interviews with stakeholders, such as community leaders and experts in the field, which further contributed to the attribute development. The selection of attributes aligns with the research questions, focusing on key dimensions of adaptive capacity and community involvement. Attributes include: (1) disaster prevention assets, (2) management strategy flexibility, (3) inter-organizational collaboration, (4) community knowledge and skills, (5) the presence of a dedicated disaster management agency, and (6) willingness to participate (WTP). These attributes reflect the multidimensional nature of CBEDM and its reliance on resident-driven participation.

Each attribute has two levels in addition to the status quo. The status quo represents the current state or existing practices. For example, the first attribute's status quo is that most communities only share community disaster prevention information through broadcasting equipment. Similarly, the fifth attribute's status quo indicates that no disaster prevention organizations currently exist within the community. The inclusion of WTP as an attribute, with five levels (0, 8, 16, 24, and 36 h per year per person), is critical to understanding community members' time commitment and engagement willingness in CBEDM initiatives. These levels enable a nuanced analysis of the trade-offs residents are willing to make, thus providing insights into optimal policy designs that align with community priorities (Table 1).

Random utility theory forms the basis of choice experience (CE), stating that individuals base their choices on available alternatives and select the ideal alternatives with the highest utility are selected (Lin 2023; Lin and Lee, 2023; Suryawan and Lee 2023). We can represent the utility function of each alternative in a linear form as follows:

$$Uni = \beta_{ni} X_{ni} + \varepsilon_{ni} \quad (1)$$

where Uni represents the overall utility, which combines the observable and unobservable utilities of individual n and alternative i ; X_{ni} denotes the level of attributes that constitute the alternatives; β_{ni} represents the level-dependent coefficient, and ε_{ni} represents the random component, which represents the selected unobserved properties.

This study integrates CBEDM attributes and adaptive capacity levels associated with earthquakes, listed in Table 1, into a preference function expressed by the following formula:

$$V_j = \beta_1 \times ASS1 + \beta_2 \times ASS2 + \beta_3 \times STR1 + \beta_4 \times STR2 + \beta_5 \times ORG1 + \beta_6 \times ORG2 \\ + \beta_7 \times LEA1 + \beta_8 \times LEA2 + \beta_9 \times AGE \ 1 + \beta_{10} \times AGE \ 2 + \beta_{11} \times WTP_j \quad (2)$$

Table 1. Attributes and levels of the community-based earthquake disaster management framework under the theory of adaptive capacity.

Attribute	Levels	Variable	Literature
Assets (ASS) Increase the disaster prevention assets the community can draw upon in times of need	0. Most communities only announce community disaster prevention information through broadcasting equipment (Status Quo) 1. Replace or rebuild infrastructure to better adapt to earthquake disaster 2. Strengthen community assets and share infrastructure with other communities (e.g. refuge spaces)	ASS $\pm$ ASS 1 ASS 2	Lin 2023 Pribadi et al. 2021 Sathurshan, et al. 2022 Tang, et al. 2010
Strategies (STR) Improve the flexibility of earthquake disaster management strategies	0. Only the government and schools have carried out disaster prevention-related plans, and no relevant disaster prevention drills have occurred in the community (Status Quo) 1. Develop community disaster prevention incentives 2. Increase space in community disaster shelters	STR $\pm$ STR 1 STR 2 STR 1 STR 2	Lin 2023 Lin and Lee, 2023 Lin and Lee, 2023 HHaworth et al. 2018
Organizations (ORG) Strengthening links between community organizations	0. The community does not have any links between social organisations (Status Quo) 1. Establishment of Community Disaster Management Committee 2. Strengthening collaboration between community organizations and disaster relief agencies	ORG $\pm$ ORG 1 ORG 2	Lin 2023 Lin and Lee, 2023 Lin and Lee, 2023 WWu and Chang 2018
Learning (LEA) Learning to respond with disaster risk mitigations	0. There are no disaster prevention courses and drills in the community (Status Quo) 1. Hold regular community disaster prevention lectures 2. Regular community disaster preparedness courses, training, and drills	LEA $\pm$ LEA 1 LEA 2	Lin 2023 Lin and Lee, 2023 Lin and Lee, 2023 Pribadi, et al. 2021
Agency (AGE) Set up an Earthquake Disaster Management Response Agency	0. The community does not currently have any disaster prevention organizations (Status Quo) 1. The government guides communities to build disaster crisis teams to strengthen the community's ability to deal with disasters 2. Empowering NGOs to help the community strengthen disaster preparedness and resilience	AGE $\pm$ AGE 1 AGE 2	Lin 2023 Lin and Lee, 2023 Lin and Lee, 2023 HHaworth et al. 2018
WTP Willingness to participate	a. 0 hr./year/person (Status Quo) b. 8 hr./one year/person c. 16 hr./ one year /person d. 24 hr./ one year /person e. 36 hr./ one year /person	Hour	Lin 2023

where V_j represents the preference function for CBEDM related to earthquake events relative to alternative j and the other attributes and levels, β_1 – β_{10} are the estimated coefficients for each alternative level, and β_{11} is the estimated coefficient for WTP. Table 1 presents the definitions and descriptions of each attribute and level.

We calculate the marginal willingness to participate (MWTP) value by referring to the estimation results of community resident preferences. The MWTP of CBEDM follows the changes in levels, measured by the ratio of the parameters of each attribute and the WTP, as shown in the following formula:

$$MWTP = \frac{-\beta_{attributes}}{\beta_{WTP}} \quad (3)$$

where $\beta_{attributes}$ represents the attribute coefficient of communities' CBEDM preference, and β_{WTP} represents the attribute coefficient of WTP. In summary, this study utilises the empirical results of Equations (1) and (2) to measure MWTP within the CBEDM framework.

3.3. Establishing community-based earthquake disaster management preference models

The study consists of three essential steps to establish a preference model for CBEDM, focusing on adaptive capacity and identifying key attributes. These steps are as follows. First, we focused on the reconstruction of six attributes (Table 1). Second, we utilised the adaptive capacity concept to inform the preference model and reviewed the disaster management literature. We also interviewed various stakeholders, including architects, government staff, firefighters, NGOs, and community leaders. These interviews aimed to confirm the level of each attribute described in Table 1. Third, to evaluate the welfare effects of residents' CBEDM preference model and test the validity of the questionnaire, we visited the study site and distributed 50 pre-test questionnaires. These questionnaires included open-ended questions to investigate respondents' willingness to pay (WTP) for CBEDM (Lin 2023; Lin and Lee, 2023; Lin and Lee, 2023). We used Table 1 to finalize the five levels of WTP, while Table 2 records the coding variable and description of each attribute level.

3.4. Choice set design of community-based earthquake disaster management

All attributes and levels combined in the study's experimental design resulted in 1,215 potential sets. We achieved this total by using an orthogonal main effect design, with three options for each attribute and five levels for one attribute, giving $3 \times 3 \times 3 \times 3 \times 3 \times 5 = 1,215$ combinations. We removed 12 unreasonable alternative cards from these potential sets, leaving 25 alternative choice sets. We can use the formula $N=13$ for the 13 remaining alternative cards to calculate the number of versions, denoted as N . We determine the final choice set, P , by multiplying N by $(N-1)$ and dividing the result by 2, giving $P = (13)(13-1)/2 = 78$ choice sets. Then, we calculate the final version, X , by dividing P by 3, resulting in $X = 78/3 = 26$ versions. Figure 3 illustrates these versions, where we randomly sorted the alternatives into three choice sets. Each choice set consists of two proposed options and a status quo option, resulting in 26 versions.

We developed the CBEDM attributes and levels through stakeholder discussions and a pre-test in the study area. The questionnaire used for data collection consisted of three parts. The first section examined the current state of individuals' and communities' adaptive capacity towards disaster prevention. It included questions about respondents' awareness of disaster prevention measures, their willingness to cooperate with the local government, their ability to escape and evacuate during a disaster, and

Table 2. Coding variable and description of each attribute and level.

Attribute	Description	Coding variable	Scale type
OBS	Number of respondents	1 to 442 (total 442 samples)	Text
ASC	Alternative specific constant	0 = Alternative scenario 1 = Status quo	Nominal
ASS1	Replace or rebuild infrastructure to better adapt to earthquake disaster	1 = Replace or rebuild infrastructure to better adapt to earthquake disaster 0 = Other options -1 = Status quo	Nominal
ASS2	Strengthen community assets and share infrastructure with other communities	1 = Strengthen community assets and share infrastructure with other communities 0 = Other options -1 = Status quo	Nominal
STR1	Develop community disaster prevention incentives	1 = Develop community disaster prevention incentives 0 = Other options -1 = Status quo	Nominal
STR2	Increase space in community disaster shelters	1 = Increase space in community disaster shelters 0 = Other options -1 = Status quo	Nominal
ORG1	Establishment of Community Disaster Management Committee	1 = Establishment of Community Disaster Management Committee 0 = Other options -1 = Status quo	Nominal
ORG2	Strengthening collaboration between community organisations and disaster relief agencies	1 = Strengthening collaboration between community organisations and disaster relief agencies 0 = Other options -1 = Status quo	Nominal
LEA1	Hold regular community disaster prevention lectures	1 = Hold regular community disaster prevention lectures 0 = Other options -1 = Status quo	Nominal
LEA2	Regular community disaster preparedness courses, training, and drills	1 = Assemble nongovernment and government forces to respond to disasters that occur. 0 = Other options -1 = Status quo	Nominal
AGE1	The government guides communities to build disaster crisis teams to strengthen the community's ability to deal with disasters	1 = The government guides communities to build disaster crisis teams to strengthen the community's ability to deal with disasters 0 = Other options -1 = Status quo	Nominal
AGE2	Empowering NGOs to help the community strengthen disaster preparedness and resilience	1 = Empowering NGOs to help the community strengthen disaster preparedness and resilience 0 = Other options -1 = Status quo	Nominal
WTP	Participate Hours	0 hr./year/person (Status quo) 8 hr./one year/person 16 hr./ one year /person 24 hr./ one year /person 36 hr./ one year /person	Ratio/Interval
CHOOSE	Scenario that chooses	0 = Not choose, 1 = Choose	Nominal
Gen	Gender	0 = Male, 1 = Female	Nominal
Inc	Grouping of monthly income	0 = <50000 NT 1 = >50001 NT or over	Nominal

(continued)

Table 2. Continued.

Attribute	Description	Coding variable	Scale type
A3	Do you and your community have the ability to deal with the disaster when an earthquake strikes?	0 = No 1 = Yes	Nominal
A5	Does your community have a disaster prevention team?	0 = No 1 = Yes	Nominal
A6	Would you like to participate in disaster prevention-related training and drills?	0 = No 1 = Yes	Nominal
A7	Do you have a strong awareness of earthquakes and can initially assess earthquake hazards?	0 = No 1 = Yes	Nominal
A8	Do you know how to escape and evacuate when an earthquake occurring	0 = No 1 = Yes	Nominal
A9	Do you have the basic survival skills needed after an earthquake?	0 = No 1 = Yes	Nominal
D6	Edu (University degree)	0 = Below 1 = Above	Nominal
D8	Will you participate in your community's disaster prevention organisation to be a member?	0 = No 1 = Yes	Nominal
D9	Are you willing to cooperate with local government and social organisations to implement disaster management (community disaster prevention)?	0 = No 1 = Yes	Nominal

their willingness to establish a disaster crisis team. The second section consisted of three choice experiments (CE) focusing on CBEDM (Figure 3). Each CE question offered three options. The section aimed to determine disaster management preferences based on community organisational behaviour. It gathered information about earthquake prevention and the current situation of CBEDM attributes. It aimed to understand the community's desire to improve the system. The final section gathered data about residents' socioeconomic backgrounds. The questionnaire was available in English and Chinese to accommodate different language preferences.

3.5. Choice experiment scenarios of community-based earthquake disaster management and adaptive capacity

Combining the CE method and the Random Parameter Logit (RPL) model has proven effective in evaluating various aspects, such as tourist preferences and sustainable tourism management (Adger 2006; Lin 2023; Lin and Lee, 2023). Researchers have also applied it to assess residents' protection preferences and protected area management (Lin 2023; Lin and Lee, 2023; Suryawan and Lee 2023), as well as citizen's protection preferences in environmental management welfare impact (Lin and Lee, 2023; Suryawan and Lee 2023). These studies have examined different scenarios, providing valuable management recommendations based on their findings. This study used the RPL model to develop a hypothetical scenario for CBEDM in a selected community in Eastern Taiwan. By comparing available options with the current earthquake situation, the study proposed a CBEDM plan. Through evaluating multiple CBEDM scenarios,

Choice Set 1			
Attribute	Alternative 1	Alternative 2	Status Quo
Increase the disaster prevention assets that the community can draw upon in times.	 Replace or rebuild infrastructure to better adapt to earthquake disasters.	 Replace or rebuild infrastructure to better adapt to earthquake disasters.	 Most communities only announce community disaster prevention information through broadcasting equipment.
Improve the flexibility of earthquake disaster management strategies.	 Only the government and schools have carried out disaster prevention-related plans, and no relevant disaster prevention drills have been carried out in the community.	 Only the government and schools have carried out disaster prevention-related plans, and no relevant disaster prevention drills have been carried out in the community.	 Only the government and schools have carried out disaster prevention-related plans, and no relevant disaster prevention drills have been carried out in the community.
Strengthening links between community organizations	 Strengthening collaboration between community organizations and disaster relief agencies	 Strengthening collaboration between community organizations and disaster relief agencies	 The community does not have any links between social organizations.
Learning to respond with disaster risk mitigations	 Hold regular community disaster prevention lectures	 No any disaster prevention courses and drills	 No any disaster prevention courses and drills
Set up an earthquake disaster management response agency.	 The government guides communities to build disaster crisis teams to strengthen the community's ability to deal with disasters.	 The community does not currently have any disaster prevention organizations.	 The community does not currently have any disaster prevention organizations.
Willingness to participate	24 hr. /per year	8 hr. /per year	0 hr. /per year
Please select one	☐	☐	☐

Figure 3. Choice Set of choice Experiment questionnaire of the adaptive capacity for community-based earthquake disaster management.

this research collected comprehensive data to inform sustainable disaster management decision-making. The study presents three CBEDM strategies, as follows.

Scenario 1. Enhancing residents' adaptability and flexibility in disaster prevention through earthquake-resistant measures, infrastructure replacement or rebuilding, and community-based disaster prevention incentives.

Scenario 2. Improving residents' awareness and stability in disaster prevention by strengthening community assets, sharing infrastructure with neighbouring communities, increasing the capacity of community disaster shelters, supporting collaboration between community organisations and disaster relief agencies, conducting regular community disaster prevention lectures, and guiding communities to build disaster crisis teams.

Scenario 3. Transforming community disaster management by integrating all five attributes at a higher level (level 2) into a cohesive plan. This approach involves

strengthening community assets, sharing infrastructure with neighbouring communities, increasing the capacity of community disaster shelters, improving collaboration between community organisations and disaster relief agencies, conducting regular disaster preparedness training courses and drills, and empowering NGOs to assist the community in enhancing disaster preparedness and resilience.

These strategies provide a framework for effective CBEDM planning and implementation.

4. Results

The study applied a choice experience method to assess the residents' diverse preferences, attribute values, and willingness to participate (Lin 2023; Lin and Lee, 2023; Suryawan and Lee 2023). In addition, we used a non-random selection approach to conduct face-to-face interviews with residents (Lin 2023; Lin and Lee, 2023; Sriarkarin and Lee 2018) in six union villages in Hualien City and nine villages in Sincheng Township (Figure 2).

We surveyed from October 2022 to February 2023, encompassing off-peak and peak periods. With a 95% confidence level and a 5% estimate bias, we assume that Hualien City and Xincheng Township share the same preference for the CBEDM program. We collected 460 responses from residents, ensuring a sufficient sample size of 442 individuals. Of these, 364 samples originated from Hualien City, while 78 samples were from Sincheng Township. We used descriptive statistics to analyse the frequency distribution and gain insights into the sample's distribution. Consequently, the analysis results from these 442 samples can serve as a valuable reference for future research.

4.1. Community residents' preference heterogeneity regarding CBEDM

Table 3 displays two latent classes identified by the impact of demographic factors and community features under CBEDM, such as housing ownership, education level, willingness to cooperate with the government and organisations, adaptability to community disaster prevention, awareness of community disaster prevention, capacity for community disaster response, and community disaster resilience. These factors were modeled using the RPL framework, with Table 3 explicitly detailing the coefficients, log-likelihood functions, and LLR values to illustrate the model's high goodness-of-fit. Latent classes 1 and 2 are almost identical, each accounting for roughly half of the samples. Residents in class 1 (50.8%) have a high school degree or lower and don't own a house. Despite their reluctance to collaborate with local government and social organizations for disaster management implementation, respondents in this group are highly motivated to change the existing situation. They show a favorable inclination towards all CBEDM strategies except for "LEA1" and "LEA2."

In contrast, residents in latent class 2 (49.2%) owned homes and had higher education levels (college degree or above). Respondents within this group significantly preferred all strategies except "STR1," despite their lack of interest in disaster prevention plans. Table 3 was added to visually depict the proportion of preferences for each

Table 3. LCM and RPL models in residents' preferences.

Attributes and Levels	Class 1 (50.8%)				Class 2 (49.2%)				All residents (442)			
	Coeff.	Std. Error	MWTP ^a		Coeff.	Std. Error	MWTP		T value	Std. Error	T value	
ASS1	1.133***	.306	3.70		1.266***	.490	2.58		6.20	0.513***	6.20	2.47
ASS2	-.869**	.392	-2.22		1.684**	.717	2.35		1.76	1.065***	1.76	3.87
STR1	1.776***	.347	5.11		-.491	.494	-.99		5.27	0.694***	5.27	3.60
STR2	1.423**	.635	2.24		-2.225**	1.133	-1.96		0.78	0.318	0.78	0.90
ORG1	-1.705**	.736	-2.32		4.988***	1.388	3.59		4.56	1.246***	4.56	5.02
ORG2	1.759***	.569	3.09		-2.438**	1.031	-2.36		-0.01	0.810***	-0.01	3.04
LEA1	.470	.675	.70		-1.778*	.931	-1.91		5.26	0.488**	5.26	2.00
LEA2	-.415	.888	-.47		5.064***	1.513	3.35		2.75	0.846***	2.75	3.40
AGE 1	-1.637*	.851	-1.92		6.560***	1.672	3.92		5.18	0.553***	5.18	2.78
AGE 2	3.687***	1.123	3.28		-6.652***	1.990	-3.34		-1.82	0.783**	-1.82	2.12
WTP	-.124***	.0312	-3.99		-.124***	.0391	-3.18		-6.29			
Class characteristics: Class 1												
Constant	.862***	.300	2.87									
A3 Do you and your community have the ability to deal with the disaster when an earthquake strikes?	-.102	.332	-.31									
A7 Do you have a strong awareness of earthquakes and can initially assess earthquake hazards?	.628***	.209	3.00									
A8 Do you know how to escape and evacuate when an earthquake occurs?	.341	.246	1.38									
A9 Do you have the basic survival skills needed after an earthquake	-.568**	.255	-2.23									
D4 Homeownership (owner)												
D6 Edu (University degree or above)	-.420**	.171	-2.45									
D9 Will you cooperate with local government and social organisations to implement disaster management?	-.341**	.171	-1.99									
	-.621*	.257	-2.41									
Model properties LLR	867.712											
McFadden Pseudo R2 Parameters	.299											
Chi-square												
Log-likelihood ratio (LLR)												
									$\chi^2 (21, 0.01) = 38.93$			
									871.62			

***, **, * are significance differences at $p < 0.001$, $p < 0.05$, and $p < 0.1$, respectively.

latent class, highlighting the demographic differences that influence preferences across CBEDM strategies.

4.2. Effectiveness of marginal willingness to participate (MWTP)

Table 4 presents the outcomes of applying an independent sample t-test to compare the mean willingness to participate across two groups of respondents, categorized by age, education level, income level, home ownership, marriage, and interest in WTP for CBEDM-related resilience activities. As shown in Table 4, MWTP for specific attributes like ASS1 (strengthening community assets) and LEA2 (community training and drills) was significantly higher among homeowners and those with higher education levels. The test results indicate that the MWTP of ASS1, ASS2, STR1, STR2, ORG1, and LEA2 was significantly higher than that of non-homeowners.

Results also show respondents with higher education levels are more likely to participate in all attributes. The willingness of high-income residents to participate in disaster prevention plans is significantly higher than that of low-income residents, as reflected by their higher MWTP. Those willing to collaborate with local governments or organisations, share their disaster prevention resources with other communities, and engage in disaster prevention courses and drills are more likely to participate in disaster prevention-related projects. Various factors influence residents' participation in disaster prevention programs and related activities, including marriage, age, education level, income, house ownership, awareness of community disaster prevention, and the level of concern for disaster prevention issues. Moreover, cooperating with local governments and organisations significantly increases residents' willingness to participate in CBEDM.

4.3. Welfare analysis of CBEDM preferences

The RPL model results for MWTP across CBEDM attributes are shown in Table 5. The table includes 95% confidence intervals and t-values. The results show that all attribute ratings had significant positive effects, indicating respondents are willing to participate in various strategies to improve the community's current situation.

Collaboration between community organisations and disaster relief agencies aims to strengthen disaster relief efforts (ORG2). The minimum MWTP required per person is 0.004 h per year. Interestingly, urban respondents are more willing to pay (0.170 h/week/person) for stronger cooperation between ORG2 compared to non-urban and all residents. The STR2 to increase the space in community disaster shelters is 1.388 h per year per person. ASS2 proposes strengthening community assets and sharing infrastructure with other communities, with an MWTP of 2.008 h per year per person. STR1 recommends developing disaster prevention incentives, with respondents willing to spend 6.594 h per year per person. ASS1 suggests replacing or rebuilding infrastructure to better adapt to earthquake disasters, with respondents willing to pay 9.431 h per year per person.

Establishing a community disaster management committee (ORG1) requires an average of 11.009 h per person per year. Meanwhile, the government's guidance

Table 4. Heterogeneity of mean MWTP of demographics and behaviour towards community-based earthquake disaster management.

Grouping Criteria	n	ASS1		ASS2		STR1		STR2		ORG1		ORG2		LEA2		AGE1		
		MWTP	t value	MWTP	t value	MWTP	t value	MWTP	t value	MWTP	t value	MWTP	t value	MWTP	t value	MWTP	t value	
Does your community have the ability to deal with an earthquake disaster?	Yes	31	9.34	-0.51	1.62	-0.71	6.21	-1.23*	1.34	-0.81	9.43	-2.01**	-0.55	-1.52*	16.10	-1.85*	14.38	0.09
	No	411	9.44		2.04		6.62		1.39		11.12		0.05		16.82		14.36	
Would you participate in disaster prevention training and drills?	Yes	354	9.49	2.68**	2.14	1.75*	6.72	3.06***	1.39	0.59	11.15	1.30*	0.10	1.95*	16.89	2.40**	14.46	3.55***
	No	88	9.18		1.49		6.08		1.37		10.44		-0.39		16.30		13.94	
Do you know how to escape an occurring earthquake?	Yes	235	9.45	0.48	1.85	-1.11*	6.62	0.38	1.36	-1.48*	10.83	-0.90	0.06	0.59	16.95	1.90*	14.42	1.12*
	No	207	9.41		2.19		6.56		1.41		11.22		-0.06		16.57		14.29	
Do you have the survival skills after an earthquake?	Yes	223	9.49	1.36*	2.03	0.165	6.56	-0.47	1.38	-0.77	11.11	0.46	0.10	1.01*	17.05	2.83**	14.48	2.07**
	No	219	9.37		1.98		6.63		1.40		10.91		-0.10		16.49		14.24	
Marriage	Married	250	9.41	-0.52	1.82	-1.42*	6.61	0.28	1.39	0.22	11.08	0.36	-0.07	-0.80	16.89	1.34*	14.28	-1.56*
	Single	192	9.46		2.25		6.57		1.38		10.92		0.10		16.62		14.47	
Age (40-49)	Above	236	9.45	0.39	2.09	0.58	6.70	1.31*	1.40	1.09*	11.01	0.00	-0.00	-0.06	16.94	1.84*	14.35	-0.18
	Below	206	9.41		1.92		6.47		1.37		11.01		0.01		16.58		14.37	
Household	Owner	211	9.52	1.84*	2.22	1.36*	6.76	1.83*	1.43	2.51**	11.55	2.40**	0.10	0.86	17.00	2.25**	14.41	0.72
	Other	231	9.35		1.82		6.45		1.35		10.52		-0.08		16.56		14.32	
Employment	Employed	299	9.43	-0.08	1.98	-0.27	6.66	1.08*	1.37	-1.20*	11.02	0.07	0.09	1.20*	16.90	1.89*	14.41	1.05*
	Other	143	9.44		2.07		6.46		1.42		10.99		-0.17		16.50		14.27	
Education (University degree)	Above	259	9.46	0.68	2.27	2.12**	6.72	1.85*	1.42	2.56**	11.22	1.14*	0.03	0.36	16.76	-0.15	14.45	1.87*
	Below	183	9.39		1.63		6.41		1.34		10.72		-0.04		16.79		14.23	
Income (50,001 ~ 70,000 NTD)	Above	63	9.65	1.90*	3.44	3.97***	6.61	0.08	1.42	0.76	11.61	1.13*	0.61	2.49**	17.00	0.96	14.71	2.45**
	Below	379	9.40		1.77		6.59		1.38		10.91		-0.10		16.73		14.30	
Would you participate in a disaster prevention organisation?	Yes	230	9.50	1.61*	2.32	2.21**	6.72	0.11	1.40	0.87	11.31	1.45*	0.05	0.43	16.9	1.41*	14.49	2.29**
	No	212	9.35		1.67		6.17		1.37		10.68		-0.04		16.6		14.22	
Would you cooperate with local government & organisations to implement disaster management?	Yes	381	9.50	3.60***	2.20	3.17***	6.67	2.30**	1.40	1.95*	11.26	2.94**	0.11	2.61**	16.97	5.06***	14.43	2.91**
	No	61	9.02		0.84		6.11		1.31		9.44		-0.64		15.55		13.94	
Would you share disaster prevention infrastructure between communities?	Yes	343	9.49	2.19**	2.13	1.54*	6.59	-0.02	1.40	0.88	11.19	1.59*	0.10	1.71*	16.91	2.54**	14.42	1.89*
	No	99	9.24		1.58		6.60		1.36		10.37		-0.31		16.30		14.16	

Table 5. The estimated results of the marginal willingness to participate.

Attributes and levels	All (n = 442)			Urban (n = 364)		Suburban (n = 78)	
	μ MWTP	C. I.	t-value	μ MWTP	C. I.	μ MWTP	C. I.
ASS1	9.431	9.340→9.521	3.809***	9.511	9.424→9.598	9.057	8.754→9.360
ASS2	2.008	1.716→2.301	3.409***	2.241	1.934→2.548	0.923	0.133→1.713
STR1	6.594	6.428→6.760	3.366***	6.724	6.558→6.891	5.985	5.474→6.496
STR2	1.388	1.355→1.421	3.342***	1.414	1.380→1.448	1.268	1.173→1.362
ORG1	11.009	10.586→11.433	4.017***	11.404	10.955→11.854	9.167	8.086→10.247
ORG2	0.004	-0.192→0.201	3.628***	0.170	-0.040→0.380	-0.770	-1.264→-0.276
LEA2	16.771	16.576→16.965	3.085**	16.911	16.708→17.114	16.116	15.574→16.657
AGE1	14.362	14.247→14.477	2.099**	14.420	14.302→14.536	14.096	13.743→14.449

Note: μ MWTP = Average marginal WTP; C. I. = Range of the 95% confidence interval.

***, **, * are the significant difference at $p < 0.001$, $p < 0.05$, $p < 0.1$, respectively.

(AGE1) to build disaster crisis teams requires an average of 14.362 h per person per year. However, LEA2 offers the highest MWTP, providing regular community disaster preparedness courses, training, and drills, totaling 16.771 h per year per person. This result indicates that people are more willing to invest their time in disaster prevention courses and drills, prioritising their personal disaster prevention awareness and adaptation abilities over other strategies.

Overall, the study found that urban residents are more willing to pay for each attribute level than non-urban residents, indicating that urban respondents are more willing to spend time on these alternatives than non-urban respondents.

4.4. Welfare estimation under hypothetical CBEDM scenarios

The study estimated welfare values for three hypothetical CBEDM scenarios using RPL coefficients: (1) Focusing on residents' adaptive and flexible skills in disaster prevention, (2) Enhancing residents' awareness and stability in disaster prevention, and (3) Transforming community disaster management.

According to Table 6, Scenario 3, which integrates all attributes at their highest levels, has the highest WTP value at 24.24 h per year per person, equivalent to 4,048 New Taiwan Dollars (NTD). This scenario prioritizes cohesive strategies such as infrastructure strengthening, disaster preparedness training, and community collaboration. The next highest value was in the "enhancing residents' awareness and stability in disaster prevention" scenario at 20.31 h per year per person, equivalent to 3,392 NTD per year per person based on monthly average income. Finally, the scenario "focusing on residents' adaptive and flexibility skills in disaster prevention" had an MWTP value of 19.15 h per year per person, equivalent to 3,198 NTD per year per person based on monthly average income. The 95% confidence intervals show significant differences in mean MWTP between scenarios. Figure 1 was shown to compare MWTP across the three scenarios, emphasizing the higher willingness to participate in comprehensive CBEDM strategies.

The study's findings indicate that CBEDM can be a highly effective strategy for preventing and managing disasters. By improving community awareness, adaptive capacity, capacity building, collaboration, and empowerment, communities can become better equipped to handle disasters and reduce their vulnerability to such events.

Table 6. Welfare estimates under hypothetical scenarios of community-based earthquake disaster management.

Attributes and Levels	Hypothetical Scenarios		
	Scenario 1	Scenario 2	Scenario 3
	Focusing on residents' Adaptive & Flexibility in disaster prevention	Enhancing residents' Awareness and Stability in disaster prevention	Transforming community disaster management
Increase the disaster prevention assets that the community can draw upon in times of need	Replace or rebuild infrastructure to better adapt to earthquake disasters.	Strengthen community assets and share infrastructure with other communities.	Strengthen community assets and share infrastructure with other communities.
Improve the flexibility of earthquake disaster management strategies	Develop community disaster prevention incentives.	Increase space in community disaster shelters.	Increase space in community disaster shelters.
Strengthening links between community organisations	Status Quo	Strengthen collaboration between community organisations and disaster relief agencies.	Strengthen collaboration between community organisations and disaster relief agencies.
Learning to respond with disaster risk mitigations	Status Quo	Hold regular community disaster prevention lectures.	Hold regular community disaster preparedness courses, training, and drills.
Set up an Earthquake Disaster Management Response Agency	Status Quo	The government guides communities to build disaster crisis teams to strengthen the community's ability to deal with disasters.	Empower NGOs to help the community strengthen disaster preparedness and resilience.
Average MWTP (hour/year/ per person)	19.15 (3,198)	20.31 (3,392)	24.24 (4,048)
95% confidence interval of MWTP (hour/year/ per person)	(19.06–19.24) (3,183–3,213)	(20.08–20.54) (3,353–3,430)	(24.00–24.48) (4,008–4,088)

Note: 1 USD = 30 NTD (2023).

5. Discussion

5.1. Evolution of national disaster management and the importance of community-based strategies

Over time, national disaster management strategies have increasingly recognised the significance of integrating community-based disaster management strategies within national policies. Research by Lin (2023), Lin and Lee (2022, 2023), and Azad et al. (2019) support this shift towards disaster management. However, one critical concern for local government disaster management and community disaster prevention organisations is ensuring the sustainable development of community-based earthquake disaster management (CBEDM). This study addressed this concern by estimating community residents' disaster prevention preferences and willingness to participate (WTP). These insights provide valuable information about the marginal willingness to participate (MWTP) for multiple attributes of CBEDM (Tables 5 and 6).

5.2. Developing a plan for disaster prevention management

Drawing upon the preferences expressed by participants regarding different earthquake disaster management scenarios, the present study developed a plan for disaster prevention management to promote sustainable community development. Details of the plan are in Table 6, along with an evaluation framework that considers community adaptability and capacity building. Figure 1 provides an illustrative representation of a theoretical model for community disaster management sustainability.

This study used the contingent evaluation (CE) method to analyse urban and suburban residents' disaster prevention plan preferences. By exploring the correlation between residents' disaster prevention awareness, perceptions, responses, adaptive behaviours, and community disaster prevention organisations, the study shed light on the social welfare valuation of key attributes related to community disaster adaptation and capacity building. These attributes include (Table 1): (1) increasing the disaster prevention assets available to the community, (2) improving the flexibility of earthquake disaster management strategies, (3) strengthening links between community organisations, (4) promoting the adoption of disaster risk mitigation measures, and (5) establishing an Earthquake Disaster Management Response Agency.

The study estimated respondents' MWTP values for multiple attributes using the random parameter logit (RPL) model. Additionally, we used the latent class model (LCM) to assess preference heterogeneity regarding CBEDM attributes.

5.3. Support for community-based earthquake disaster management

According to the study's findings, respondents overwhelmingly supported the CBEDM program. The results suggest collaboration among local governments, non-profit organisations, and communities can enhance community preparedness and response capacity while improving the effectiveness of post-disaster recovery. Furthermore, involving community residents in disaster prevention plans can increase awareness and reduce the impact of disasters. Empowering social organisations to assist in community-based disaster management enhances the quality and delivery of recovery services, promotes social inclusion, and ensures transparency and accountability. These findings align with various sources, including Lin (2023), Lin and Lee (2022, 2023), Tariq et al. (2021), Deng et al. (2019), and Cui et al. (2018).

The study also revealed that communities actively participating in CBEDM programs and having a strong awareness of disaster prevention are more likely to support government-implemented disaster management development programs. Respondents identified disaster prevention education and drills within the community as crucial for improving citizens' awareness of disaster prevention. Moreover, strengthening a community's resilience management capacity can make it more independent, resilient, and self-preserving. These findings are consistent with the concept of disaster adaptive capacity and community-based disaster preparedness organisations, as presented by Lin (2023), Lin and Lee (2023), and Duchek (2020). They further support the argument that enhancing a community's disaster adaptive capacity and capacity building can improve its CBEDM capacity (Lin 2023; Lin and Lee, 2023; Cui et al. 2018).

To strengthen the practical relevance of the findings and provide actionable insights for policy implementation, local governments and NGOs should consider specific strategies. For instance, local governments could integrate community-based disaster prevention programs into their official disaster management frameworks, ensuring that policies prioritize community participation and capacity building. NGOs, in collaboration with governmental bodies, can facilitate training and educational campaigns to improve disaster awareness at the grassroots level. Additionally, fostering partnerships between local governments, NGOs, and community groups could further enhance the sustainability and effectiveness of CBEDM programs. By linking these findings directly to policy action, the study's insights can be transformed into tangible, impactful strategies for disaster risk reduction and community resilience.

6. Conclusion

This study emphasizes the need for an adaptive framework to evaluate community-based earthquake disaster management (CBEDM), identifies regional limitations, and proposes directions for future research. The framework utilises the CE approach depicted in [Figure 1](#), emphasising integrating various aspects of CBEDM to enhance its effectiveness. To optimise CBEDM, managers should focus on (1) increasing disaster prevention assets, (2) improving the flexibility of CBEDM strategies, (3) strengthening links between community organisations, (4) learning to respond with disaster risk mitigations, and (5) transforming community organisations.

We estimated the welfare effects of CBEDM by evaluating residents' willingness to participate in these strategies, using key attributes and levels identified in [Table 6](#). The study highlights three actionable scenarios, providing policymakers with a practical decision-making framework to enhance community disaster resilience. The findings underscore strong public support for CBEDM strategies, reflecting a collective willingness to engage and adapt to disaster prevention and recovery measures.

This research makes several key contributions. First, it offers a robust adaptive framework for evaluating and implementing CBEDM ([Figure 1](#)), which incorporates residents' preferences, adaptive capacity, and social welfare valuation. Second, the use of CE and RPL models highlights significant heterogeneity in community preferences, providing tailored strategies for urban and suburban contexts. Third, the study emphasizes collaboration between local governments, NGOs, and community stakeholders, fostering a multi-stakeholder approach for enhanced disaster management outcomes. Future studies should explore CBEDM frameworks in low-resource settings to generalize findings and examine regional differences in adaptive capacity.

Author contributions

Bih-Chuan Lin^{*1}: Corresponding Author* and First Author¹

Conceptualization, Data curation, Methodology, Writing—Original Draft, Project administration, Writing—Review & Editing,

Chun-Hung Lee*: Corresponding Author*

Conceptualization, Funding acquisition, Methodology, Project administration, Supervision and Writing—Review & Editing.

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We declare that this manuscript has not been published before and is not currently being considered for publication elsewhere.

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