

Developing Community Awareness in Disaster Risk Management toward NATECH

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Abstract

A catastrophic event is one that is difficult to predict in terms of timing, place, and impact. The impact is only visible after the catastrophe, as evidenced by statistics on the number of casualties and property damage. These incidents can potentially result in technology disasters, also termed as "natural-hazard triggered technological accidents (NATECH)". Explosions, fires, destruction of chemical storage sites, processing plants, gas/petroleum pipelines, nuclear reactors, toxic emissions, and other impacts are all possible. This makes the community very vulnerable if the importance of preventive action through mitigation and preparedness for disasters is not emphasized. This capability will facilitate the next phase in disaster management, namely the response and recovery phase. Therefore, the objectives of this study were to: (i) identify the key elements in the mitigation and disaster preparedness phase; and (ii) propose a framework for the measurement of the disaster prevention and preparedness phase. This framework was created using a combination of document analysis, interviews, observations, and focus group discussions with 129 respondents in Penampang, Sabah; Miri and Bintulu, Sarawak; Port Dickson, Negeri Sembilan; Southwest and Northeast Districts, Penang; Petaling Jaya and Shah Alam, Selangor; and Hulu Perak District in Perak. This study discovered numerous essential elements, including knowledge, experience, attitude, exposure, and awareness of the reaction, that influence people's perceptions of disasters, as well as mitigation efforts and disaster preparation. This research is expected to assist disaster management practitioners in developing activity modules and training/education curricula linked to disaster mitigation and preparedness in NATECH.

Keywords: community, disaster management, disaster preparedness, mitigation, NATECH

1. Introduction

A natural disaster is a catastrophe that results in loss including loss of life, economy, infrastructure and psychological effects or trauma to its victims Sendai Framework for Disaster Risk Reduction 2015-2030, 2015; The State of Queensland (Queensland Fire and Emergency Services, 2013). This catastrophe has caused destruction to property, loss of life and displacement of population. Natural disasters are mostly weather -related and have affected

more than 200 million people worldwide each year (UN, 2013). In Malaysia, the main disasters that often hit are floods, followed by landslides, droughts, forest fires and haze, besides also affected by earthquakes including tsunamis that occur in regional countries. In a period of 20 years (2008-2018) alone, the disaster that occurred in Malaysia has affected more than 3 million people, causing the death of 218 people, as well as costing RM 8 billion. (Malaysia Disaster Management Reference Handbook, 2019). National Security Council (NSC) Instruction No. 20 (2013) define disaster as: "Any incident whether natural or due to human factors that occurs suddenly causes injury/death and damage to property or the environment and causes disruption to the activities of daily living."

This definition clarifies that, a disaster is an event that causes disruption to community activities and state affairs, involving loss of life, property damage, economic loss and environmental destruction that exceeds the community's ability to cope and requires extensive resource mobilization action. Natural disasters also sometimes result in "technological disasters or natural-hazard triggered technological accidents" (NATECH). Natural disasters are likely to trigger explosions, fires, destruction of chemical storage sites, gas processing, nuclear reactors, toxic emissions and so on (Krausmann & Baranzini, 2009; Krausmann, Girgin & Necci, 2019). Among the NATECH-related incidents were, the earthquake and tsunami in Tohoku, Japan in 2011 that destroyed the Fukushima Dai-ichi Nuclear Power Plant (NPP); Hurricane Sandy, New York in 2012 which caused a hydro-carbon spill and Hurricane Harvey in Texas, USA in 2017 that caused oil and chemical leaks and spills; and landslides in Ecuador in 2013 resulted in cross -border pollution due to oil pipeline leaks (Buessler, Aoyama & Fukusawa, 2011; Hirose, 2012; Krausmann, Girgin & Necci, 2019). Therefore, disaster incidents are in dire need of handling that involves very extensive resources, equipment, frequency and manpower that require the amalgamation of various agencies by performing an effective coordination. This requires a very complex action and may take a long time to handle the situation.

The focus of this study is the mitigation phase of disaster risk and the preparation phase of the community to face disasters, whether natural disasters or disasters of the next level that is NATECH. This is because, the impact of a catastrophic event can only be seen clearly after an event. It is impossible for us to determine the time, location, and degree of impact of a disaster. Technology, as well as existing empirical evidence can only predict the time, location and impact of the disaster. The knowledge and technology possessed is not able to prevent disasters, but able to minimize the risk by increasing the aspect of resilience to the victims. Although technology is created to curb the risk of disasters, but if the elements of individual, community and group resilience are not emphasized, then it does not make any sense. Therefore, the implementation and contribution by the community at the local level is very important in contributing to the government's ability to improve the ability to cope with any form of disaster in the future more effectively. Community awareness in the mitigation phase and disaster preparedness, can at least help the next phases in disaster management, namely the response phase and the recovery phase.

The phases of disaster management namely mitigation, preparation, response and recovery are different entities, but are interrelated and have their respective importance according to the situation. The action phase and the recovery phase are the main phases of a disaster that include rescue activities, damage control, as well as restoring community peace and unrest (Izham et al., 2018; Poser & Dransch, 2010). However, the phase of mitigation and preparation is also important because in these phases, the community will be stressed on the importance of mitigation and preparation in the face of disasters. This strategy is able to reduce

the risk of loss of life, destruction of property and the environment. In addition, it is also able to prepare the community to face the psychological effects of disasters such as stress, health problems, anxiety and chaos due to damage and destruction of property. In turn, the capacity of this community will facilitate the agencies involved in managing disaster victims in the recovery phase. Therefore, the main objectives of this study are: (i) to identify the key elements in the mitigation and disaster preparedness phase; and (ii) to propose a framework for the measurement of the mitigation and disaster preparedness phases.

2. Literature Review

Several studies have been conducted by scholars related to community awareness in disaster risk mitigation and preparation. Studies by Vari (2002) on community involvement in flood disaster risk management in Hungary; a study of 528 respondents by Hellen et al. (2010) on community perceptions of awareness of flood risk understanding and response to flood risk in Nyando District, Western Kenya; and a study by Agrawal, Elliot and Simonovic (2020) of 100 respondents focusing on community assessment and perceptions of risk, exposure, vulnerability and coping capabilities in assessing community resilience in the face of disasters. These studies aim to identify the level of community awareness of mitigation actions and disaster preparedness. The findings of these studies have been proposed to develop the capacity of the community in the mitigation and preparation phase in applying more comprehensive disaster risk management. Subsequently, a study by Odiase, Wilkinson and Neef (2020) on 88 samples consisting of South African communities residing in Auckland, New Zealand. The findings of the study found that knowledge related to disaster risk, as well as the experience of dealing with disasters have an influence on the perception of disaster among respondents. This perception affects their preparation in the face of disaster risks such as earthquakes, floods and tsunamis. In addition, a study by Titko, Ristvej and Zamiar (2021) of 794 samples in the Slovak Republic related community resilience in the face of disasters and extreme weather. The findings of the study indicate that bad experiences related to disasters (floods, tornadoes, thunderstorms, earthquakes, landslides, forest fires, snowstorms, droughts and high heat waves) make them always proactive in taking preventive measures, i.e. mitigation and preparedness.

Scholars also conduct studies based on the disaster situation in Malaysia. According to Tuan Pah Rokiah et al. (2015) in a study of 1100 samples in several mukims in Segamat district, Johor stated that the preparation of individuals and communities is influenced by their experiences affected by disasters. The findings of their study show that there are differences between individuals who have experienced disasters and vice versa. Those who are experienced will make preparations from a psychological point of view covering cognitive, affective and psychomotor aspects compared to those who have no experience. In addition, Ang Kean Hua (2016) has studied related to community preparation in facing the monsoon floods in Kota Bharu, Kelantan. The findings of a study of 400 respondents who live near the Kelantan river show that the experience of experiencing disasters makes the community always ready. These preparations can be seen through the actions of the community who built high-rise houses, storage of food stocks, preparation of boats and buoys as safety devices. Meanwhile, Nasir et al. (2017) have conducted a study on the impact of flood disasters on businesses in Kuala Krai Kelantan. The study involved 175 experienced traders affected by flood disasters that resulted in damage and loss of their business premises. The findings of this study show that cooperation between all parties is the key to success in raising awareness about the threat of disaster. Formal and informal awareness campaigns, workshops, courses and trainings are among the important steps in preparing the community for disasters.

Next, Ahmad Azan et al. (2017) in a study of 318 respondents consisting of residents of Bukit Antarabangsa, Ampang Jaya, Selangor found that education, involvement and leadership have a significant relationship with community preparedness in the face of disasters. Sarina et al. (2018) conducted a study related to adaptation actions and preparedness done by the residents of Hulu Dungun to face the phenomenon of flood disasters. Findings from indepth interviews and observations on the 15 respondents found that their experience of facing the flood disaster has caused various disturbances and stress either physically, socially and emotionally of the victims. The experience led the community to take the initiative by implementing mitigation measures and preparedness for the short and long term to face the threat of floods in their locality with the help of government agencies. These measures (mitigation and preparation) are to facilitate other aspects of disaster management to be coordinated.

Meanwhile, a study by Noorazuan et al. (2019) on 1,050 respondents related to awareness of climate change and disasters related to sea level rise in several coastal locations in Selangor. The findings of the study found that the level of awareness of the respondents was at a moderate level. The concern of coastal communities in the study area on awareness of the dangers of climate change to sea level rise varies based on demographic profiles especially in terms of race and level of education. A study by Norsyuhada et al. (2021) against 384 respondents is about community resilience. A study conducted in Manik Urai Lama, Kuala Krai, Kelantan showed that education/training, knowledge and experience on disasters are closely related to the community's ability in the phase of disaster mitigation and preparation. They are able to prepare in order to strive for survival in the face of disasters, especially in the storage of food, beverages and stocks of medicines. However, the experience also sometimes makes some of them take relief and disaster preparedness seriously.

Furthermore, a review on several documents that are disaster management policies were also implemented. Among them is the policy developed by the International Commission for the Protection of the Danube River (ICPDR) in 2015 related to flood risk management for countries in the Danube river basin, namely Germany, Austria, Czech Republic, Slovakia, Hungary, Serbia, Bosnia Herzegovina and Moldova. In addition, the Queensland State Disaster Management Plan (2013), the proposed disaster coping framework by the Sendai Framework for Disaster Risk Reduction 2015-2030 (2015); Disaster Risk Management for Sustainable Development (DRM-SD) (2013) by the Center for Global Sustainability Studies, Universiti Sains Malaysia and Malaysia Disaster Management Reference Handbook (2019) were also examined to get an appropriate ideas as a foundation to develop a conceptual framework for mitigation and preparation phase in disaster management.

The empirical findings of these studies as well as the resolutions set out in the policies found that knowledge, experience, attitudes, exposure and awareness of disasters are factors that catalyze public perceptions of awareness to prevent and prepare for disasters. These factors in turn influence community behavior towards disasters, namely prevention and preparedness. These empirical findings and proposed resolutions have been matched with Theory of Planned Behavior to understand the attitudes of individuals and communities in the face of disaster phases. According to Wan Baharudin et al. (2016) in their study of organizational achievement while implementing changes to ensure organizational success. Theory of Planned Behavior outlines three main factors that affect behavior, namely (i) attitude; (ii) subjective norms; and (iii) behavioral control expectations. Next, affecting change -supporting behavior is the

expectation of benefits from change (attitudes), leader support (subjective norms) and self-efficacy regarding change (behavioral control expectations). Overall, all three factors namely attitudes, subjective norms and behavioral control expectations as expressed will determine an individual's willingness to perform their respective behaviors which in turn will lead to behaviors manifested by actual actions (Wan Baharudin et al., 2016).

3. Methodology

The study design will use qualitative methods that allow the researcher to combine information from relevant literature reviews, detailed interviews, focus group discussions and observations as the main procedures in the data collection of the study. Qualitative methods are commonly used to design valid and reliable instruments for obtaining detailed information, encoding, parsing, translating and defining a phenomenon in its original state (Chua, 2020; Creswell, 2012; Bougie & Sekaran, 2020). This method provides several advantages to researchers such as saving time, facilitating more in-depth and accurate research on a problem in the study organization, allowing simultaneous data collection for analysis, reporting research results, avoiding bias and reliability in evaluating, interpreting, perception and agreement. respondents in views or opinions (Creswell, 2012; Bougie & Sekaran, 2020).

An in-depth interview is the first step in the data collection procedure. This method is one of the methods of data collection done orally, and the answers are recorded by the researcher in writing, audio recordings, video and other electronic media (Chua, 2020; Creswell, 2012). The interview method will be implemented semi-structured to allow the researcher to ask formal questions constructed before the interview as well as explore in more depth by re-questioning respondents related to the answers given to a formal question that has been asked (Chua, 2020; Othman, 2015; Zikmund et al., 2012). This allows the researcher to get more accurate information on a question. The next researcher will transcribe the answers for analysis (Creswell, 2012).

The respondents involved in this interview totaled 117 people from various parties including federal/local government agencies, and the community. The interview process was conducted in several series, namely in Penampang, Sabah on 7-8 April 2019 (25 respondents from various agencies); Miri and Bintulu, Sarawak on 10 - 11 April 2019 (15 respondents from various agencies), North East and Southwest Districts of Penang on 1 - 2 August 2019 (9 agencies and 30 community members), Port Dickson, Negeri Sembilan on 19 - August 20, 2019; Petaling Jaya and Shah Alam, Selangor on 20 - 21 February 2020; and Hulu Perak District (Pengkalan Hulu, Grik and Lenggong) on 22 - 23 September 2020 (8 agencies and 30 community members). These locations were chosen because they are not only vulnerable to natural disasters, but also natural disasters that occur at risk of triggering NATECH. There are important installations such as dams and hydroelectric power plants (Penampang, Sabah; Southwest and Northeast Districts, Penang; and Hulu Perak District, Perak); petroleum processing plants and gas pipelines (Miri and Bintulu, Sarawak; and Port Dickson, Negeri Sembilan); industrial chemicals (Petaling Jaya and Shah Alam, Selangor; and Bayan Baru, Southwest District, Penang); and radioactive storage (Penang Hospital, North East District, Penang).

The respondents representing the agency comprised of various levels of positions whether at the strategic, operational and tactical levels. They are experienced to be directly involved in several disaster incidents that occur in their respective localities. As for the focus group discussions, the discussions focused on their respective areas of assignment, especially

in terms of contributions, strengths and weaknesses in related incidents, especially those related to mitigation activities and preparation of individuals and communities involved. This is to obtain more detailed and clear information related to preventive measures and preparation at the individual, community and organizational levels.

In addition, observation methods were also used to identify awareness of mitigation activities and disaster preparedness among the community at the study site. This method allows observations to be made on the effects of events in addition to gathering information related to the attitudes and behaviors of study subjects (Chua, 2020; Creswell, 2012). In addition, this method has also been adapted from the experience of several researchers working in the security forces and also directly involved in operations related to disaster incidents. The experience from these observations is used to describe the effects of disaster events that occur as well as gather information related to the attitudes and behaviors of the community in the area in disaster relief and preparation. In this study, the researchers used the experience involved in flood management in the state of Kedah involving the areas of Kuala Muda, Baling, Sik and Seberang Perai, Penang between 2000 to 2009; floods in the state of Kelantan in November and December 2013 and 2014/2015 covered three areas of responsibility, namely the districts of Jeli, Tanah Merah and Gua Musang; as well as involved in flood management in the state of Sarawak in 2007 and 2008 covering the Sri Aman Division, Lubok Antu, Betong and Saratok Districts.

4. Findings

4.1. Demographic characteristics

These characteristics include gender, age, marital status, level of education, occupation, income, type of residence, location of residence. The demographic characteristics of the respondents can have a significant effect on their perception of disaster thus can affect the low or high level of preparation for disaster. In addition, demographic characteristics can also affect respondents' perception of disaster thus can provide them with knowledge and skills to prevent future disaster. In terms of gender, female may be well prepared for disaster in comparison with male as they are seen to be more at home and caring for the safety of their children than male who are less at home and working. Nevertheless, it may be otherwise. In addition, respondents, level of education may also influence their perception on disaster and hence their preparedness. Some respondents may have read and studied on managing disaster, hence, it can greatly impact their perception on preparing for disaster. Indeed, occupation of an individual can have an influence on preparing and/ or preparing for disaster. For example, a military personnel's may have disaster relief experiences and these experiences can greatly influence their preparation for disaster. In addition, they may even have the knowledge and skills to prevent further disaster. Finally, type and location of residence may have an effect on community's perception and thus their prepared or prevention for future disaster. In this scenario, Malaysia has several very popular flood prone areas. Therefore, community in these areas may be able to prevent future disaster by improving the structure or heights of their home.

4.2. Knowledge of disaster risk

These elements include education on disasters, knowledge related to the types of disasters, early indications of the occurrence of disasters, actions and so on. There is no denying that knowledge is an important component in disaster risk preparedness. In order to improve disaster management capabilities, communities need to understand the components or context

of disasters and how disasters can be reduced and avoided. Our social environment gives us a broad knowledge of values, perceptions and norms. Disasters will occur when society does not have the knowledge to understand the dangers of an event and its effects. Knowledge can be in the form of local or expert knowledge. Local knowledge is the community's ability to understand the practices, experiences and understandings of the local community. Meanwhile, expert knowledge can be resources in handling disaster-related information technically and integrated with local knowledge. The combination of the two is important for improving disaster management.

4.3. Experienced in disasters

These elements include experiences related to the type of disaster that has been experienced, the duration of the incident, the effects and actions before, during and after the incident. Individuals who have ever experienced a disaster or risk have a sensitivity to the environment that makes them always sensitive and always ready to face it. The experience will also reduce the stress on the individual as they may be able to anticipate the impact of an event. After an incident, an individual may feel shocked, confused, unable to integrate thoughts and information and become traumatized. This reaction may gradually subside or various thoughts may arise and changes in behavior may occur. Some people may become more sensitive to an environment that makes them constantly alert and prepared for disaster. This allows them to address other challenges and larger problems at both the individual or larger group levels.

4.4. Attitude/awareness of disaster risk

Assessment of the causes and consequences of disasters, taking into account the indicators and warnings of disasters, responsibility for prevention, mitigation and preparation at the individual, community and organizational levels. Individual attitudes and awareness vary according to the knowledge possessed, gender, disaster coping training they have gone through, experience involved in disasters, short-term and long-term effects of disasters. An individual may also have a positive attitude towards disaster causing them to be willing to acquire knowledge in order to be better prepared to face it. They will also integrate the information obtained which is an advantage to them in the event of a disaster.

4.5. Exposure to mitigation and preparation

Includes prevention activities, rescue training, obtaining disaster -related information, as well as education at the individual, community and organizational levels. Information on daily activities, the latest instructions from the authorities, as well as training on rescue activities and evacuation plans as well as gathering places should be a priority in this element. Every individual, community and agency should always be aware of this.

4.6. Awareness and preparation to react

Emergency preparedness such as food supplies, clothing, rescue equipment, finance, communication, medicine and so on are the items contained in this element. This preparation will facilitate the response phase in the event of a disaster. It starts with an early warning system, the establishment of a coordination center, a victim evacuation plan and so on. This will facilitate further business.

Figure 1 shows the conceptual framework of the proposed results of the literature review and field study conducted by the researchers. The independent variables were demographic characteristics, knowledge of disaster risk, experience in disaster, attitude/awareness of disaster risk, exposure to mitigation and preparation, and awareness and preparedness to react. For mediating variables, the proposed construct is the individual perception of the disaster, the views of respondents to disasters. As for the dependent variable, the construct is proposed to conduct disaster sub-constructs containing the disaster awareness and disaster preparedness. These constructs will understand the individual behavior of their ability to perform activities of mitigation before a disaster occurs and their preparations in the event of a disaster.

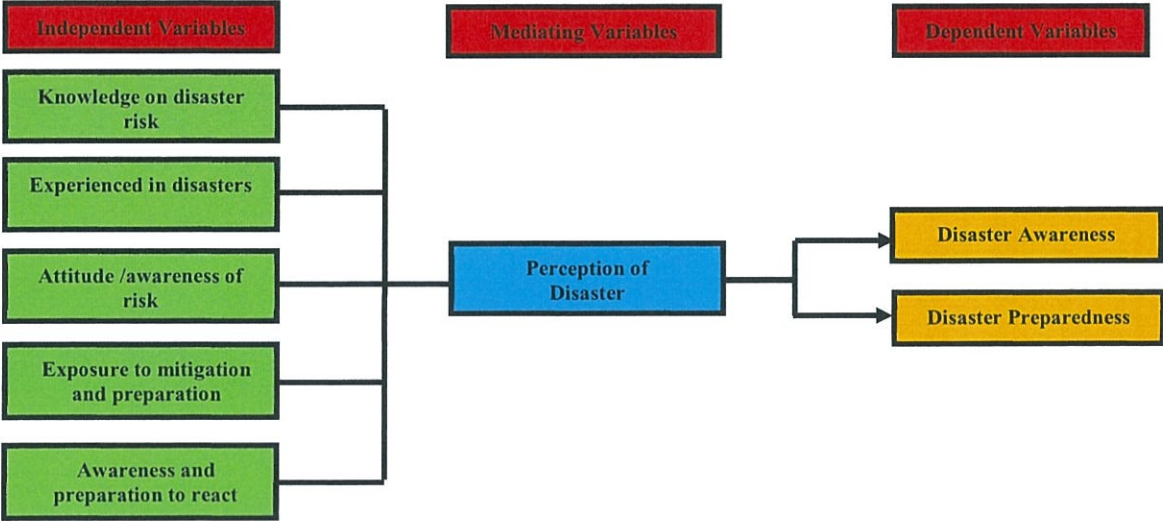


Fig. 1. Proposed Theoretical Framework

5. Conclusion

This study has proposed a conceptual framework for the measurement of the level of mitigation awareness and preparedness in disaster management. The formation of this conceptual framework is a combination between a literature review of the works of previous scholars and field studies conducted by researchers. Thus, the formation of this conceptual framework has further enriched studies related to disaster management. With this conceptual framework, it is hoped that it will be a guide for practitioners in the field of disaster management in designing and designing activity modules and training/education curriculum related to prevention to mitigate the impact of disasters and preparation in preparation for disaster management at the individual, community level, organizational and national.

In addition, it is hoped that this model can be tested in quantitatively in the future. Quantitative testing will be able to further strengthen the capabilities of this model as its instruments can be statistically proven in terms of its reliability and validity. This quantitative testing allows for modifications and improvements to the conceptual framework that has been established. Quantitative testing will also produce findings that can contribute to improvements to existing policies, modules and activities towards producing individuals and communities that are more sensitive to disaster prevention and preparedness.

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