TECHNICAL AND NON-TECHNICAL EFFECT OF DISASTER THAT ARE RELEVANT TO DISASTER RISK MANAGEMENT CYCLE (DRMC)

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By

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I hereby declare that I have checked and revised the whole draft of dissertation as required by my supervisor.

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(Signature of Supervisor)

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ABSTRAK

Bencana adalah bahaya yang menyebabkan kerugian besat terhadap kehidupan, harta dan mata pencarian. Setiap tahun, negara kita terjejas oleh bencana sama ada bencana alam atau bencana buatan manusia. Pengurusan risiko bencana adalah pengurusan sumber-sumber dan tanggungjawab bagi berurusan dengan semua aspek kecemasan. Pengurusan risiko bencana yang berkesan memerlukan gabungan pengetahuan dan kemahiran. Kitaran Pengurusan Risiko Bencana (DRMC) adalah sebahagian daripada usaha penting yang direkabentuk untuk mengurangkan risiko bencana. DRMC mengandungi empat fasa iaitu tindak balas, pemulihan, mitigasi dan persediaan. Kesan bencana diklasifikasikan kepada kesan teknikal dan kesan bukan teknikal. Kesan teknikal memberi tumpuan kepada pembinaan struktur, penyelenggaraan dan keselamatan manakala kesan bukan teknikal memberi tumpuan kepada kerugian ekonomi, kos pembinaan semula, pengubahsuaian dan kesihatan. Dalam kajian ini, ia bertujuan untuk mengenalpasti kesedaran ahli projek tentang DRMC dalam projek pembinaan. Selain itu, ia juga adalah untuk meneroka pengurusan risiko bencana dan risiko yang berkaitan dengan projek pembinaan. Soal selidik telah diedarkan kepada ahli industri pembinaan dan mangsa-mangsa banjir. Keputusan yang diperoleh berdasarkan kajian menyatakan bahawa majoriti responden adalah kurang sedar tentang DRMC. Selain itu, kajian ini telah mendapati bahawa dalam setiap fasa DRMC, kedua-dua responden profesional dan bukan profesional mempunyai pendapat yang berbeza tentang hierarki jenis-jenis pengurusan risiko bencana dan kesan-kesan bencana.

ABSTRACT

Disaster is a hazard that has caused heavy loss of life, properties and livelihood. Every year, our country has been affected by disaster, whether natural disaster or manmade disaster. Disaster risk management is a management of resources and responsibility for dealing with all aspect of emergency. An effective disaster risk management requires the combination of knowledge and skills. Disaster Risk Management Cycle (DRMC) is a part of the important efforts which was designed to handle disaster risk. DRMC contains of four phases which are response, recovery, mitigation and preparedness. In this study, the effects of disaster were classified into technical effects and non-technical effect. Technical effects were focused on building structure, maintenance and safety while non-technical effects were focused on economic losses, cost of reconstruction, refurbishment and health. This paper aimed to determine the awareness of project members on DRMC in construction project. Besides, it was also to explore the disaster risk management and related risk that were relevant to a construction project. Questionnaires were distributed to the construction industry players and flood victims. The result obtained based on the survey revealed that majority of respondents did not aware about DRMC. In addition, it was discovered that in each phase of DRMC, both professional and non-professional respondent had different opinion on disaster management as presented by the hierarchy of the types of disaster risk management and the effects of disaster.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

DRMC	**D**isaster **R**isk **M**anagement **C**ycle
UNISDR	**U**nited **N**ations **I**nternational **S**trategy for **D**isaster **R**eduction
DRR	**D**isaster **R**isk **R**eduction
CIDB	**C**onstruction **I**ndustry and **D**evelopment **B**oard
RII	**R**elative **R**ank **I**ndex
SPSS	**S**tatically **P**ackage **S**ocial **I**ndex
DID	**D**rainage and **I**rrigation **D**epartment
DRMC	**D**isaster **R**isk **M**anagement **C**ycle
UNISDR	**U**nited **N**ations **I**nternational **S**trategy for **D**isaster **R**eduction
DRMF	**D**isaster **R**isk **M**anagement **F**ramework

NOMENCLATURES

ai	Weighing factor
xi	Variable representing respondents frequency of response

CHAPTER 1

INTRODUCTION

1.1 Introduction

Disaster is a hazard that causes a heavy loss towards life, properties and livelihood. Based on the International Federation of Red Cross and Red Crescent Societies, disaster is a sudden, calamitous event that seriously disrupt the functioning of a community or society and cause human, material and economic or environmental losses that exceed the community's or society's ability to cope using its own resources (Braman et al. 2013). Though often caused by nature, disaster can have human origins. There are three types of disaster, namely natural, man-made and hybrid varieties. Natural disasters are created by natural forces, man-made disasters are result from human decisions and hybrid disasters are combination of both natural and man-made disaster. There are many types of disaster around the world such as earthquake,storm surge, Tsunami, flood, and typhoon. In this study, the focus is on flood disaster (UNISDR,2016).

According to Kapucu (2012), disaster management is management of resources and responsibility for dealing with all aspect of emergencies that aims to reduce or avoid the potential losses from hazard, assure help and appropriate assistance to victim of disaster; and achieve rapid and effective recovery. In recent years, human casualties and economic losses caused by natural disasters in Malaysia have been increasing, indicating that the population and economic assets of the area are becoming concentrated in disaster-prone areas (Guha-Sapir and Vos, 2011).

Through a systematic effort such as Disaster Risk Management Cycle (DRMC), the disaster risk can be reduced (Sapountzaki et al. 2011). The function of disaster risk management cycle is to reduce the impact of disaster, how to respond and react during the disaster and to recover after a disaster had happened. There are four phases of disaster risk management cycle which are mitigation, preparedness, response and recovery (Vasilescu et al., 2008). Mitigation phase is minimizing the effect of disaster risk to society. For example, an analysis of the vulnerabilities of disaster has to be done and an education about disaster has to be taught to the public. In the preparedness phase, planning on how to respond during disaster must be plan and an emergency training should be practiced. For response phase, it is focus on the effort to minimize the hazard create by the disaster. This phase may include search and rescue, firefighting and emergency medical support. The recovery phase is to returning the community to normal. It begins soon after the emergency phase has ended. The complete DRMC includes the shaping of public policies and plan that either mitigate the effect on people, property and infrastructure, or modify the cause of disaster (Wilhite et al., 2014).

1.2 Problem Statement

The real problem of disaster management is related to the annual loss of capital stock and social expenditure as presented in Table 1.1. According to the United Nations International Strategy for Disaster Reduction (UNISDR, 2010), the probabilistic risk results on the average annual loss (AAL) by hazard in Malaysia from 2005 – 2014 are as follows:

Table 1.1: Probabilistic Risk Results on Average Annual Loss (AAL) by Hazard in Malaysia from 2005-2014

Type of Hazard	Absolute [Million US$]	Capital stock [%]	Gross Fixed Capital Formation [%]	Social Expenditure [%]	Total Reserves [%]	Gross Savings [%]
Earthquake	10.49	0.001	0.012	0.038	0.008	0.011
Storm Surge	0.52	0.000	0.001	0.002	0.000	0.001
Tsunami	5.52	0.000	0.007	0.020	0.004	0.006
Flood	1,271.09	0.109	1.511	4.555	0.953	1.312
Multi-Hazard	1,287.62	0.110	1.531	4.614	0.965	1.329

According to the report in Table 1.1 above, flooding stays as the most risky natural disaster in Malaysia with estimated annual loss of $1.2 Billion USD, followed by Earthquake $10 million USD, Tsunami $5.5 million USD and lastly storm surge $0.5 million USD. Due to the huge amount of annual loss, it is important to study relevant effects to mitigate disaster risks. According to DRMC, these losses are related to the activities of response, mitigation, preparedness and recovery.

In Malaysia, the common natural disaster that always occurs is flood disaster ((UNISDR, 2016). There is a lot of technical and nontechnical effect happen after the disaster such as effect on environment, social and economic. However, various developments occurring in potentially hazardous environments, for example construction projects susceptible to disaster, continue to occur as an outcome of risk management processes (Blaikie et al., 2014). Thus, this study will focus more on flood disaster. Most of the research in this field are focused on either the technical (Anderson et al., 2011; Seneviratne et al., 2010; Tran et al., 2009) or non-technical perspectives of disaster risks (Bubeck et al., 2012; Petley, 2012). Hence, there is a gap in disaster risk research as the combination of both perspectives is still lacking.

Consequently, this study was conducted to determine the technical and non-technical effects of disaster that is relevant to Disaster Management Risk Cycle (DRMC) in the construction industry. Besides, the awareness of project members towards the DRMC will also be identified. This research is a quantitative study using questionnaire surveys.

1.3 Aim

The primary aim for this research is to discover the perception of construction players towards the Disaster Risk Management Cycle (DRMC) and also the technical and non-technical effect of disaster that relevant to DRMC. A case study on a flood area was also explored from the perspective of the residences of selected locations in Pulau Pinang.

1.4 Research Objectives

In order to meet the aim of research mentioned above, the research objectives of this study are as follows:

a) To determine the awareness of project members on DRMC in construction projects.

b) To explore the types of disaster risk management and their related risks that are relevant to a construction project.

c) To compare the cycle of disaster management that is important in managing various type of disaster based on a model development.

1.5 Expected Outcomes

Expected outcomes of this research are as follows:

- The awareness of project members on Disaster Risk Management Cycle in a construction project.
- A clearer information about the type of disaster risk management and its related risk that is relevant to a construction project.
- A comparison of the disaster management that is important in managing various types of disaster to assist decision-making and policy development.

1.6 Scope of Work

The focus of this research is on the participant of stakeholders in the construction industry which consists of consultants, contractors and developers in order to get their opinion about the importance of Disaster Risk Management Cycle (DRMC) in terms of its elements in construction projects. This research is based on the perception of

construction stakeholders towards construction projects in Semenanjung Malaysia. The study was conducted in Penang, in duration of February to May 2017.

1.7 Dissertation Structure

Chapter 1: Discusses about the general explanation of the research which includes problem statement, aim of the research, objectives of study, expected outcome and also scope of study.

Chapter 2: This chapter consists of the elements of Disaster Risk Management Cycle (DRMC) from different sources such as books, websites, journals, articles and et cetera, in order to get more information and understanding on the research study.

Chapter 3: This chapter presents methods and strategies to collect the data to achieve the objectives of research. It also includes the flow of study with aid of flow chart.

Chapter 4: This chapter shows the analysis of data collected from questionnaire. The data interpretation and results discussions are presented in details.

Chapter 5: In this chapter, the conclusion of the research are described and some suggestion for future study are also recommended.

1.8 Importance of Study

This research is important because it is related to weather, climate change and development issues that contribute to occurrence of disaster. Moreover, this research

will contribute to a sustainable future from the perspectives of social, economic and environment. Natural disasters, even when they are classified as small or moderate, they are responsible for adverse socio-economic and environmental impacts. This is due to both a lack of preventive action plans and resources and to low resilience, inherent to low levels of social capital, which contribute to the prolongation of the adverse effects on the environment and society (Mata-Lima et al., 2016). In a sustainable future, a more prudent approach would involve a host of win-win early intervention that would reduce risk to an acceptable level and correspondingly reduce the impact of any disaster that natural hazards might cause, reducing losses and leading to a faster recovery (CGSS, 2013).

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Disaster is a serious disruption of the functioning of a community or a society (Kelman and Gaillard, 2010). Based on the United Nations, disasters involve widespread human, material, economic or environmental impacts, which exceed the ability of the affected community or society to cope using its own resources. There is increasing evidence that disasters caused by natural hazards are becoming both more frequent and more severe (Guha-Sapir et al., 2012).

In Malaysia, the most frequent natural disaster that occurs is flood (Razi et al., 2010). Almost every year, the government has to provide numerous amount of money to restore the damage caused by flood (Chan, 2015). Flooding is a common natural hazard that noticeably damages properties, human lives, and the environment. Flooding contributed to about 39.26% of worldwide natural disasters and caused USD 397.3 billion worth damage between 2000 and 2014 (Ran and Nedovic-Budic, 2016). Flood commonly occurs through a combination of events (Dawson et al., 2011). For example, rainfall fills rivers, streams and ditches beyond their capacity. Floodwater overflows river banks and flood defences.

Rainfall can be so intense that it is unable to soak into the ground or enter drainage systems. Instead the water flows overland, down hills and slopes. Property at the bottom of hills or in low spots may be vulnerable. In urban areas, floodwater may

become contaminated with domestic sewage. Besides, prolonged, heavy rainfall soaks into the ground and can cause the ground to saturate. This results in rising groundwater levels which leads to flooding above the ground. Floodwater may enter properties through basements or at ground floor level. Groundwater flooding may take weeks or months to dissipate (Jha et al., 2012).

According to Merz et al. (2010), the effects of flood can give a significant damage to materials, structure and services. At construction sites, flood water will follow the least resistance path to enter a building, particularly through masonry and construction joints, and any gaps or voids. Current building and traditional construction do not use materials and design details that can withstand long-term immersion in flood water (Escarameia et al., 2012). Mostly, flood water contain various contaminants such as silt, sewage, chemical and biological substances. These contaminants can affect the performance of building and also the health of the construction workers (Taylor et al., 2011). Buildings may require further cleaning or extended drying times following a flood leading to increase costs and delays in construction works. Physical health may suffer if floodwater is contaminated or if the building is re-occupied before it is allowed to dry effectively. Stress caused by the disruption to lifestyle and livelihood both during and after a flood is probably one of the main consequences of a flood (Fed et al., 2013).

2.2 Disaster Management

According to Kapucu (2012), disaster management is the organization and management of resources and responsibilities for dealing with all humanitarian aspects of emergencies. In particular, preparedness, response and recovery in order to lessen the impact of disasters (Field, 2012). The management of disasters and particularly flood

events are managed in the form of Disaster Operations Management (DOM), and by inclusion emergency planning (Hoyos et al., 2015). Disaster operations represent the set of activities performed before, during and after a sudden, devastating incidence that seriously disturbs the functioning of a population and causes human, material, economic or environmental damages that are beyond the ability of the affected population to cope with by using its own resources (Powell et al., 2016).

Risk management is defined as the process of identifying and assessing risk, and to apply methods to reduce it to an acceptable extent (Haimes, 2015). The main purpose of project risk management is to identify, evaluate, and control the risk for project success (Serpella et al., 2014). In construction project, risk management is important in order to handle and plan on how to overcome the disaster risk at site. However, disaster risk is expressed as the likelihood of loss of life, injury or destruction and damage from a disaster in a given period of time. Disaster risk is therefore considered as the combination of the severity and frequency of a hazard, the numbers of people and assets exposed to the hazard, and their vulnerability to damage (UNISDR, 2016).

2.3 Disaster Risk Management Cycle (DRMC)

According Baas et al. (2008), Disaster Risk Reduction (DRR) refers to the conceptual framework of elements considered with the possibilities to minimize vulnerabilities and disaster risks throughout a society, to avoid (prevention) or to limit (mitigation and preparedness) the adverse impacts of hazards, within the broad context of sustainable development. According to Fekete et al. (2015), Disaster Risk Management (DRM) includes but goes beyond DRR by adding a management perspective that combines prevention, mitigation and preparedness with response. Moreover, DRM also includes

sum of all activities, measures and programs which should be taken before, during, an after a disaster with purpose to avoid a disaster, reduce its impact or recover from its losses (Heazle et al., 2013).

In general, the concept of disaster management can be defined as the correct set of actions and activities taken during each phase of the disaster extending between preventing the disaster from happening to overcome its effects (Blaikie et al., 2014). In disaster management, there are four phases of disaster risk which are prevention phase, preparedness phase, response phase and lastly recovery phase (Vasilescu et al., 2008). All these phases will contribute to the existence of Disaster Risk Management Cycle (DRMC).

Figure 2.1: Phases of Disaster Risk Management Cycle (DRMC)

The four phases of Disaster Risk Management Cycle (DRMC) as shown in Figure 2.1 are presented as follows:

a) Prevention/Mitigation:

The term “mitigation” can be comprised in the term of “prevention”. Mitigation means to reduce the severity of the human and material damage caused by the disaster (Berke

et al., 2012). Prevention is to ensure that human action or natural phenomena does not result in disaster or emergency (Cutter et al., 2008). The mitigation phase occurs as disaster management improvements are made in anticipation of disaster events (Hristidis et al., 2010). This phase is to prevent hazards from developing into disaster or to reduce the effects of disaster. Prevention phase focuses on long- term measures to eliminate or reduce the risk (Keim, 2011). Personal mitigation is mainly about knowing and avoiding unnecessary risks.

b) Preparedness:

In this phase, the development of action plans takes place before a disaster occurs. According to Masten and Obradović (2008), disaster preparedness refers to measures taken to prepare for and reduce the effects of disasters. According to Simpson (2008), common preparedness measures are:

- The communication plans with easily understood terminology and chain of command.
- Development and practice of multi-agency coordination and incident command.
- Proper maintenance and training of emergency services.
- Development and exercise of emergency population warning methods combined with emergency shelters and evacuation plans.
- Stockpiling, inventory and maintenance of supplies and equipment.

c) Response:

The response phase of an emergency may commence with a search and rescue phase. According to Kapucu et al. (2009) response phase includes providing immediate

assistance, assessing damage, continuing assistance and the immediate restoration of infrastructure. This phase will plan the activities and measures taken in advance to ensure effective response. The response phase includes the necessary emergency services in disaster area. The response phase also contains the mobilization of the necessary emergency services and first responders in the disaster area (Goodchild and Glennon, 2010). This is likely to include a first wave of core emergency services, such as fire-fighters, police and ambulance crews. They may be supported by a number of secondary emergency services, such as specialist rescue teams (Sylves, 2014).

d) Recovery:

Disaster recovery is a stage of re-construction that aims to make improvements from the effects of significant negative events (Aldrich, 2012). This phase presents the actions that need to be taken after a disaster with a view to restoring infrastructure and services. The purpose of the recovery phase is to restore the affected area into the origin state and this phase is about issues and decision that should be made after immediate needs are known (Phillips, 2015). Recovery efforts are concerning with the action that involve re-employment, rebuilding the destroyed property and repair of the infrastructure.

2.4 Application of Disaster Risk Management Cycle (DRMC)

The purpose of Disaster Risk Management is to determine the underlying factors of risk and to prepare for and initiate an immediate response should a disaster hit, for the purpose of reducing and handling disaster risks. According to Mercer et al. (2010), the Disaster Risk Management Framework (DRMF), which has been improvised from accordingly, is a framework to simplify the DRMC. A DRMC which is used in this study is illustrated in Figure 2.1. DRMF actions are aimed at strengthening the capacities and resilience of households and communities to protect their lives and

livelihoods, through measures to avoid (prevention) or limit (mitigation) adverse effects of hazards and to provide timely and reliable hazard forecasts. During emergency response, communities and relief agencies focus on saving lives and property. In post-disaster situations, the focus is on recovery and rehabilitation, including the concept of "building back better". This implies to initiate disaster risk reduction activities during recovery and rehabilitation. Conclusively, a DRMC is used as a foundation and a guideline to verify technical and non-technical factors of disaster risks from a holistic approach.

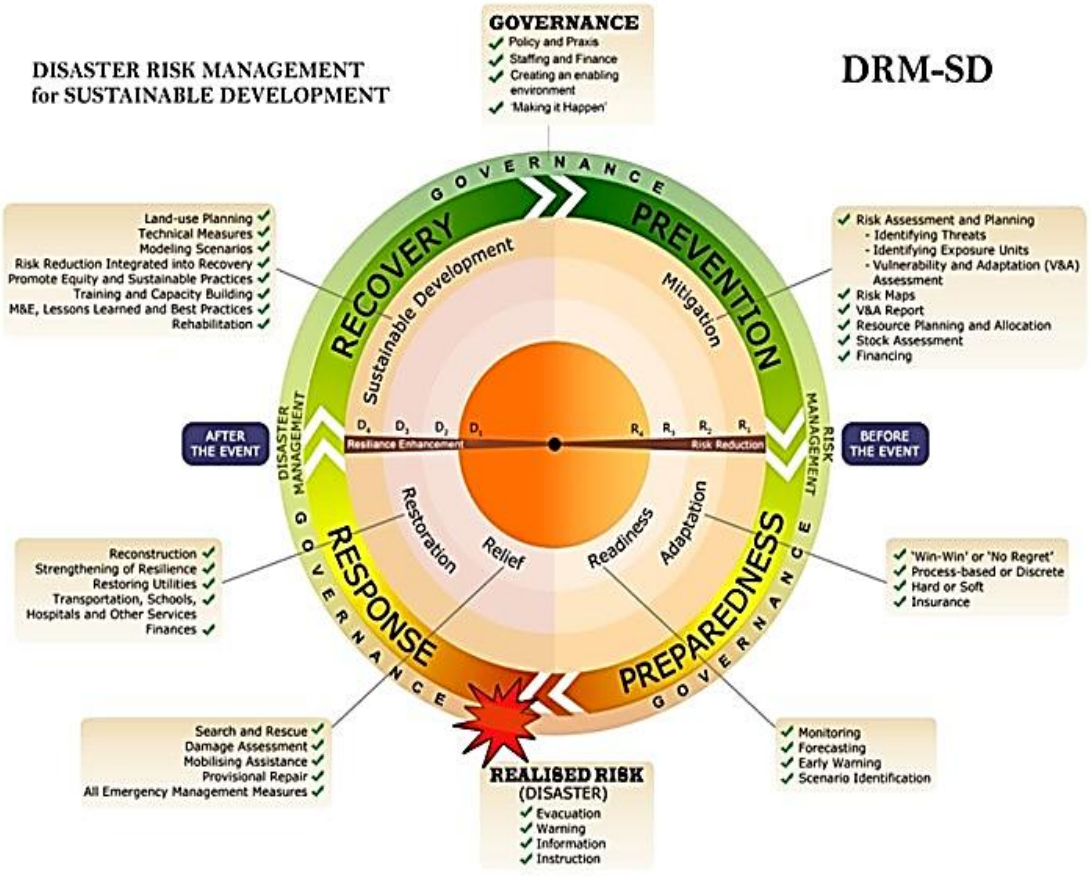

Figure 2.2: Disaster Risk Management Framework (DRMF) for Sustainable Development (Source: Centre for Global Sustainability Studies, Universiti Sains Malaysia)

McNeil et al. (2015) claimed that systematic risk management has already been widely appreciated and applied in industrial, engineering and financial sectors. A systematic processes and procedures had been well organized and systematic processes and procedures have been introduced in risk management to examine risks and make decisions. The innovative application of the generic methodology of risk management process to disaster management presents a new approach of understanding the nature of disasters, preventing their harmful effects, as well as seeking opportunities from their occurrences. Disaster risk management is defined as a series of actions (programs, projects and /or measures) and measures expressly aim in reducing disaster risk of the regions which are in danger, and mitigate the extent of disasters (Prabhakar et al., 2009). Disaster risk management strengthens prevention/mitigation and preparedness in the pre-disaster stage to reduce the frequency of disaster, proposes effective control measures to the unavoidable disasters, and makes full preparation to deal with the disasters and reduce the damage.

2.5 Technical and Non- Technical Effect of Disaster

A disaster is the occurrence of an extreme hazard event that impacts on vulnerable communities causing substantial damage, disruption and possible casualties, and leaving the affected communities unable to function normally without outside assistance (Bilau et al., 2015). Whereas the most devastating disasters in terms of human casualties tend to occur in the developing world, the highest disaster-related economic losses occur in the developed world. The built environment plays a central role in both casualties and economic losses. Its failures are associated with loss of life and it makes up, in infrastructure and real estate, most of the assets which get destroyed. The effect of disaster can be divide into two which is technical and non-

technical effect. The technical effect will focus on building structure, maintenance of the building after disaster occurs, safety of the workers and also the defect of the building. Meanwhile, non-technical effect of disaster will focus on economic, cost of reconstruction, refurbishment and also social effect.

2.6 Summary

On the list of most frequent natural hazard, floods come on the first place. Even so, the urban communities are not always ready to accept the flooding and to cope with the consequences. The level of damages caused by floods increase and function of existing structural measures does not provide acceptable protection (Batica and Gourbesville, 2016). In the construction industry, the flood disaster is a calamitous disaster that can cause delay and failure in building construction. There are also the sudden effects occur after the disaster had happen. This research discovers the technical and non-technical effect of disaster (focusing in flood disaster) based on the above presented Disaster Risk Management Cycle (DRMC).

CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter presents the methodology of this research which includes research strategy, research method, data analysis and data interpretation that were conducted in the research. This research is a quantitative study. Thus the development of a questionnaire and distribution of questionnaires to the respondent are major steps in implementing the research. The objectives of this research are to identify and explore the technical and non-technical effect of disaster towards the Disaster Risk Management Cycle (DRMC). In order to achieve the objectives of this research, 45 questionnaires were distributed to the construction industry stakeholders and flood victims. These study is consider as quantitative because data analysis was performed based on questionnaire data.

3.2 Respondent Background

The questionnaires were distributed to the stakeholders in the construction industry and also the flood victims. The target respondents comprise of architects, engineers, contractors and construction managers who are the main construction players in the construction industry. The questionnaires were distributed through email and by hand to the construction companies and according to the respondents' background. All the construction companies chosen were registered with the Board of Architect, Board of Engineer and also the Construction Industry and Development Board (CIDB). While as for the flood victims, the questionnaire were distributed by hand.

3.3 Data Collection

The questionnaires were distributed through email and by hand to the construction companies and flood victims. This method was chosen because it was the most convenient method. The reason of distributing those questionnaires by this convenient method was because the results can be obtained as quickly as possible within a short period, besides meeting the target respondents straight away. The amount of questionnaire used in this study was 45 sets.

3.4 Questionnaire Development

A set of questionnaire was developed in this study in order to obtain data, perform data analysis and to interpret the research results (Appendix A). The questions of the survey were based on previous literature reviews to ensure the objectives of the research can be achieved. The items of the questionnaire consist of multiple choice answers to ease the respondents during the answering process of the questions. The questionnaire consists of three (3) major variables with the total of twenty four (24) research items to measure risk factors relevant to the major four (4) phases of Disaster Risk Management Cycle (DRMC), namely preparedness, response, recovery and mitigation.

Questionnaire was developed based on literature reviews. The questionnaire was structured up according to the stages of DRMC. The question was choose based on according to the importance of each DRMC stage, based on its relevant or dominant activities.

The questions for the survey consist of 3 aspects as presented below:

Table 3.1: Items and Contents of Questionnaire

ITEM AND CONTENTS OF QUESTIONNAIRE	DESCRIPTION
1. Personal Background	Items regarding background information of the respondents such as gender and designation.
2. Awareness of Disaster Risk Management Cycle (DRMC)	Items regarding the awareness of the construction industry stakeholders towards the DRMC.
3. Technical and Non-Technical Factors in DRMC	Items regarding steps to be taken before, during and after a disaster that are relevant to technical and non-technical factors of disaster risks.
4. Effect of Disaster	Items regarding the opinion of respondents towards the significant effect of disaster.

The survey consists of 4 sections of questions which according to the variables as shown in Table 3.1. For the first variable, the questions were about the general information of the respondents such as gender and designation. The second section of the questions was about the awareness of the respondent towards the DRMC. The next section was about the technical and non-technical factors of disaster risks. The Disaster Risk Management Cycle contains of 4 phases which are preparedness phase, response phase, recovery phase and mitigation phase. For each of these phase, the questions are

related to the important aspects of disaster risks as perceived by the respondents according to each DRMC phase. This was intended to determine the most significant risk factors that need to be considered by the construction stakeholders. The last section was about the effect of the disaster. This section seeks to know the opinion of respondent towards the significant effect of disaster risks.

In this research, the Likert scale method was used for questions in section 3 and section 4. The range of answer was scaled from 1 to 5 as shown in Table 3.2 for section 3 and Table 3.3 for section 4.

Table 3.2: Range of Scale for Section 3

Scale	**Range**
1	Strongly disagree
2	Disagree
3	Neither agree or disagree
4	Agree
5	Strongly agree

Table 3.3: Range of Scale for Section 4

Scale	**Range**
1	Not significant
2	Less significant
3	Significant
4	Very significant
5	Highly significant

The reason of using the Likert scale method in this research was because the rationale of a Likert-item is that attitude or opinion will vary on a bi-polar continuum (the scale stem), from "negative" (e.g. "strongly disagree" or "no importance"), to "positive" (e.g. "strongly agree" or "very important") (Johns, 2010). A Likert-item holds optimum psychometric properties with between four and seven response categories (Leung, 2011). Likert-items incorporating five response categories are typical (Jamieson, 2004), such that the "middle" category represents neither a negative or positive response. However, even-numbered scales can be used on the basis that they help avoid (e.g. acquiescence) bias or ambivalence (no mid- or neutral-response category) and, to "force" either a negative or positive response attitude (Johns, 2010).

3.5 Research Methodology Framework

The 7 phases shown in Figure 3.1 gives clear information about the methodology framework used in this research. This framework of methodology described all steps taken to achieve the objectives of research. This study involves questionnaire survey and interview. However questionnaire was used to obtain and gather the primary data of this study. While interview was performed to further understand the scenario of flood disaster which was for development of a descriptive case study.

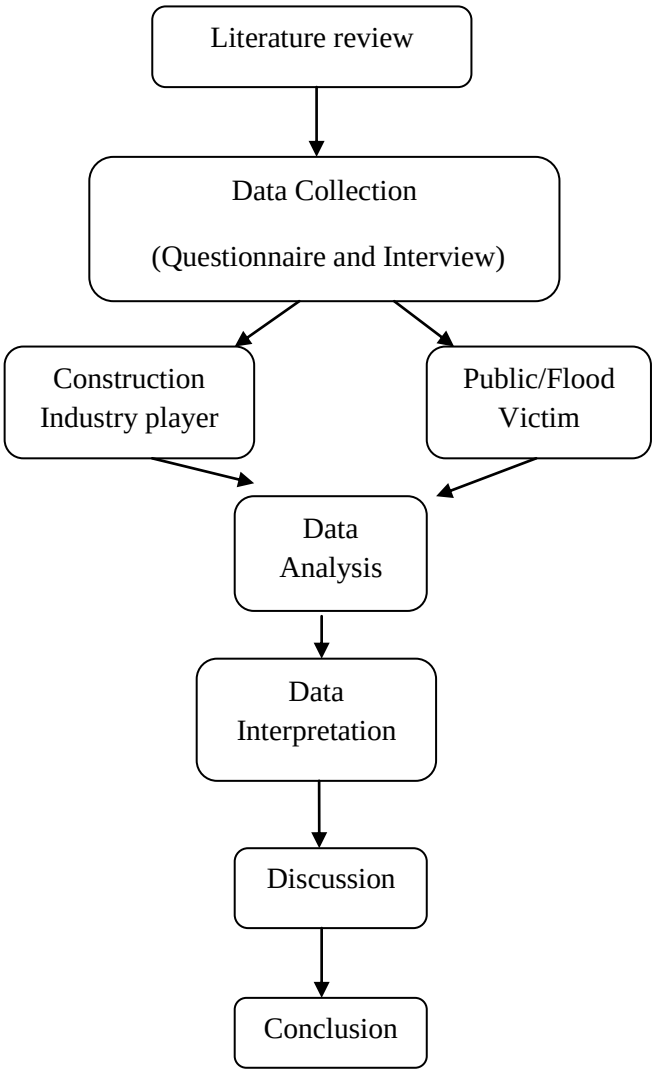

Figure 3.1: Research Methodology Framework

3.6 Data Analysis

The analysis of data was performed accordance to the objectives of the research. The research data was analyzed using Statically Package Social Science (SPSS) version 22 and Microsoft Excel. For data analysis, these 2 approaches were used.

1) Index Average and Relative Important Index (RII)

Relative Important Index was a type of relative important analysis. It was used because it fits well with the aim of this research to determine the perception of construction players towards the Disaster Risk Management Cycle (DRMC) and also the technical

and non-technical effect of disaster that relevant to DRMC in a hierarchical way. The hierarchy is important to determine the importance of each phase of DRMC. In the calculation of RII, the formula used was shown below:

$$\text{Index Average} = = \frac{\Sigma ai \times xi}{\Sigma xi} \quad (3.1)$$

Where ai = constant (weighing factor)

xi = variables representing respondents frequency of response

The factors which scored the highest value of RII are the most important factors.

2) Frequency Analysis

The Frequency analysis was used to give meaning on the information or data of the study such as distribution of responses, frequency and to summarize the responses to each question. The frequency of various variables is tabulated out accordingly.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Introduction

This chapter discusses and presents the data collected from the questionnaire survey of this research. The data from the collected questionnaires that were distributed to the professional players (engineers, architects and contractors) and the flood victims, has been analyses using frequency analysis, average index analysis and relative important index (RII) rank. The respondents of this study are considered as stakeholders of the construction industry.

4.2 Respondent Background

In the questionnaires survey, the respondents were requested to give their information about gender and career (Appendix B). These two information were the only background detail needed since it was not crucial to know the other personal background because some of the respondent might feel reluctant to share their personal background. Furthermore, the nature of this research is not to study any relationships between the subject matters with the background information of respondents.

4.2.1 Types of Respondent

In this research, there are two types of respondents namely, the professional respondent and non-professional respondent. The professional respondents are the construction industry player (engineers, architects and contractors). The non-professional respondents are the flood victims. The questionnaires were distributed via email and