An Evaluation on Factors Influencing Decision making for Malaysia Disaster Management: The Confirmatory Factor Analysis Approach

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Abstract. For the past few years, natural disaster has been the subject of debate in disaster management especially in flood disaster. Each year, natural disaster results in significant loss of life, destruction of homes and public infrastructure, and economic hardship. Hence, an effective and efficient flood disaster management would assure non-futile efforts for life saving. The aim of this article is to examine the relationship between approach, decision maker, influence factor, result, and ethic to decision making for flood disaster management in Malaysia. The key elements of decision making in the disaster management were studied based on the literature. Questionnaire surveys were administered among lead agencies at East Coast of Malaysia in the state of Kelantan and Pahang. A total of 307 valid responses had been obtained for further analysis. Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) were carried out to analyse the measurement model involved in the study. The CFA for second-order reflective and first-order reflective measurement model indicates that approach, decision maker, influence factor, result, and ethic have a significant and direct effect on decision making during disaster. The results from this study showed that decision- making during disaster is an important element for disaster management to necessitate a successful collaborative decision making. The measurement model is accepted to proceed with further analysis known as Structural Equation Modeling (SEM) and can be assessed for the future research.

1. Introduction

Natural disaster is commonly known to be disaster caused by the nature [1]. Natural disaster are beyond control of human beings and cannot be predicted accurately when it occur [2]. Major natural disasters consists of volcano eruptions, earthquakes, tsunami, avalanches, lahars (volcanic mudslides), landslides, blizzards, heat waves, hurricanes, typhoons, tornadoes, droughts, floods and others. No matter what types of natural disasters it may be, it usually leads to financial, environmental, and human loses [1], [2]. It is indeed a great danger for the earth if these sort of natural disasters tend to continues. Natural disasters are said to be cataclysmic or in other words a violent natural event that could give either a direct or indirect impact towards the public health and well-being [1].

Malaysia is safe from experiencing some of natural disasters that are happening around the world such as earthquakes, volcano, and typhoon because lies in a geologically stable region just outsides the "Pacific Ring of Fire" [1]–[5]. Hence, it is free from earthquakes and volcanic eruptions. It also lies too far south of the major typhoon paths, although tail-ends of tropical storms have occasionally hit it. However, that does not mean Malaysia is totally free from natural disasters and calamities, as it is often hit by floods, droughts, landslides, haze, tsunamis, and human made disasters [4]. The most intense natural disaster experienced in Malaysia is the flood [1], [2], [4], [5].

The Malaysia flood that happened from 15 December 2014 – 3 January 2015, has been described as the worst floods in decades. More than 200,000 people were affected and 21 people were killed due to this [1], [5]. It is important to reflect back what was happening in the flood 2014. It was unforgettable disaster happened at the end of 2014 [6]. By the end of 2014, most of the rivers in Kelantan, Pahang, and Terengganu had reached dangerous levels. Due to this, many businesses were affected and about 60,000 people were displaced by the following day. It is reported that Kelantan had the most evacuees with an estimation of 20,468 to 24,725 people followed by other states in Malaysia [1].

Disaster management is an alternative to improve resilience and therefore avoid or reduce the impact of natural disasters. Thus, disaster management is defined as an ongoing process composed of a set of activities before, during and after an event, separated into four main phases: mitigation, preparedness, response and recovery [7], [8]. In all these phases, information used by emergency agencies plays a key role in ensuring the reduction of impacts. Because of this, it is important that there are accurate, timely and complete information about the current state of environmental variables, as well as on the scientific predictions about the upcoming changes and their associated impacts [8].

The threat of natural and man-made disasters like earthquakes or deforestation is ever-present in our society. Past investigations have clearly shown that the number of natural disasters, as well as the victims and economic losses they cause is rising. This requires improvements in disaster preparedness, disaster mitigation, and organization of disaster responses. The emergency response process remains inefficient and sometimes weakly organized [7].

2. Background of the Study

From time to time, Malaysia experience disaster which affect the country and cause remarkable damages to lives and properties [3], [4], [9]. During the period of 1968-2004, Malaysia has experienced 39 disasters, classified as natural, human-made, and subsequent disasters that caused 1742 deaths and 2713 injuries [3], [4]. The matter raises the need for setting up for advanced warning systems, forecast future disasters, and effective disaster management in order to reduce the effect of such disasters [3], [4], [9].

Disaster management in Malaysia is not focused on a specific type of disaster. Every policy issued is applicable to all types of disasters, including flood [10]. After several disaster affecting Malaysia, the government has launched new mechanism for disasters and enhance the local knowledge, specialized rescue operation by establishing the Special Malaysian Disaster Assistance and Rescue Team (SMART), and National Security Council to be responsible about disaster management under the Directive No. 20 "The Policy and Mechanism of National Disaster Management and Relief" [3], [4]. National Security Council (MKN) Directive No. 20 was developed on May 11, 1997 [10]. It is merely a policy that is administered from the Prime Minister's Department to manage disaster generally [11]. The directive outlines the policy on disaster management and relief, including the roles and responsibilities of different agencies involved in managing disaster when occurred. The directive also set up emergency management programs to be well prepared and insure preparation, prevention, and mitigate the effect of disasters [3], [4]. In addition, the directive also covers the action of monitoring the activities of all agencies involved in disaster management. In 2012, the National Security Council have updated that Directive No. 20 for been revised to conform with the current changes, as well as the complexity of disasters is often the case at present [10].

A recurring problem in the management of response to natural disaster is the lack of coordination between various rescue agencies involved [12]–[14]. These agencies include not only the emergency services such as police, fire and rescue, and ambulance, but also local and national government bodies, private sector organizations and volunteer groups [14]–[16]. Successful operations are often attributed to effective inter-agency cooperation and coordination [14], [15].

Past investigations have clearly shown that the number of natural disasters, as well as the victims and economic losses they cause is rising. This requires improvements in disaster preparedness, disaster mitigation, and organization of disaster responses. The emergency response process remains inefficient and sometimes weakly organized. In order to handle disasters, save human lives, and reduce damages, it is essential to have quick response times, good collaboration and coordination among the parties involved, as well as advanced technique, resources, and infrastructure. The current response to disaster is inefficient and sometimes poorly organized. Various studies, research, and analyses have helped clarify needs, understand failures, and improve technology and organizational procedures. One of the major bottlenecks mentioned in many reports is communication between different parties involved in managing a disaster during the decision making process. The lack of good overview of the locations of teams, personnel, and facilities or insufficient information about the tasks needing to be completed may lead to misunderstanding and errors [7].

Decision making encompasses an array of processes some of which have been the subject of extensive investigations [17]. Decision making is a process of making a choice from a number of alternatives to achieve desired results. Anyone can make decisions. However, only a few people can make a good decision. In order to have a good decision, the decision makers should have a set of skills in decision making. During a disaster event, the main aim of the decision maker should be to save as many lives as possible. Therefore, decision making becomes an important element in everyday process and activities. Decision making carries a certain amount of responsibility and accountability. Decisions taken during disaster events impact a larger community and business audience. It also has impacts on community, economy, and the environment. Managing a response to catastrophic incident requires timely, effective decision making and a systematic management approach that applies sound tested principles [18].

During the decision making process, decision makers need to perceive the problem, gather relevant information, make the right judgment, and conduct a plan of action. Real-time situations such as crisis response or natural disaster relief, create a unique, threatening decision making environment that must be dealt with consistently in a timely manner [19]. Effective decision making under conditions of uncertainty involves the ability to recognize risk, formulate strategies for action, and coordinate with others in an effort to bring an incident under control quickly. Learning to make decisions effectively in urgent, uncertain conditions is not easily achieved [20].

3. Methodology

3.1 Sampling

The target respondents are among the lead agencies in two states in East Coast of Malaysia namely Kelantan Darul Naim and Pahang Darul Makmur. The agencies are National Security Council (MKN), Fire and Rescue Department (JBPM), Royal Malaysian Police (PDRM), Department of Irrigation or Drainage (JPS), Health Department (JK), Social Welfare Department (JKM), Public Works Department (JKR), and Malaysia Civil Defence Force (JPAM). The sampling strategy employed in this study are simple random sampling and cluster sampling. Simple random sampling was adopted so that everyone has an equal chance of being selected as part of the sample [21]. While cluster random sampling is a collective type of unit that includes multiple elements [22]. The study involved the selection of a suitable geographical area (East Coast of Malaysia) and the selection of a preferred agency in Malaysia disaster management. A total of 307 usable questionnaire had been obtained for further analysis.

3.2 Data Collection

Data collection was conducted over a two-month period during October and November 2015. The questionnaires are collected after one week it was distributed to each agency. It took ten working days at Kelantan and nine working days at Pahang. Before conducting surveys, each agency management's permission was obtained. A note-book was given to the participants as an incentive for participation in the study.

3.3 Data Analysis
Verifying the instrument for the study is done through Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA). At first, EFA was conducted first before proceeding to subsequent analysis which is CFA. EFA consists of principle component analysis (PCA) used for data reduction. The value at the threshold of 0.6 or above is suppresses once EFA procedure is applied. Once the authors execute the EFA procedure, this component will be employ in Structural Equation Modeling (SEM). [23] stated that SEM has two models namely measurement model (for CFA approach) and structural model (for path estimate). Every measurement of a latent construct needs to undergo CFA before modelling in SEM. The CFA was employed to validate the measurement model [24]. The assessment of fitness index comprised of three categories namely parsimonious fit, absolute fit and incremental fit but the researcher deserves to choose any fitness so as long the fitness chosen represents each category. However, the use of at least one fitness index from each category of model fit is suggested. The implementation of CFA ascertains the researchers to identify to what extent the strength of indicators and measurement model relates to decision making. Thus, the valid measurement model can help the researchers make a true interpretation based on their findings [23]. Table 1 below shows the fitness indexes with the threshold values.

Table 1. Fitness Indexes Categories of Model Fit and Level of Acceptance [25].

Name of Category	Name of Index	Level of Acceptance
Absolute Fit	Chi-Square	P-value > 0.05 Not applicable for sample size>200
	RMSEA	RMSEA < 0.08
	GFI	GFI > 0.90
Incremental Fit	AGFI	AGFI > 0.90
	CFI	CFI > 0.90
	TLI	TLI > 0.90
	NFI	NFI > 0.90
Parsimonious Fit	Chisq/df	Chisq/df < 3.0

4 Results
4.1 Descriptive Statistic
Prior to analysing the data, descriptive statistics were examined to check the normality of decision making.

Normally the data should be conducted to investigate how the standard of the data that has been collected so that the developing model may suit the parametric technique in the future research. Using Kolmogorov-Smirnov approach, the data is highly significant indicating as normal data. The reliability of the scale is determined by computing the coefficient alpha. The Cronbach’s alpha of 0.6 or higher for a component reflects the measuring items under that particular component provide a reliable measure of internal consistency [26]. In this study, the Cronbach’s Alpha values for decision making, approach, decision maker, influence factor, result, and ethic construct vary from 0.526 to 0.885. The result of reliability test shows that some of the sub-constructs from the main construct have to be deleted since the Cronbach’s Alpha value less than 0.6.

4.2 Exploratory Factor Analysis

Using the data collected based on the sampling used, the data was executed using EFA to categorized which items is suited to be composed of the same component. The data was analysed using Statistical Package for Social Science (SPSS) version 22. The software used not only limited to the EFA procedure but has been used for the reliability to measure the goodness of actions. A PCA with varimax rotation was applied to analyse the data. [23] remarked that Kaiser-Meyer-Olkin (KMO) value greater than 0.60 were used to purify the measurement items. In this study, KMO for each variable (decision making, approach, decision maker, influence factor, result, and ethic) ranged between 0.747 to 0.861. This means the EFA approach is accepted and the result of KMO has achieved the requirement. This KMO value exceeds the recommended value of 0.6 and close to 1.0 with the Barlett's test significance value close to 0.0 suggest the data is appropriate to proceed with its reduction procedure [26]. The remaining items will proceed for the CFA approach.

4.3 Confirmatory Factor Analysis

CFA was analysed using Analysis of Moment Structure (AMOS) version 22. The CFA for second-order reflective and first-order reflective measurement model was performed with maximum likelihood estimate. The second-order model are Decision making (*DM*) and Influence Factor (*I*). While the first-order model are Approach (*Ap*), Decision Maker (*D*), Result (*R*), and Ethic (*E*). In the beginning, the items that carry the high factor loadings in EFA are deleted in measurement model for CFA approach. In order to fulfill the requirement of CFA specifically of the fitness index, reliability and discriminant validity, some of the items from each factor should be removed in the measurement model. Removal items are based on modification index (MI) that can be provided in Amos report to identify which items has carried the multicolinearity problem. Basically, MI over 15 should be considered as high multicollinearity problem.

The acceptable model is shown in Figure 1. The fit value for RMSEA = 0.060, CFI = 0.901, Chisq/df = 1.738, indicates that all indicators are significance. The model achieved the absolute fit, incremental fit, and parsimonious fit as shown in Table 2.

Table 2. The Assessment of Fit for Measurement Model.

Name of Category	Name of Index	Level of Acceptant	Comments
1. Absolute Fit	P-value	0.000	NA as the sample size > 200
	RMSEA	0.060	Meet the required level < 0.080
2. Incremental Fit	CFI	0.901	Meet the required level < 0.900
3. Parsimonious Fit	Chisq/df	1.738	Meet the required level < 3.0

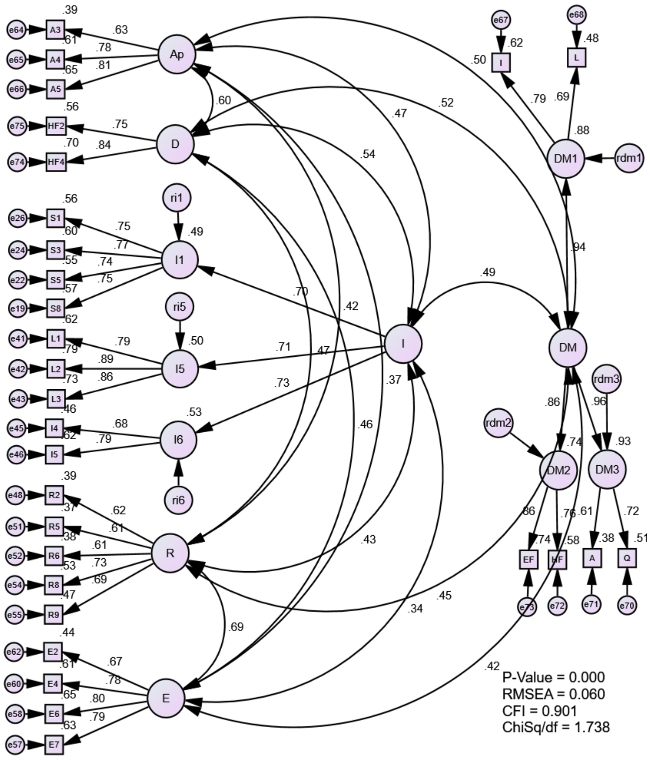

Figure 1. Measurement Model

5. Conclusion

Overall, the present study tries to explore the factor related to decision making in disaster management. In conclusion, based on the analysis, it shows that the data reasonably fit the model. This indicates that the model has achieved the absolute fit, incremental fit, and parsimonious fit that make up the achievement of the fitness indexes of the measurement model. The results revealed that approach, decision maker, influence factor, result, and ethic have a significant and direct effect on decision making during disaster. The measurement model is accepted to proceed with further analysis known as Structural Equation Modeling (SEM). The measurement model can be assessed for the future research so that next study would be included in this model.

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